LAW SCHOOL ADMISSION TEST

LOGIC LAB

Tom Beatty & Jodi Gubernat
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NOTE TO THE TEST TAKER ~

Congratulations on your decision to take the next step in pursuing a career in the legal profession. This text is designed to accompany our minicourse in the analytical reasoning, or logic games, section of the Law School Admission Test (LSAT). As you probably know, satisfactory performance on this test is necessary for admission to law school programs approved by the American Bar Association. To do well on the overall exam requires that you make a reasonable score on the logic games part. While the logic games are only one of several sections in the overall exam, many people who have taken the LSAT regard it as the most challenging section.

Our immediate purpose is to give you practical instruction and experience in applying strategies for solving logic games problems, but our ultimate goal is to help you develop confidence in knowing what to expect from the exam and in applying your newly acquired knowledge so that you can do your very best.

Neither of us are attorneys, however our minicourse has been developed with the assistance of two attorneys with decades of combined professional experience. We are mathematicians with substantial backgrounds in teaching all aspects of applied logic. We sincerely believe that this gives us a unique advantage in communicating quickly and efficiently the basic knowledge that is required for maximizing performance on the analytical reasoning component of the LSAT. We have taken many standardized tests in our careers, so we can appreciate any apprehension you may have about these tests, in general, and the LSAT, in particular. Our job is to help you rise above it.

There are several LSAT review courses available from national providers featuring various blends of self-study, distance learning, and traditional classroom instruction. Although they tend to be complete and informative, they also tend to be expensive, time intensive, and in some cases, rather inconvenient or impersonal. We have tried to identify and further develop some of the strengths of these courses so that they can be presented at a reasonable pace in a teaching environment featuring personalized support, immediate feedback and reinforcement from instructors, and collaborative engagement and learning with peers. We have taught mathematics with
this approach for many years with a fair amount of success.

We hope this little book and the minicourse are just what you need to succeed in taking that next step.
INTRODUCTION

OVERVIEW OF THE LSAT

HISTORY

The LSAT (Law School Admission Test) was originally developed by representatives from several elite law schools (Harvard, Yale, and Columbia included, of course) and first administered in 1948. There was a perception that the admissions exams in use at the time were not sufficiently correlated with first year grade performance. A committee was formed to draft an exam that would correct this, although some participating law schools were openly skeptical about the admission of applicants on the basis of “aptitude”. In retrospect, this seems quaint.

Preparation and administration of the test is currently managed by the LSAC (Law School Admission Council), and there are four test dates every year: February, June, September/October, and December. Pending sufficient registration, the FGCU LSAT minicourse will be offered on Saturdays the month prior to each test date. Currently, about 150,000 examinees take the test in a given year, although it has peaked at over 170,000 in the past. Most examinees are from the United States, although the LSAT is being used increasingly in Canada and other nations in the Anglosphere.

The LSAT has evolved quite a bit since its early years. The “modern era” of the LSAT started with the June 1991 test, which was labeled "Prep Test 1". The basic form of the exam has remained relatively stable from that point on, and all subsequent tests have been numbered consecutively, so that the February 2010 test became "Prep Test 60". Unlike, for example, the testing bodies that administer exams for the engineering profession, the LSAC is quite cooperative about making prior exams available to the public, although some particular exams are no longer accessible. In fact, the LSAC recommends that examinees study the prior exams and it even makes available a practice exam at the LSAC website. The sample problems in this book and the worksheets distributed in our minicourse use these prior exams freely as a resource, as do the big test prep firms such as Kaplan and Power Score.
The scoring system for the LSAT goes from 120 to 180. The LSAC takes raw scores (questions answered correctly) and adjusts them with a conversion formula to account for variability in the difficulty level of the exams from year to year. This ensures some degree of comparability of scores over time. Typically, the 50th percentile score is about 151, the 90th percentile about 163, and 99th percentile about 172. The "sooper genius" percentile (99.9th) requires a score of 178.

A study at the University of North Texas has focused on the distribution of average LSAT scores by academic major. The findings are intriguing: criminal justice majors average 146.0, pre-law majors 148.3, liberal arts majors 152.4, English majors 155.2, and (sorry) mathematics majors 160.0.

While the LSAT is currently required for admission to law schools accredited by the American Bar Association, there has been some discussion regarding making them optional. This parallels the current debate over making the SAT and ACT optional in order to promote diversity of the student body. Georgetown and the University of Michigan have waived LSAT scores for students with sufficiently high GPAs.

As far as the original purpose of the LSAT - to predict first year law school grades - the LSAC has studied the issue and reports that there is about a 40% correlation between LSAT score and first year GPA. The claim is that this is a better predictor than baccalaureate GPA. Evidently a combination of undergraduate GPA and LSAT score, called an admission index, is even better at predicting first year grades. There is some small variability in the correlation depending on the particular law school attended.

There is a rule concerning how many times you can take the LSAT - no more than three times in two years unless specifically granted an exemption. Also, unlike the SAT, the LSAC reports all the scores that you have gotten in the preceding five years to the schools you have chosen as score recipients. You can't "hide" a poor showing, although if you are absolutely sure you don't want the results recorded for a test you have just completed, there is a provision on the answer sheet to basically pretend it didn't happen. That particular score will not be part of any score report, and, in fact, LSAC will not even report it to you. This is the nuclear option, so you may want to consider this very carefully. Law schools have different policies regarding which score or scores to consider if they receive multiple scores.
FORM OF THE TEST

The LSAT has six parts: two sections of logical reasoning, one section of analytical reasoning, one section of reading comprehension, one section that can be any of the three preceding types, but which is not scored, and one section consisting of a writing sample, which always comes last. The order of the other sections may be shuffled to improve test security. The unscored section is considered experimental in the sense that responses to questions on it may guide the preparation of future test questions. Examinees are not told which section is the unscored one.

It may seem that logical reasoning and analytical reasoning should be one and the same, but that is definitely not the case. In the logical reasoning part of the exam, a short argument is stated and then the examinee is asked to identify assumptions, errors, and the effect on the strength of the argument if certain premises are added or removed. Common sense and a little practice with the format is excellent preparation. Our minicourse covers logical reasoning in the afternoon session.

In the analytical reasoning part of the exam, various puzzles known as “logic games” are presented. They are the subject of this book. Logic games are a bit like crossword puzzles, Sudoku™, or the word game Jumble™ in that they have partial information given in the form of clues which fit a predetermined game structure. The challenge is to fill in the blanks, so to speak, and answer various questions about that structure. The difficulty level of the games is determined by the exact nature and complexity of the game format, the quantity and helpfulness of the clues, and the depth of the questions that must be resolved. We will analyze these issues in complete detail shortly.

The reading comprehension section, which is also addressed by our minicourse in the afternoon session, consists of four short (about 500 words max) articles on various academic subjects that would be reasonably familiar, for example, to a liberal arts or pre-law major. The questions center on determining the main theme of the article, correctly identifying facts that are presented, and making valid conclusions from the information given in the text. Obviously, the ability to read quickly and with decent comprehension is the key to handling these tasks in the time frame allowed. Skimming
for critical information is a skill that can be learned.

The writing sample section asks you to take a pro or con position on a fairly benign subject and defend your choice as eloquently as you can manage after the grueling multiple choice part of the exam is over. The LSAC used to administer the writing sample part at the beginning of the overall exam. This section of the LSAT is actually not evaluated by the LSAC as part of your score report. An electronic image of your response is sent along with your score report to the various law schools you have designated. Those institutions are free to use or ignore your essay, but you should write something, since the LSAC may not report your scores if you don't attempt the writing sample. Schools that require other written material, such as a "statement of intent" or similar personalized essay expressing your interest in a law career, may typically be the ones to ignore your LSAT essay.

COST, SECURITY, & SCHEDULE

The current cost to take the LSAT is about $140. The testing center will want to take a thumbprint for positive identification, in addition to seeing some form of government issued photo identification, such as a driver's license, passport, or military ID.

The cycle for the four annual tests begins with the June exam, followed by the fall exam which may occur in September or October, then the December exam, and finally the February exam. The fall exam is the most popular with examinees intending to enter law school the following fall. December and February exam dates provide an opportunity to shore up scores that may need to be improved to allow a realistic chance at a top school.

The test itself consists of five 35 minute multiple choice sections totaling just about 100 questions plus a final 30 minute writing sample section. There is a short break given in the middle of the exam. There is no penalty for wrong guesses, so you should save a little time to fill in the answer sheet no matter what with your best guesses after you have made all the responses in which you have some confidence. Poker is as much about money management as card management, and tests of this nature are as much about time management as anything else. Using well the rather short amount of time allotted for the multiple choice sections is one of the key principles we will stress.
INTRODUCTION

OVERVIEW OF LOGIC GAMES

GENERAL

The analytical reasoning, or logic games (LG) section of the LSAT consists of four self-contained games with typically five to eight multiple choice questions about each game. The multiple choice format is five possible responses per question. The total number of questions is usually about 24. You have 35 minutes for these questions, so that is an average of about a minute and a half each to respond to everything. This includes the amount of time you need to read and understand the game scenario. We mention this not to alarm you, but to reinforce the point that time is very much of the essence. If you are not by nature a quick thinker, and most of us are not, you may take some comfort in considering that if you slow down to make sure that what you do is correct, even if you only answer half of the questions right on the test overall, your score would still be about 150.

The games themselves are logic puzzles of very specific configurations that the test authors use year after year. The common thread is that a puzzle presents a little story that defines various people or things which appear and the nature of the relationships among them. The little story is called a "scenario" and the people or things are called "variables". The variables are given to you in the scenario so there is no confusion, but in some cases you may have to decide how to symbolize them with single letters in order to work with them efficiently. Next after the scenario is a listing of various conditions, or "rules", which govern the allowed or possible relationships among the variables. These are generally fixed for the entire game and are called "global" rules. Finally, there is a list of five to seven (rarely eight) multiple choice questions which ask you to determine other facts or relationships that are consistent with the given rules. Typically the first few questions depend only on the global rules, but later questions may also introduce a new "local" rule just for that question, or suppress one of the global rules just for that question.

While one question for a given game may seem completely independent of another question, it is frequently the case that having the answer to one vastly simplifies the search for an answer to the other. Keep this in the back of your mind. The test
authors can be a little diabolical and they know, of course, that you are under severe time pressure. Often they plant a question toward the beginning that is not intrinsically difficult, but takes a little time to chase down and reject a number of incorrect answers. Learning how to recognize a "time-waster" will be something we want to practice.

**TYPES OF GAMES**

Among the game configurations that have appeared during the last twenty years of the LSAT, four main ones and their variants account for substantially all of the problems used in the analytical reasoning section. These are: (1) linear games, (2) grouping games, (3) multilevel linear games, and (4) combination linear and grouping games. There are a few formats that have appeared very infrequently, such as games based on sequencing, and we will mention them briefly but spend the bulk of our time on the main four above.

The best way to understand what these game formats are is to look at some examples:

1) **Linear Games**

Linear games require you to arrange variables in a single sequence subject to all the constraints given.

This is a linear game from the December 1996 LSAT:

**SCENARIO:** During a 4 week period, each of 7 previously unadvertised products G, H, J, K, L, M and O, will be advertised. A different pair of these products will be advertised each week. Exactly one of these products will be advertised twice. The following constraints must be observed:

**RULES:**
1) J is not advertised during a given week unless H is advertised during the immediately preceding week.
2) The product advertised twice is advertised during week 4, but is not advertised during week 3.
3) G is not advertised during a given week unless either J or else O is advertised that week.
4) K is advertised during one of the first two weeks.
5) O is one of the products advertised during week 3.

The linear nature of this game is apparent from the string of four successive weeks. The problem consists in figuring out how to distribute the advertised products over the four weeks so that the constraints are satisfied. We are “lining up” four pairs of products in a sequence. Whenever there is an explicit or implied time sequence in a
scenario, you can be pretty sure you are dealing with a linear game.

Here is the first question asked in connection with this game:

*Which of the following is a pair of products that CANNOT be advertised during the same week as each other?*

a) **H** and **K**
b) **H** and **M**
c) **J** and **O**
d) **K** and **L**
e) **L** and **M**

To answer this question, you would have to try to configure the product pairs over the four weeks obeying all of the constraints. You may find in trying to do this that one of the five pairs above cannot appear without violating a constraint. That would be your answer. We will solve this game in detail later using our strategies for linear games.

2) **Grouping Games**

Grouping games (*pure* grouping games, not the linear/grouping combo games discussed subsequently) present a set of variables and ask you to assign them to subsets according to rules that link individual variables. There is no concern for any type of sequential order as with linear or multilevel linear games. Matching games fall into this category.

This is a grouping game from the October 1996 LSAT:

*SCENARIO:* A university library budget committee must reduce exactly five of eight areas of expenditure - G, L, M, N, P, R, S, and W - in accordance with the following conditions:

*RULES:*
1) If both G and S are reduced, W is also reduced.
2) If N is reduced, neither R nor S is reduced.
3) If P is reduced, L is not reduced.
4) Of the three areas, L, M, and R, exactly two are reduced.

The task presented by this game is to make an assignment of the eight variables to two groups: those reduced and those not reduced. Many assignments would be disallowed by the constraints. Although it may not seem like it, there are enough
constraints in this problem to whittle down the possible assignments so that we could identify a definite subset of five areas that would be reduced (and by implication three that would not).

Here is the third question asked for this game:

*If P is reduced, which one of the following is a pair of areas of expenditure both of which must be reduced?*

- a) G and M
- b) M and R
- c) N and R
- d) R and S
- e) S and W

This question falls into the category of “game changer”. In fact, five of the seven questions posed for this game are of this type, where new information in the form of a hypothetical ("If P is reduced...") changes the basic rules of the game. This is a very common occurrence in the logic games.

3) **Multilevel Linear Games**

Multilevel linear games (some test prep authors call them stacked linear games) require you to arrange sets of variables in two or more sequences with all constraints satisfied. There is some interdependence among the variables in different sets established by the language of the constraints, so the sequences need to be coordinated.

This is a multilevel linear game from the September 1998 LSAT:

**SCENARIO**: Eight physics students - four majors: Frank, Gwen, Henry, and Joan; and four non-majors: Victor, Wanda, Xavier, and Yvette - are being assigned to four laboratory benches, numbered 1 through 4. Each student is assigned to exactly one bench, and exactly two students are assigned to each bench. Assignments of students to benches must conform to the following conditions:

**RULES**:  
1) Exactly one major is assigned to each bench.  
2) Frank and Joan are assigned to consecutively numbered benches, with Frank assigned to the lower numbered bench.  
3) Frank is assigned to the same bench as Victor.  
4) Gwen is not assigned to the same bench as Wanda.
Although a time sequence is not evident in this problem, it is clear that the sequence of numbered benches will do. The problem author gives us a big hint here. Note that there are two groups of variables that are separated by a condition...being a major or non-major. And note how thoughtful the test writer was to invent names that would allow us to assign variable letters F, G, H, and J versus V, W, X, and Y. We recognize this problem as a multilevel linear game, since we are tasked with arranging each set of variables separately with regard to the benches 1 through 4. The two sequences will not be independent...this is what makes the problem tough...because there are connections between them that have to be respected. Constraints (3) and (4) do precisely that by requiring the linking F and V and forbidding the linking of G and W.

Here is the second question asked for this game:

*If Victor is assigned to bench 2 and Wanda is assigned to bench 4, which of the following must be true?*

a) Frank is assigned to bench 1.
b) Gwen is assigned to bench 1.
c) Henry is assigned to bench 3.
d) Xavier is assigned to bench 1.
e) Yvette is assigned to bench 3.

To address this question you would need to lay out the skeleton of a sequence for majors and one for non-majors with the definite assignment of V to position 2 and W to position 4 in the non-major sequence. Then, coordinating the two sequences so that all of the given constraints are observed, one of the five answers must be unavoidable. You can be confident that a "which of the following must be true (or false)" type question will mercifully have only one answer.

4) **Linear/Grouping Combo Games**

Both ideas of linear and grouping games can be combined. In these games, variables are sorted into groups and then the variables within a group are arranged in a linear order which is compatible with the constraints of the problem. So the grouping part of the solution precedes the linear sequencing part of the solution. Although it may seem that a game with a complicated structure and many constraints would always be the most difficult, the silver lining is that more structure and rules often combine to reduce the number of possibilities for the variable configurations. The methods we will discuss for linear and grouping games carry over to analysis of combo games.
This is a combo game from the February 1994 LSAT:

**SCENARIO:** A soloist will play six different guitar concertos, exactly one each Sunday for six consecutive weeks. Two concertos will be selected from among three concertos by Giuliani - H, J, and K; two from among four concertos by Rodrigo - M, N, O, and P; and two from among three concertos by Vivaldi - X, Y, and Z. The following conditions apply without exception:

**RULES:**
1) If N is selected, then J is also selected.
2) If M is selected, then neither J nor O can be selected.
3) If X is selected, then neither Z nor P can be selected.
4) If both J and O are selected, then J is played at some time before O.
5) X cannot be played on the fifth Sunday unless one of Rodrigo’s concertos is played on the first Sunday.

Here is the second question asked for this game:

*If the six concertos to be played are J, K, N, O, Y, and Z and if N is to be played on the first Sunday, then which one of the following concertos cannot be played on the second Sunday?*

- a) J
- b) K
- c) O
- d) Y
- e) Z

This question requires that you have in mind tentative layouts of concerto selections for the six dates that satisfy the constraints plus the additional condition that N is played on the first date. You can see that the grouping process...picking the six concertos to be played out of the ten available...is aided considerably by the extra rule presented in the question itself. If N must be played, then by constraint (1) so must J, then by constraint (2) M must not, and so forth. Then as we attempt to arrange the concertos selected into a sequence, we will discover that one of the answers, if it is required to be played on the second date, is incompatible with all of the constraints. We will explore general methods to attack games like this shortly.

5) PATTERN GAMES

Pattern games are a variant of multilevel linear games where the constraints apply to the variables across the board rather than to one or perhaps several variables only. For example, you might be told that no variable can appear first in both sequences, rather than variable A must appear second in at least one sequence.
Here is a pattern game from the October 1997 LSAT:

**SCENARIO**: Five candidates for mayor - Q, R, S, T, and U - will each speak exactly once at each of three town hall meetings - meetings 1, 2, and 3. At each meeting, each candidate will speak in one of five consecutive time slots. No two candidates will speak in the same time slot as each other at any meeting. The order in which the candidates will speak will meet the following conditions:

**RULES**:
1) Each candidate must speak either first or second at at least one of the meetings.
2) Any candidate who speaks fifth at any of the meetings must speak first at at least one of the other meetings.
3) No candidate can speak fourth at more than one of the other meetings.

Here is the third question asked for this game:

*If the order in which the candidates speak at meeting 1 is R, U, S, T, Q, and the order in which they speak at meeting 2 is Q, R, U, S, T, which one of the following could be true of meeting 3?*

a) Q speaks first  
b) R speaks third  
c) S speaks first  
d) T speaks second  
e) U speaks fifth

We will use a modification of our strategy for multilevel linear games to deal with pattern games.

Occasionally, the LSAT presents circular linear games, sequencing games (distinct from linear games), or mapping games. We will cover these briefly in the text.

6) **CIRCULAR LINEAR GAMES**

These are just linear games with the beginning and end of the natural order connected. An example would be a game based on a seating arrangement for persons around a circular table. Apparently the LSAT has used this game format once in the last twenty years.

7) **SEQUENCING GAMES**

This game format has appeared much more frequently than the circular linear game. Sequencing games resemble ordinary linear games except that the positions of the
variables are relative only to one another and not to some fixed natural order such as days of the week or fixed rows of seats, for example.

8) MAPPING GAMES

Mapping games involve determining the complete picture of relationships among several variables based on incomplete information. They have been used more frequently in the past than recently. Often they can be reduced to a grouping game.
STRUCTURE OF LOGIC GAMES

GAME STATEMENTS

The vast majority of logic games that appear on the LSAT are puzzles based on two general ideas...order and association. Solving such a puzzle amounts to identifying a typically small collection of objects called variables and then arranging them in a certain way (order) or grouping them together in a certain pattern (association) so that all of the arbitrary rules that constrain possible solutions are obeyed. The introductory patter that defines the variables and describes the basic task of the game is called the scenario. The scenario and the rules make up the game statement.

The test authors may create games based on simple orderings (linear games), unordered groupings (grouping games), simultaneous orderings (multilevel or stacked linear games), and ordered groupings (combination games). Once you gain some experience in handling problems based on the two main concepts of order and association, you will find that extending your problem-solving skills to games that are offshoots or combinations of these concepts will be easier. You will also be able to immediately classify a game as to its type, and this will save time...always a good thing...in organizing your approach to solving the game.

SCENARIOS

Logic games are introduced in the form of a scenario, or short paragraph that defines all the variables and the initial relationships that must be established among them. Scenario comes from the Italian “scaena” for scene or stage, and it is particularly apropos in this context. A logic puzzle could be correctly and completely given in terms of nothing but dry as dust mathematical symbols, but unless you are used to this sort of thing, this would stimulate no immediately useful imagery in your mind and would make the crucial details of the game less easy to remember and work with. The test authors recognize this and try to make the details of the game statement more memorable by inventing a little story and couching the game in more familiar and concrete terms. Allowing the game to come alive on stage in your imagination, if only for the few minutes you need to answer the game questions, is a skill that you will
want to cultivate.

Memory experts will tell you, the more links you can make between new material and your own experience, the better your retention will be. After all, the faster you can absorb the big picture, the sooner and more confidently you can move on to answering the questions. Another benefit of being able to quickly relate to the basic elements of a logic game is that the questions asked will not be, except in rare (but most welcome) instances, of the "look up" type. This is a question where a single look back to the scenario or rules nails down an answer. The majority of logic game questions require the construction of a solution template, or diagram, which incorporates both the given conditions of the scenario and the constraints embodied in the rules. Often there are subtleties in drawing an acceptable template that are apparent only if you have thoroughly digested the game statement.

VARIABLES

Identifying the variables in a logic game is usually cut-and-dried. Either the test authors just go ahead and give you symbolic variables...capital letters...or they give you a string of names that are conveniently chosen so that the initial letters are a successive string in the alphabet, in which case you simply use those. In doing problems, we have occasionally seen the case where one letter is skipped over in the variable list, and unless you catch it, you may jump in and construct a solution template that has a serious error.

Occasionally you may encounter a game which seems to have two sets of variables and it is not clear how to proceed. Typically, this happens with a linear game which has a scenario that presents both objects that are to be arranged in some order, and also the positions available (in time or space or some other order) for this to be done. You can resolve these cases easily by focusing on which apparent set of "variables" has a natural order...like days of the week, rows of seats, and that sort of thing. The objects with the natural order form the positions in the template into which the objects that have no natural order are to be arranged. For example, if a doctor was to see one patient per day among Al, Bob, and Charlie on Monday, Tuesday, and Wednesday, it is the people who are variables, not the days, which will be naturally ordered positions in the solution template. Another clue may be found in the rules. Generally, the variables appear as subjects in the sentences giving the contraints.
RULES

The difficulty of logic games is contained in the scope and subtlety of the rules which limit your freedom in constructing valid solution templates. It would be easy to seat five people on five chairs. Less so if we have to worry about seating them so that two particular people can’t be adjacent and one specific person has to be in the middle. The number of feasible arrangements plummets as soon as we start imposing extra conditions. We could easily put so many conditions on the seating problem that there would be no solution. Obviously the LSAT test designers don’t want to go that far, but there is a happy...for them...medium, where the solution to such a problem would exist (there could be several) but be far from obvious.

These limiting constraints or conditions which follow the scenario in a game statement constitute the rules. There are typically three to five such “global” rules which we must observe right from the outset in constructing a solution template. The questions posed for the game may introduce additional “local” rules, or even relax an existing global one. Pay careful attention to any modifications in the basic rules when addressing a specific question.
STRUCTURE OF LOGIC GAMES

QUESTIONS

GENERAL OBSERVATIONS

The Logic Games part of the LSAT typically presents twenty-four questions overall covering four separate games. Occasionally the total number of questions will vary slightly, but the number of games is always four. Individual games have between five and eight questions, with eight being very rare. A typical pattern is to have a five question game, two six question games, and a seven question game. Having the larger number of questions does not automatically mean that the game is the hardest. In fact, since there is some time overhead spent in absorbing and understanding the game statement, we may welcome a (simple) seven question game, since we can knock out more questions without having to stop and absorb a new game statement.

The questions posed after the game statement loosely follow a general pattern. The first couple of questions usually do not introduce any modification to the rules. This happens with the later questions. Often one of the initial questions is a so-called “acceptability” question”, which is designed to fritter away your valuable minutes by requiring you to do a process of elimination. We have a suggestion later on how to handle these efficiently. The flip side of the time-waster is that it may reinforce the game statement in your mind so that you have a better perspective for the remaining questions.

Questions posed after the first few often introduce special local or ad hoc assumptions that change the rule environment. Generally you need to make secondary deductions from the rules in order to answer these confidently. Certain types of these secondary deductions are automatic, and we will discuss them later. Oddly or not, very often the last question for a game has a “silver bullet” answer, by which we mean it can be answered immediately without any lengthy process of elimination by appealing to a single insight gotten from the rules and secondary deductions.

Provided that all the rules, modifications included, are identical for two questions, a
correct answer for one may be an immense help in answering the other, so don’t treat the questions in isolation....there are linkages. And the linkages work both forwards and backwards.

The LSAT authors adhere to some conventions in framing questions, so we will explore them below. Also, we present a basic review of logic with particular emphasis on some of the logical fallacies that test writers rely on for temptation.

QUESTION STYLES

Most logic game questions, adjusted for specifics, are of three types:

1) Which of the following statements must be true?

   This is the most common type of question. To answer it you must be able to make an argument that a particular configuration of variables is forced to happen by the rules.

2) Which of the following statements could be true?

   This is a popular type of question. To answer it you need to identify a configuration of variables that satisfy all the rules. It need not be forced as with type 1), and in fact, there could be other configurations consistent with the rules. You may rest assured, however, that only one valid configuration will be presented as an answer choice. Very often, this type of question is posed in connection with verifying some complete configuration...all the variables assigned somewhere. Having a valid answer to this question is an immense help in dealing with other questions that ask if such and such a detail is possible. You will see it phrased as “Which of the following could be a complete and accurate list of the ...” or words to that effect. The acceptability question mentioned above is one of this type, and it is worth having a confident answer.

3) Which of the following statements CANNOT be true?

   This is the flip side of type 1). We are now looking for what cannot possibly happen. Don’t make the mistake of interpreting it as “could be false”...it is definitely false. You could approach a question of this type by trying to eliminate the four incorrect responses that “could be true”, but unless you have
some substantial information on this already, you are headed for wasting time with a process of elimination. One nice thing about so-called counterexample problems is that all it takes is for one thing to be out of place...one rule violated...and you have your answer.

You may see questions like these:

4) Which of the following statements must be false?

5) All of the following statements are true EXCEPT:

Question types 4) and 5) are clearly equivalent to 3). The test authors capitalize words like "cannot" and "except" as a courtesy to the test taker, so there is no doubt about the negation in the question.

Other frequently encountered generic questions include:

6) It is possible to determine the exact status (position in a sequence, membership in a group) of exactly how many variables?

7) Which of the following variables must come before a given variable (in a sequence)?

8) Which variables must be grouped with a given variable?

9) If A happens before B (A is grouped with B), then [ a type 1, 2, or 3 question]?

Question types 1) and 3) are generally easier to answer than type 2) because they involve definite conditions. A solution template may rule out or rule in a particular outcome, and that is enough to decide questions of those types. A question of type 2) may require that we investigate each candidate statement and determine if it is not necessarily false. Sometimes there may not be enough information contained in the scenario and rules to reason your way to a definite answer for a type 2) question. In that case, a trial solution diagram that can be shown not to violate any of the rules, and therefore result in a "could be true" may be the only approach. This happens, so don't be discouraged by the apparent lack of definiteness.

For a type 1) or 3) question that does not yield easily to a direct interpretation, a process of elimination, like that for a type 2) question, may have to be used, but try
to avoid it if at all possible. To rule out an answer to a “must be true” or “CANNOT be true” question, it suffices to find a single respective counterexample. Don’t forget that if you are reasonably sure that you have answered a type 1) or 3) question correctly, the content of your answer is as good as another rule in guiding your response to further questions based on the same rule set.

A type 6) question can be answered with the help of answers to type 1) questions. The latter establish what is forced to be true, and that is the point of type 6) questions. Type 7) and 8) questions also benefit from having as complete a picture as possible of what is necessarily true. A type 9) question introduces a local rule...good just for that question or maybe the one right after it, too. Local rules can turn “could be trues” into “must be trues” by eliminating all but one rule-consistent variable configuration. So having a confident answer to a “could be true” might lead to a quick answer for a type 9).

It is always a good idea to “pick the low hanging fruit”...by which we mean writing down for easy reference the obvious implications of the scenario and rules. Let us call these derived rules. As you parse the game statement, it may be immediately obvious that a potentially useful derived rule can be inferred from the stated rules. Write this down on speculation even before you approach the task of building a solution diagram. You may need it...maybe not...but very often the low fruit leads to an easier time with the questions. If nothing occurs to you, don’t try to force it...concentrate on the questions.

Generally, using a process of elimination is more time consuming than appealing to a direct interpretation of the rules...the silver bullet, so to speak. Questions of type 2) usually require the process of elimination. For type 1) or 3) questions that involve a particular variable, look for rules that place restrictions on that variable...the more numerous and confining the rules the better, as this limits the possibilities. Often a question with this feature can be cracked by an application of basic logic to the rules, either explicitly stated or derived.
A conditional statement is one where we say "If A happens, then B happens". It is conditional because A might not happen. B can happen on its own without forcing A to either happen or not. The only thing this statement really says is that should A somehow happen, it is unavoidable that B will happen as well. Logicians would call the "if" part the antecedent, and the "then" part the consequent. There is an implied before/after order here...whoever or whatever can cause event B is somehow aware of the status of possible event A, and should A ever happen, then the trigger for event B must inevitably be pulled.

We can characterize the two events in the following way. A is a **sufficient condition** for B, since whenever we have A, we then have B. Not only do we just have B, we *must* have B, and that means B is a **necessary condition** for A. You can’t have A without B. Logicians call a conditional statement like this a **material implication**. It is a weaker assertion than it may first appear to be. The only thing that is being ruled out is that you can’t simultaneously have A and not B.

We have squeezed all the juice out of the conditional statement “If A, then B”. A is sufficient for B and B is necessary for A. A common mistake is to think that if B has happened, that must mean A has happened, or that B is sufficient for A. It often seems like this is a superficially reasonable conclusion, especially if the most probable way for B to happen is to be preceded by A, but it does not follow from the rules of logic. “If you stay out too long in the sun, then you will have reddened skin.” Our common experience suggests that reddened skin is often caused by too much sun, but there could be other reasons...allergies, chemicals, or tanning beds, for example. “If B, then A” does not follow from “If A, then B”.

Given the statement “If A, then B”, the **converse** statement is “If B, then A”, the **inverse** statement is “If A, then not B”, and the **contrapositive** statement is “If not B, then not A”. We have just noted that the truth of the converse statement is independent of the truth of the original conditional statement. The inverse statement is the denial of the original, so when the original is true, the inverse is false, and vice versa. The contrapositive statement is true or false precisely whenever the original conditional statement is true or false. We say that they are logically equivalent. Note that in the original A is sufficient for B and B is necessary for A. So if we deny B, that is sufficient to conclude that we cannot have A...but this is the contrapositive.
In the context of logic games, we are often given a rule such as “If A is in position 2, then B is in position 5”. We may not conclude that if B is in position 5, then A must be in position 2. This is the converse. But we may conclude that if B is not in position 5, then A is not in position 2. Again, this is the contrapositive. Get into the habit of writing down the contrapositive for every “if-then” statement you see in a logic game.

The English language is very expressive, and there are many ways to make a conditional statement. Some samples are presented below. We recommend converting all conditionals to the model “if...then” form, which will be the most familiar to us.

If the furnace isn’t working, then the guest bedroom will be cold.
Unless the furnace works, the guest bedroom will be cold.
If the guest bedroom is not cold, then the furnace must be working.
Unless the guest bedroom is not cold, the furnace must not be working.
Should the furnace not be working, the guest bedroom will be cold.
In the event that the guest bedroom is not cold, then the furnace must be working.
Either the furnace is working or the guest room is cold.
Except when the furnace is working, the guest room is cold.
Whenever the guest room is not cold, the furnace must be working.

Every one of these statements is logically equivalent to the first, and hence to each other. We will want to practice parsing conditional statements and reducing them to the more familiar “if-then” form.

Two logical fallacies to avoid are these:

If A then B, and subsequently if also not A, then not B. This is called the fallacy of denying the consequent. A happening definitely causes B to happen, but just because A does not happen, B may still happen for some other reason.

If Johnson pitches, then we will win. Johnson didn’t pitch. We won anyhow.

If A then B, and subsequently if also B, then A. This is called the fallacy of affirming the antecedent. Again, A happening forces B to happen, but if B happens spontaneously, that doesn’t mean A had to happen.

If it rains, the street will be wet. The street is wet, therefore it must be raining. Could have been a fire hose!
MODELING LOGIC GAMES

NOTATION

A good diagram or template that faithfully models the scenario and rules of a game statement is priceless. That is because it summarizes visually all of the quirks of a game and allows you to see subtleties and relationships that might not be apparent from simply reading the words of a game statement. A good diagram may answer some questions all by itself. Several observations can be made about “optimal notation”:

1) You have to be comfortable using it...it has to be natural for you and effortlessly recalled. Some of the national prep courses have complicated systems where learning the notational system is a project in itself. You will be under constant time pressure taking the exam, and mentally fumbling for the niceties of some notational system is not what you want to be doing in the middle of the exam. Recall the story of the medical student who had studied a mnemonic phrase (little ditty that spurs the memory) to remember the Latin names for the craniofacial nerves. He took his exam and got so confused with the ditty that he completely botched the list of nerves.

2) It has to be sketched quickly. Given enough time, we could probably create a game diagram that flawlessly and completely summarized anything we might ever want to know about the game. But we don’t have unlimited time, and the important thing is to get something written quickly and accurately that will give us the insights we need.

3) It has to fit legibly in the space we have to write it. Learn to write small. Scratch work has to be done on the examination pages and there is not a lot of room. Questions that introduce new or modify old rules may require a re-do of the template. Or you may get off on the wrong foot and have to start over on a diagram. Space is at a premium as well as time. We recommend committing to a horizontal format for whatever diagram you develop. The text on the pages is horizontal, and you will be able to scale and position your scratchwork better.

4) It has to be expressive enough to model the features of every game you might encounter.
The following chart presents a notational system that we have found satisfies the above desirable properties. This is admittedly subjective, so we present our system as a starting point for you.

**Chart of Suggested Notation**

<table>
<thead>
<tr>
<th>Notation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>( S' )</td>
<td>( S ) is a variable which does not appear in any game rule</td>
</tr>
<tr>
<td>( xS )</td>
<td>( S ) is a variable which cannot occupy a given position</td>
</tr>
<tr>
<td>( \text{ST} )</td>
<td>( S ) immediately precedes ( T )</td>
</tr>
<tr>
<td>( x\text{ST} )</td>
<td>( S ) does not immediately precede ( T )</td>
</tr>
<tr>
<td>( \text{S_T} )</td>
<td>( S ) is two positions before ( T )</td>
</tr>
<tr>
<td>( \text{S....T} )</td>
<td>( S ) is ( n ) positions before ( T )</td>
</tr>
<tr>
<td>( S/T )</td>
<td>Either ( S ) or ( T ) occupy a given position</td>
</tr>
<tr>
<td>( S,T )</td>
<td>Both ( S ) and ( T ) can occupy a given position</td>
</tr>
<tr>
<td>( S &lt; T )</td>
<td>( S ) is positioned before ( T )</td>
</tr>
<tr>
<td>( S,T &lt; U )</td>
<td>( S ) and ( T ) are positioned before ( U )</td>
</tr>
<tr>
<td>( \ldots S_{n} \ldots )</td>
<td>( S ) must be at position ( n )</td>
</tr>
</tbody>
</table>
...S/...  S could be at position $n$

(ST...Z)  ST...Z appear somewhere in that order

\[
\begin{array}{c}
S \\
T
\end{array}
\]  S is bound to base variable T

\[
\begin{array}{c}
S \\
TU
\end{array}
\]  S is bound to T and T immediately precedes U

$nS$  S occurs $n$ times

$S_A \rightarrow T_B$  If $S$ has property $A$ then $T$ has property $B$

[STU]  $S$, $T$, and $U$ are grouped together
GENERAL OBSERVATION

Linear games have historically, along with grouping games, been the bread-and-butter puzzles for the LSAT. Rarely during the last twenty years has the LSAT not contained at least one straight linear game per test date. Linear games are easy to understand, if perhaps difficult at times to solve, so they lend themselves to the kind of instructional approach we are trying to provide here. Certain principles of game construction are used over and over again, so if we study these diligently, we will have both a sense of familiarity with the type of game and enough confidence in our ability to solve it that we may actually do so with a reasonable proportion of success.

RECOGNITION KEYS

The first task with linear games, as with any type of game, is to recognize them correctly. The game principle is, of course, putting things in order or sequencing them, so we should be on the lookout for clues that suggest this purpose in a game statement. Words that indicate some variables are before or after others in time, importance, or with respect to some other measure that reflects an intrinsic order are the key.

The test makers may try to de-emphasize the nature of a linear game, but it is always visible to the trained eye. The basic components are variables...objects that will be placed in positions...and the positions available. A linear game statement will introduce some kind of sequence of positions...days of the week, hours in a day, seats in a row, rows in a stadium...that sort of thing. It may be far from time-related, and, in fact, the sequence of positions could be based on something abstract, like consumer preferences, or some other non-physical scale. But the defining feature is that somehow the available positions will be ranked from first to last, lowest to highest, worst to best, or by a similar type of order.

Sometimes the line between variables and positions is a little murky, and under the battle conditions of an exam, there may be an opportunity for momentary confusion.
One way to avoid this is to note that in the rules for a linear game, almost always the variables appear as subjects in the rule statements, and the positions available are described in the predicates. Occasionally the test authors are completely transparent about the nature of a linear game, and almost draw the game diagram for you.

After we have identified a sequencing feature in a game statement, we need to assure ourselves of two things: (1) we haven’t hooked a hybrid or combo game, and (2) we are not looking at a multiple level sequencing game. If there is any grouping or non-sequencing type of rule present, we have a combo game. If there are different levels of available positions (mornings vs. afternoons of days of the week, for example) we may have a multilevel linear game. Now sequences inside of sequences don’t take us out of the realm of linear games, but two independent sequences with tie-ins between variables in one to variables in the other do qualify as a multilevel linear game.

Now that we are sure we have a straight linear game, there are some features that appear frequently.

**GAME FEATURES**

It is always clear how many positions are available for placing variables in order. Sometimes a rule explicitly tells you that a particular variable must go in a particular position. This is valuable, as it takes that variable off the table, so to speak. Use that variable as an anchor to roughly locate other variables. For example, if A is in position three out of five available, and B is later than A, then B must be in position four or five.

A common rule in linear games is that either one variable immediately precedes another, or it just precedes it, but we don’t know by how much. This immediately precludes certain configurations of these variables. The variable that is “earliest” cannot be last, as there would be no place for the “later” variable. Likewise, the later variable cannot be first, as there would be no place for the earlier. If we know how many positions separate two variables with this type of rule in effect, it may even be enough to completely specify their positions in the overall sequence. For example, if A must be two positions before B (there is one skipped position between them) and there are only three positions available in this game, it is unavoidable that A will come first and B last. Even if there were five positions available in this game, we could still conclude that A would be restricted to the first, second, or third position, and
likewise B would only have access to the third, fourth, or fifth position. So a seemingly simple relative relationship between two variables may have substantial implications regarding their absolute placement.

Another trick the game authors use is to give a rule which pastes several variables together into a block. Then they create an obstacle in a sequence that forces the block, or something else that has to fit beside the block, into a definite absolute position. For example, say we are to sequence A thru E in five positions. If A immediately precedes B and B immediately precedes C, then somewhere the block ABC must appear. If we now ask, if E must precede C, but D must follow A, the only game in town is to put the block square in the center of the available positions, E first, and D last. We go from seemingly innocent relative position rules to a hard and fast unique final position of all variables. This is a gimmick that crops up often.

The preceding block trick can be expanded on by creating blocks of different sizes. Then depending on the placement of the obstacle...a variable that by assumption goes in a particular place...it may very well be that the remaining multiple-variable blocks only fit into the grand scheme one way. Imagine a block of three and a block of two variables to be placed in a sequence with six available positions. If the obstacle is placed in the first or last position, there are two ways each to position the blocks. But if the obstacle sits on the fourth position, there is a unique way to assign the blocks to the sequence. If the obstacle were in the fifth position, there would be no legitimate placement for the blocks available!

These are the main principles the game authors use to limit the options available in a linear game without appearing to do so in the statement of the rules.
Linear Game 1

Scenario

A professor will listen to exactly one speech from each of six students – H, J, K, R, S and T. The six speeches will be delivered one at a time, consecutively, according to the following conditions:

Rules

1) The speeches delivered by H, J, and K, no matter what their order relative to each other, cannot form a sequence of three consecutive speeches.
2) The speeches delivered by R, S, and T, no matter what their order relative to each other, cannot form a sequence of three consecutive speeches.
3) H’s speech must be earlier than S’s speech.
4) J’s speech can be neither first nor sixth.
5) T’s speech can be neither immediately before nor immediately after J’s speech.

Questions

1) Which of the following could be the order, from first to last, in which the students deliver their speeches?

(A)  H, J, R, S, T, K  
(B)  H, R, T, K, S, J  
(C)  K, J, T, H, S, R  
(D)  R, J, K, T, H, S  
(E)  T, R, J, S, K, H

2) If T delivers the third speech, which one of the following must be true?

(A)  H delivers the first speech  
(B)  J delivers the fifth speech.  
(C)  K delivers the fourth speech.  
(D)  R delivers the sixth speech.  
(E)  S delivers the fourth speech.

3) If S delivers the third speech and T delivers the fourth speech, then which one of the following must be true?

(A)  H delivers the second speech.  
(B)  J delivers the fifth speech.  
(C)  K delivers the fifth speech.
(D) K delivers the first speech.
(E) R delivers the first speech.

4) If K delivers the first speech and H delivers the fifth speech, which one of the following must be true?

(A) R delivers the third speech.
(B) T delivers the fourth speech.
(C) J’s speech is immediately before H’s speech.
(D) K’s speech is immediately before T’s speech.
(E) R’s speech is immediately before J’s speech.

5) If R’s speech is immediately after S’s speech and immediately before K’s speech, then which one of the following could be true?

(A) H’s speech is immediately before S’s speech.
(B) H’s speech is immediately before T’s speech.
(C) K’s speech is immediately before J’s speech.
(D) K’s speech is immediately before T’s speech.
(E) T’s speech is immediately before S’s speech.

6) If K delivers the third speech, any of the following could be the student who makes the fourth speech EXCEPT

(A) H
(B) J
(C) R
(D) S
(E) T
Linear Game 1 - Diagram for Solution

Step 1 - list what is being placed in order and what the positions available are:

```
H J K R S T
```

Step 2 - translate the scenario and rules to shorthand notation

```
H J K R S T
```

Step 3 - add any obvious derived rules

```
H J K R S T
```

Step 4 - check answers against diagram, add new rule if question introduces it
Linear Game 1 - Analysis

1) Answer is (D)

By the process of elimination, we can rule out (A) as R, S, T cannot form three consecutive speeches. Then we eliminate (B) as J cannot be sixth. Then we eliminate (C) as JT cannot be consecutive. Finally, we can rule out option (E) as H must be before S.

2) Answer is (B)

We can obtain this answer directly since if T is placed third, J cannot be second or fourth. Taking this fact along with the original rules that J cannot be first or sixth, we see that J must be fifth.

3) Answer is (C)

By positioning S third and T fourth we have to put J second (since J cannot be next to T but also not first nor last). It follows that H must be first, since H must be before J. R cannot be fifth as that would result in S, T, and R forming three consecutive speeches, so K must be fifth.

4) Answer is (A)

Placing K first and H fifth forces S into sixth place since H must be before S. The rule that states T and J cannot be consecutive dictates that T cannot be third (as that would leave only slots 2 and 3 would be available – neither of which J could fill). Similarly J cannot be third. This leaves R to go in third place.

5) Answer is (D) - this is a time waster question

By the process of elimination, (A) cannot be true, since the 4-block H, S, R, K must start at position 2 and end at position 5 in order to keep J and T separate. But J cannot be in position 1 or 6. We know (B) is false since the H,T pair must precede the S,R,K triple (as H precedes S). This implies that the triple must occupy either positions 3 to 5, or 4 to 6, but neither one is possible as J can be neither in position 1 or 6, nor next to T. Option (D) creates a block of four: S, R, K, J which must occupy positions 2 to 6 since S cannot occupy position 1 and J cannot occupy position 6. Now since H cannot occupy position 6 either, it must be in position 1, but that would leave T to fill position 6 and that cannot be because J and T cannot be together.
(D) is correct since H, J, S, R, K, T is a valid ordering. We can eliminate (E) since if T is immediately before S, that would mean T, S, R form a consecutive block.

6) Answer is (A)

We can see that if we put H in position 4 that leaves no position available for J. And J cannot be in position 1 or 6 anyway, now with K in position 3 and H in position 4, J cannot occupy position 2 or 5 as that would create J, K, and H in a consecutive triple.
Linear Game 2

Scenario

During a 4 week period, each of 7 previously unadvertised products G, H, J, K, L, M and O, will be advertised. A different pair of these products will be advertised each week. Exactly one of these products will be advertised twice. The following constraints must be observed:

Rules

1) J is not advertised during a given week unless H is advertised during the immediately preceding week.
2) The product that is advertised twice is advertised during week 4, but is not advertised during week 3.
3) G is not advertised during a given week unless either J or else O is advertised that week.
4) K is advertised during one of the first two weeks.
5) O is one of the products advertised during week 3.

Questions

1) Which of the following could be the schedule of advertisements?
   (A) week 1: G, J; week 2: K, L; week 3: O, M; week 4: H, L
   (B) week 1: H, K; week 2: J, G; week 3: O, L; week 4: M, K
   (C) week 1: H, K; week 2: J, M; week 3: O, L; week 4: G, M
   (D) week 1: H, L; week 2: J, M; week 3: O, G; week 4: K, L
   (E) week 1: K, M; week 2: H, J; week 3: O, G; week 4: L, M

2) Which of the following is a pair of products that CANNOT be advertised during the same week as each other?
   (A) H and K
   (B) H and M
   (C) J and O
   (D) K and L
   (E) L and M

3) Which one of the following must be advertised during week 2?
   (A) G
   (B) J
   (C) K
   (D) L
   (E) M
4) Which one of the following CANNOT be the product that is advertised during two of the weeks?

(A) G  
(B) H  
(C) K  
(D) L  
(E) M

5) If L is the product that is advertised during two of the weeks, which of the following is a product that must be advertised during one of the weeks in which L is advertised?

(A) G  
(B) H  
(C) J  
(D) K  
(E) M

6) Which of the following is a product that could be advertised in any of the four weeks?

(A) H  
(B) J  
(C) K  
(D) L  
(E) O

7) Which of the following is a pair of products that could be advertised during the same week as each other?

(A) G and H  
(B) H and J  
(C) H and O  
(D) K and O  
(E) M and O
Linear Game 2 - Diagram for Solution

Step 1 - list what is being placed in order and what the positions available are:

GHJKLM0 X

---

Step 2 - translate the scenario and rules to shorthand notation

GHJKLM0 X

HJ

GJ or GJ

Step 3 - add any obvious derived rules

GHJKLM0 X

HJ

GJ & GJ

Step 4 - check answers against diagram, add new rule if question introduces it
Linear Game 2 - Analysis

Immediate observation:

Note that the product advertised twice cannot be O, (since O is advertised in week 3 and the repeated product is advertised in week 4 but not advertised during week 3), it also cannot be J (since if J were advertised twice, then H would be advertised twice). Also, J cannot be advertised during week 1 since J is only advertised when H is advertised the previous week.

1) Answer is (B)

We can eliminate (D) since K must be advertised during week 1 or 2. We can also eliminate (A) as J cannot be advertised during week 1. We can also rule out (C) as G must appear with O or J. Finally we can eliminate (E) as J cannot be advertised during week 2 unless H is advertised during week 1.

2) Answer is (C)

If J and O are advertised together in week 3, either J or O must be repeated in order for G to be advertised, but it is stated that the product advertised twice is not advertised in week 3. Note – this provides a new global rule: “J is not advertised in week 3” and a secondary global rule: “H is advertised during week 1”.

3) Answer is (B)

We have the greatest restrictions on J and K, so it makes sense to check these out first. We want to find out what 'must be true' so try finding an arrangement for the alternative, (that K could be in either week 1 or week 2). So try finding an arrangement where K is advertised in week 1 to rule out (C). We know that J cannot be advertised during weeks 1 or 3 (previous question), so try finding an arrangement where J is advertised during week 4 to rule out (B). However, if J is advertised during week 4, that means H is advertised with O in week 3. Since neither J nor O is repeated, G must be advertised exactly once during week 4 with J. (G is not advertised unless either J or O is also advertised the same week). This however violates the rule whereby the product that gets advertised twice gets advertised during week 4. Thus B must be true.

Note – this adds a new global rule: “J must be advertised during week 2” and hence H must be advertised during week 1.
4) Answer is (A)

This question can be rephrased as “which product cannot be advertised during week 4” since whichever product is advertised twice, must be advertised during week 4. Of the answer options, we have the most restrictions on G, since G must be advertised the same week as either J or O. If G is advertised during week 4, it must appear with J (since O is only advertised once – during week 3). However, our new global rule from the preceding question states that J is advertised during week 2. Note that question 5) implies that the answer here is not (D).

5) Answer is (E)

Positioning L in week 4, O in week 3, J in week 2 and H in week 1, leaves G, K, L, and M to be positioned. Since K appears in week 1 or week 2, and G cannot be advertised in week 4 (as we saw in question 4), this leaves M to be advertised in week 4 with L.

6) Answer is (D)

We know that J can only be advertised during week 2 so we can rule out (B). Similarly, O can only be advertised during week 3 so we can rule out (E). The product that is advertised twice cannot be advertised on week 3, so K and H cannot be advertised on week 3. (H is advertised on week 1 and if it is advertised twice, it will run on week 4 the second time around. K is advertised on either week 1 or week 2, so if it is advertised twice it will run on week 4 the second time around). This leaves L that can be advertised during any of the four weeks.

7) Answer Is (E)

We can rule out (A) because G must be advertised during the same week as either J or O. We can rule out (B) since if H and J are advertised together it would have to be during week 2 (this is the only week that J can be advertised), but if J is advertised during week 2, then H must also be advertised during week 1. Thus making H the product advertised twice, but this violates the rule that states that the duplicated product must be advertised during week 4. We can rule out (C) for similar reasons. H would have to be the duplicated product, yet isn’t being advertised during week 4. Lastly, we can rule out (D) for the same reason. If K is the duplicated product, K must be advertised on week 4, yet if K appears with O it would have to be during week 3, and we already know that K is advertised during either week 1 or 2. The answer is (E).
Linear Game 3

Scenario

A college offers one course in each of three subjects – mathematics, nutrition, and oceanography – in the fall and again in the spring. Students’ book orders for these course offerings are kept in six folders, numbered 1 through 6, from which labels identifying the folders’ contents are missing. The following is known:

Rules

1) Each folder contains only the orders for one of the six course offerings.
2) Folder 1 contains orders for the same subject as folder 2 does.
3) The orders in folder 3 are for a different subject than are the orders in folder 4.
4) The fall mathematics orders are in folder 1 or else folder 4.
5) The spring oceanography orders are in folder 1 or else folder 4.
6) The spring nutrition orders are not in folder 5.

Questions

1) Which of the following could be the list of the contents of the folders, in order from folder 1 to folder 6?

   (A) fall mathematics, spring mathematics, fall oceanography, fall nutrition, spring nutrition, spring oceanography.
   (B) fall oceanography, spring nutrition, fall nutrition, fall mathematics, spring mathematics, spring oceanography.
   (C) spring mathematics, fall mathematics, spring nutrition, fall oceanography, fall nutrition, spring oceanography.
   (D) spring oceanography, fall oceanography, fall nutrition, fall mathematics, spring mathematics, spring nutrition.
   (E) Spring oceanography, fall oceanography, spring mathematics, fall mathematics, fall nutrition, spring nutrition.

2) Which one of the following statements must be false?

   (A) The spring mathematics orders are in folder 3.
   (B) The fall nutrition orders are in folder 3.
   (C) The spring oceanography orders are in folder 1.
   (D) The spring nutrition orders are in folder 6.
   (E) The fall oceanography orders are in folder 5.
3) If the fall oceanography orders are in folder 2, then which one of the following statements could be true?

(A) The spring mathematics orders are in folder 4.
(B) The spring mathematics orders are in folder 6.
(C) The fall nutrition orders are in folder 1.
(D) The spring nutrition orders are in neither folder 3 nor folder 6.
(E) Neither the spring nor the fall nutrition orders are in folder 3.

4) Which of the following statements could be true?

(A) The spring mathematics orders are in folder 1.
(B) The fall oceanography orders are in folder 1.
(C) The fall nutrition orders are in folder 4, and the fall oceanography orders are in folder 6.
(D) The fall oceanography orders are in folder 2, and the spring oceanography orders are in folder 1.
(E) The spring oceanography orders are in folder 1, and neither the spring nor the fall nutrition orders are in folder 3.

5) If the fall oceanography orders are in folder 2, then for exactly how many of the remaining five folders can it be deduced which course offering’s orders are in that folder?

(A) One
(B) Two
(C) Three
(D) Four
(E) Five

6) Which one of the following lists a pair of folders that must together contain orders for two different subjects?

(A) 3 and 5
(B) 4 and 5
(C) 3 and 6
(D) 4 and 6
(E) 5 and 6
7) Which one of the following could be true?

(A) The fall mathematics and spring oceanography orders are in folders with consecutive numbers.
(B) Folder 5 contains the orders for a spring course.
(C) Folder 6 contains the orders for a subject other than nutrition.
(D) The mathematics orders are in folders 1 and 4.
(E) The orders for the fall courses are in folders 1, 3, and 6.
Linear Game 3 - Diagram for Solution

Step 1 - list what is being placed in order and what the positions available are:

\[ M_F \quad M_S \quad N_F \quad N_S \quad O_F \quad O_S \]

Step 2 - translate the scenario and rules to shorthand notation

\[ M_F \quad M_S \quad N_F \quad N_S \quad O_F \quad O_S \]

\[ \text{O}_S \rightarrow \text{O}_F \quad \text{O}_F \leftrightarrow \text{O}_S \quad \text{M}_F \rightarrow \text{M}_S \quad \text{M}_S \leftrightarrow \text{M}_F \]

\[ \leftarrow 1 \text{ each} \]

Step 3 - add any obvious derived rules

\[ \text{NONE} \]

Step 4 - check answers against diagram, add new rule if question introduces it
Linear Game 3 - Analysis

1) Answer is (D)

By process of elimination it cannot be (A) since the fall nutrition orders cannot be in folder 4. It cannot be (B) or (C) as either the fall mathematics orders or the spring oceanography orders must be in folder 1. It cannot be (E) as folders 3 and 4 cannot both contain the mathematics orders.

2) Answer is (A)

We can reach this solution directly, since if the fall mathematics orders are in folder 1, the spring mathematics orders are in folder 2. Alternatively, if the fall mathematics orders are in folder 4, the spring mathematics orders cannot be in folder 3. Note – this is a new global rule: Spring mathematics orders are not in folder 3.

3) Answer is (B)

We can automatically see that (A), (C), (D), and (E) are false (cannot be true since if the fall oceanography orders are in folder 2, then the spring oceanography orders are in folder 1, and so the fall mathematics orders must be in folder 4. It follows that folder 3 contains a nutrition order.

4) Answer is (D)

Process of elimination: (A) and (B) are false as folder 1 contains either the mathematics orders or the spring oceanography orders. (C) is false as folder 4 contains either the fall mathematics orders or the spring oceanography orders. is false since if the spring oceanography orders are in folder 1, then the fall oceanography orders are in folder 2 and the fall mathematics orders are in folder. But folder 3 contains orders for a different subject than folder 4, which means it must contain either the fall or the spring nutrition orders.

5) Answer is (B)

If fall oceanography is in folder 2, then spring oceanography is in folder 1, which means that fall mathematics is in folder 4. This leaves both nutrition orders and spring mathematics. None of these can be placed definitively.
6) Answer is (E)

Since folders 1 and 2 have orders for the same subject, we have only the orders for two subjects left that could be in folders 3 – 6. Folders 3 and 4 contain different subjects (one of each) which means folders 5 and 6 must also contain one of each.

7) Answer is (C)

By process of elimination we see that (A) is false since the fall mathematics orders and the spring oceanography must be in folders 1 and 4. (B) is also false as the spring nutrition orders cannot be in folder 5 and neither can the oceanography orders. (D) is false as the spring oceanography orders must be in either folder 1 or folder 4. (E) also has to be false, since if the fall mathematics orders are in folder 1, the fall nutrition orders are in folder 3, and the fall oceanography orders are in folder 6, then the spring nutrition orders would have to be in folder 5 and this cannot be.
Linear Game 4

Scenario

On a particular Saturday, a student will perform six activities- grocery shopping, hedge trimming, jogging, kitchen cleaning, laundry, and motorbike servicing. Each activity will be performed once, one at a time. The order in which the activities are performed is subject to the following conditions:

Rules

1) Grocery shopping has to be immediately after hedge trimming.
2) Kitchen cleaning has to be earlier than grocery shopping.
3) Motorbike servicing has to be earlier than laundry.
4) Motorbike servicing has to be either immediately before or immediately after jogging.

Questions

1) Which of the following could be the order, from first to last, of the student’s activities?

   (A) Jogging, kitchen cleaning, hedge trimming, grocery shopping, motorbike servicing, laundry.
   (B) Jogging, motorbike servicing, laundry, hedge trimming, grocery shopping, kitchen cleaning.
   (C) Kitchen cleaning, hedge trimming, grocery shopping, laundry, motorbike servicing, jogging.
   (D) Kitchen cleaning, jogging, motorbike servicing, laundry, hedge trimming, grocery shopping.
   (E) Motorbike servicing, jogging, laundry, hedge trimming, kitchen cleaning, grocery shopping.

2) Which one of the following activities CANNOT be third?

   (A) Grocery shopping
   (B) Hedge trimming
   (C) Jogging
   (D) Kitchen cleaning
   (E) Motorbike servicing

3) Which one of the following CANNOT be true?
(A) Hedge trimming is fourth.
(B) Jogging is fourth.
(C) Kitchen cleaning is second.
(D) Laundry is third.
(E) Motorbike servicing is second.

4) Which of the following activities CANNOT be fifth?

(A) Grocery shopping
(B) Hedge trimming
(C) Jogging
(D) Laundry
(E) Motorbike servicing

5) Which one of the following, if substituted for the condition that motorbike servicing has to be earlier than laundry, would have the same effect in determining the student’s activities?

(A) Laundry has to be one of the last three activities.
(B) Laundry has to be either immediately before or immediately after jogging.
(C) Jogging has to be earlier than laundry.
(D) Laundry has to be earlier than hedge trimming.
(E) Laundry has to be earlier than jogging.
Linear Game 4 - Diagram for Solution

Step 1 - list what is being placed in order and what the positions available are:

```
G H J K L M
```

Step 2 - translate the scenario and rules to shorthand notation

```
HG
K < G
M < L
MJ or JM
```

Step 3 - add any obvious derived rules

```
K < HG
JM < L
```

Step 4 - check answers against diagram, add new rule if question introduces it

```
K-H-G-K
```
Linear Game 4 - Analysis

1) Answer is (D)

Use process of elimination. It cannot be (A) since motorbike servicing has to be either immediately before or immediately after jogging. We can rule out (B) since kitchen cleaning cannot be last as kitchen cleaning has to be earlier than grocery shopping. We can eliminate (C) since motorbike servicing has to be earlier than laundry. (D) is valid. (E) is invalid since grocery shopping has to be immediately after hedge trimming.

2) Answer is (B)

Only one of the five CANNOT be third. That means the others could possibly be third. The rule that states that K < HG is the tightest rule so it is a good idea to start with that. If hedge trimming is third, then it follows that grocery shopping is fourth and so motorbike servicing and jogging must either be in positions 5 and 6, or positions 1 and 2 (since they must be done consecutively). However neither of these will work because of the fact that laundry must be done after motorbike servicing (which means that motorbike servicing and jogging cannot be done fifth and sixth), and also kitchen cleaning must be done before grocery shopping which would mean that kitchen cleaning must be done first or second, yet positions 1 and 2 are taken up by motorbike servicing and jogging. Note – this provides a new GLOBAL RULE: Hedge trimming cannot be done third. It also follows that grocery shopping cannot be done fourth.

3) Answer is (C)

If kitchen cleaning is done second, then position 1 is unusable as the only other ‘single’ task (ie- one that doesn’t have to be done consecutively with another task) is laundry, yet laundry must be done after motorbike servicing, so laundry cannot be done first. This is a new GLOBAL RULE: Kitchen cleaning cannot be done second.

4) Answer is (D)

If laundry is done fifth, then position 6 is unusable as the only other ‘single’ task (ie- one that doesn’t have to be done consecutively with another task) is kitchen cleaning, but that task must be done prior to grocery shopping. This is a new
GLOBAL RULE: Laundry cannot be done fifth.

5) Answer is (C)

This is the only option that doesn't completely change the rule: M,J < L (Or J, M < L).
Linear Game 5

Scenario

In the course of one month Garibaldi has exactly seven different meetings. Each of her meetings is with exactly one of five foreign dignitaries: Fuentes, Matsuba, Rhee, Soleimani, or Tbahi. The following constraints govern Garibaldi’s meetings:

Rules

1) She has exactly three meetings with Fuentes, and exactly one with each of the other dignitaries.
2) She does not have any meetings in a row with Fuentes.
3) Her meeting with Soleimani is the very next one after her meeting with Tbahi.
4) Neither the first or last of her meetings is with Matsuba.

Questions

1) Which of the following could be the sequence of the meetings Garibaldi has with the dignitaries?

   (A) Fuentes, Rhee, Tbahi, Soleimani, Fuentes, Matsuba, Rhee
   (B) Fuentes, Tbahi, Soleimani, Matsuba, Fuentes, Fuentes, Rhee
   (C) Fuentes, Rhee, Fuentes, Matsuba, Fuentes, Tbahi, Soleimani
   (D) Fuentes, Tbahi, Matsuba, Fuentes, Soleimani, Rhee, Fuentes
   (E) Fuentes, Tbahi, Soleimani, Fuentes, Rhee, Fuentes, Matsuba

2) If Garibaldi’s last meeting is with Rhee, then which one of the following could be true?

   (A) Garibaldi’s second meeting is with Soleimani.
   (B) Garibaldi’s third meeting is with Matsuba.
   (C) Garibaldi’s fourth meeting is with Soleimani.
   (D) Garibaldi’s fifth meeting is with Matsuba.
   (E) Garibaldi’s sixth meeting is with Soleimani.

3) If Garibaldi’s second meeting is with Fuentes, then which one of the following is a complete and accurate list of the dignitaries with any one of whom Garibaldi’s fourth meeting could be?

   (A) Fuentes, Soleimani, Rhee
   (B) Matsuba, Rhee, Tbahi
4) If Garibaldi’s meeting with Rhee is the very next one after Garibaldi’s meeting with Soleimani, then which of the following must be true?

(A) Garibaldi’s third meeting is with Fuentes.
(B) Garibaldi’s fourth meeting is with Rhee.
(C) Garibaldi’s fifth meeting is with Fuentes.
(D) Garibaldi’s sixth meeting is with Rhee.
(E) Garibaldi’s seventh meeting is with Fuentes.

5) If Garibaldi’s first meeting is with Tbahi, then Garibaldi’s meeting with Rhee could be the

(A) second meeting
(B) third meeting
(C) fifth meeting
(D) sixth meeting
(E) seventh meeting

6) If Garibaldi’s meeting with Matsuba is the very next meeting after Garibaldi’s meeting with Rhee, then with which one of the following dignitaries must Garibaldi’s fourth meeting be?

(A) Fuentes
(B) Matsuba
(C) Rhee
(D) Soleimani
(E) Tbahi
Linear Game 5 - Diagram for Solution

Step 1 - list what is being placed in order and what the positions available are:

\[ \text{FFFFMRST} \]

Step 2 - translate the scenario and rules to shorthand notation

\[ \text{FFFFMRST} \]

Step 3 - add any obvious derived rules

\[ \text{FFFFMRST} \]

Step 4 - check answers against diagram, add new rule if question introduces it
Linear Game 5 - Analysis

1) Answer is (C)

This is a typical first question, asking for a sequence that violates no rules. Use process of elimination by appealing to the basic rules. First check for three meetings with Fuentes. (A) is eliminated but no others. Check for consecutive meetings with Fuentes. (B) is eliminated but no others. Check for TS (Tbahi/Soleimani). (D) fails, but no others. It is now between (E) and (C). Check the Matsuba rule - can’t be first or last - that eliminates (E).

2) Answer is (D)

This question introduces a local rule - Rhee is last - so we can make a copy of our basic diagram and put R in last. We scan our rules to see if this forces any other positions, but it doesn’t do so obviously. There is too much apparent freedom. We suspect at this point that there are several legitimate solutions with Rhee last, but what will happen is that only one answer will correspond to a legitimate solution. Looks like this question may be a time eater. If we are confident, we can just start plugging in letters, starting with the one given in each answer, and see what fails. If we are lucky and one works, we are done.

(A) requires an S in position 2. The TS rule forces T into position 1. Now T, S, and R have been placed and we have four consecutive positions for three F’s and one M. Two F’s will be together...that’s a no-no. (A) is out. (B) says put M in position 3, an F has to go to the left and two F’s to the right with a space between them. Looks like T and S will have to be separated, which violates the TS rule, so (B) is out. (C) puts S in fourth position. Then by the TS rule, T is third. Either two F’s have to be on the left of T or to the right of S, and they must be together, which violates the non-consecutive F rule. So (C) is out. (D) starts with M in the fifth position. R is already in seventh. One of the F’s has to go then in sixth. Since TS has to go in the four slots to the left of M, and the remaining F’s can’t be together, the only feasible arrangement is F T S F M F R, which works. Stop now.

If you invested three minutes in this question with no progress, drop it and move on. Remember...even eliminating one answer improves your odds for a correct guess.
3) Answer is (E)

Draw a secondary sketch with F in the second position. Ask who can go first. Certainly not another F, since FF is out. M is already excluded. The TS condition rules out either T or S. So evidently it is R that must go first. Fill that in. Which answers are ruled out by that..(A), (B), and (D). The remaining choices both have S as a possibility, so that must be true. So it comes down to either M or F being the other possibility for fourth position. Recall that we have to place two more F’s and they cannot be adjacent. If M were fourth, the TS pair would have to be after it, then one of the remaining two F’s would have to be in third position. This puts two F’s together, which can’t be. Apparently F must go in position 4.

4) Answer is (E)

Draw another secondary sketch and add the local rule SR. Since we already have TS, make it TSR. This has to appear somewhere as a block. Test it in various positions and watch where the F’s could go...recall they must be separated. The only things available for this purpose are the block TSR and the single letter M. The only way they can be used as separators is if there is an F in positions 1 and 7. The only sure bet among the answers is then (E).

5) Answer is (D)

Draw yet another secondary sketch and put T first. The TS condition (this is global...applies to entire problem...unlike the TSR condition which was just for the preceding question) requires S to be second. The only feasible placement of F’s is in slots 3,5, and 7. This leaves R and M for slots 4 and 6. Only R being sixth is a choice.

6) Answer is (A)

Draw another secondary sketch and add RM as a local rule. We already have TS, and the three F’s must be separated by these two double letters. This forces the F’s to be in slots 1,4, and 7, so (A) is the only one that works.
Linear Game 6

Scenario

Three short seminars - Goals, Objections, and Persuasion - and three long seminars - Humor, Negotiating, and Telemarketing - will be scheduled for a three day sales training conference. On each day, two of the seminars will be given consecutively. Each seminar will be given exactly once. The schedule must conform to the following conditions:

Rules

1) Exactly one short seminar and exactly one long seminar will be given each day.
2) Telemarketing will not be given until both Goals and Objections have been given.
3) Negotiating will not be given until Persuasion has been given.

Questions

1) Which one of the following could be an accurate schedule for the sales training conference?

   (A) first day: Persuasion followed by Negotiating
       second day: Objections followed by Telemarketing
       third day: Goals followed by Humor
   (B) first day: Objections followed by Humor
       second day: Goals followed by Telemarketing
       third day: Persuasion followed by Negotiating
   (C) first day: Objections followed by Negotiating
       second day: Persuasion followed by Humor
       third day: Goals followed by Telemarketing
   (D) first day: Objections followed by Goals
       second day: Telemarketing followed by Persuasion
       third day: Negotiating followed by Humor
   (E) first day: Goals followed by Humor
       second day: Persuasion followed by Telemarketing
       third day: Objections followed by Negotiating

2) If Goals is given on the first day of the sales training conference, then which one of the following could be true?

   (A) Negotiating is given on the first day.
   (B) Objections is given in the first day.
   (C) Persuasion is given on the first day.
   (D) Humor is given on the second day.
   (E) Telemarketing is given on the second day.
3) If Negotiating is given some time before Objections, then which of the following must be true?

(A) Negotiating is given at some time before Goals.
(B) Persuasion is given at some time before goals.
(C) Persuasion is given at some time before Objections.
(D) Humor is given at some time before Objections.
(E) Negotiating is given at some time before Humor.

4) Which of the following CANNOT be the second seminar given on the second day of the sales training conference?

(A) Humor
(B) Persuasion
(C) Objections
(D) Negotiating
(E) Goals

5) If Humor is given on the second day of the sales training conference, then which one of the following could be true?

(A) Telemarketing is given on the first day.
(B) Negotiating is given on the second day.
(C) Telemarketing is given on the second day.
(D) Objections is given on the third day.
(E) Persuasion is given on the third day.
Linear Game 6 - Diagram for Solution

Step 1 - list what is being placed in order and what the positions available are:

\[ g \circ p \ HNT \]

Step 2 - translate the scenario and rules to shorthand notation

\[ g, o < T \]
\[ p < N \]

\[ g \circ p \ HNT \]

1 big
1 small
each day

Step 3 - add any obvious derived rules

\[ g, o < T \]
\[ p < N \]

\[ g \circ p \ HNT \]

1 big
1 small
each day

\[ x \]
\[ \text{where would } g, o \text{ fit?} \]

Step 4 - check answers against diagram, add new rule if question introduces it
Linear Game 6 - Analysis

1) Answer is (B)

This is a typical first question, asking for a sequence that violates no rules. Use process of elimination by appealing to the basic rules. (A) puts g after T contrary to the second rule, (B) doesn’t seem to violate any rules, (C) puts p after N contrary to the third rule, (D) puts g and o on the first day, violating the first rule, and (E) places o after T, again contrary to the second rule.

2) Answer is (E)

Draw a secondary sketch with g in the first position. The choices for second position then are H, N, and T. It cannot be N, which has to come after p. It cannot be T, since that has to come after o. It must therefore be H. Then the sequence starts with g and H, and every answer except E conflicts with this.

3) Answer is (C)

Add the local rule N < o. Combining this with our other before/after rules, we get the following derived rule: p < N < o < T. (A), (B), (D), and (E) are all out since g, H, p, N, o, T satisfies the rules. This leaves (C).

4) Answer is (B)

If we take our own advice to look over and attempt the ‘could be true’ questions first, we would have temporarily skipped over this one and done the next problem. The statement of problem 5) tells us immediately that answer (A) for problem 4) is wrong. The sketch for problem 5) reveals that g or o could be on the second day, so answers (C) and (E) are out as well. Now we are down to (B) or (D). If p is in fourth position (second seminar of second day), then the p < N rule puts N on day 3. This means T is the first seminar on day 2, since it can’t be on day 1. But both g and o must precede T, and there isn’t room for two short seminars before T. So this configuration cannot work and (B) is the correct response.

5) Answer is (D)

Draw another sketch with H on the second day. Consider where N and T can appear. T is certainly not on day 1, so the only possibility is that appears on day 3. That leaves N on day 1. Now place g, o, and p. We know p is before N, so p must go in the very first position with N second. The g, o < T rule allows g or o to be on day 2 (third or fourth position) or before T on day 3 (fifth position). Looking at the answer choices, (A) and (C) are out because T can’t be on day 1. (B) is out
because we needed N on the first day (in position 2). (E) is out because it has to precede N. The only remaining choice is (D).
Linear Game 7

Scenario

Each of exactly three actors - Gombrich, Otto, and Raines - auditions for parts on exactly two of the following days of a particular week: Wednesday, Thursday, Friday, and Saturday. On each of these days at least one of the actors auditions for parts. The order of that week’s auditions must meet the following conditions:

Rules

1) The first day on which Otto auditions is some day before the first day on which Raines auditions.
2) There is at least one day on which both Gombrich and Raines audition.
3) At least one of the actors auditions on both Thursday and Saturday.

Questions

1) Which of the following could be an accurate matching of the actors to the days on which they audition?

(A) Gombrich: Thursday, Friday
   Otto: Wednesday, Saturday
   Raines: Friday, Saturday
(B) Gombrich: Thursday, Saturday
   Otto: Wednesday, Friday
   Raines: Friday, Saturday
(C) Gombrich: Friday, Saturday
   Otto: Thursday, Saturday
   Raines: Wednesday, Friday
(D) Gombrich: Wednesday, Thursday
   Otto: Wednesday, Saturday
   Raines: Thursday, Saturday
(E) Gombrich: Wednesday, Friday
   Otto: Wednesday, Thursday
   Raines: Thursday, Saturday

2) If Otto auditions on both Thursday and Saturday, then Gombrich could audition on both

(A) Wednesday and Thursday
(B) Wednesday and Friday
(C) Thursday and Friday
(D) Thursday and Saturday
(E) Friday and Saturday
3) Which of the following CANNOT be true of the week’s auditions?

(A) Gombrich’s last audition is on Thursday.
(B) Gombrich’s last audition is on Friday.
(C) Otto’s last audition is on Saturday.
(D) Raines’ last audition is on Friday.
(E) Raines last audition is on Thursday.

4) Which one of the following pairs of days CANNOT be the two days on which Otto auditions?

(A) Wednesday and Thursday
(B) Wednesday and Friday
(C) Wednesday and Saturday
(D) Thursday and Friday
(E) Thursday and Saturday

5) Which of the following could be true?

(A) All three actors audition on Wednesday.
(B) All three actors audition on Friday.
(C) All three actors audition on Saturday.
(D) Otto auditions on Friday and on Saturday
(E) Raines auditions on Wednesday and on Friday

6) If Gombrich auditions on both Wednesday and Saturday, then which one of the following could be true?

(A) Otto auditions on both Wednesday and Thursday
(B) Otto auditions on both Wednesday and Friday
(C) Otto auditions on both Wednesday and Saturday
(D) Raines auditions on both Wednesday and Saturday
(E) Raines auditions on both Thursday and Friday
Linear Game 7 - Diagram for Solution

Step 1 - list what is being placed in order and what the positions available are:

\[ \text{actor} \]
\[ G_1, G_2, O, O_2, R, R_2 \]
\[ w e f s \]

Step 2 - translate the scenario and rules to shorthand notation

\[ G_1, G_2, O, O_2, R, R_2 \]
\[ w e f s \]

Step 3 - add any obvious derived rules

\[ O_1 < R_1 \]
\[ G \geq 1 \]
\[ R \neq \emptyset \]

Step 4 - check answers against diagram, add new rule if question introduces it

\[ \text{nobody's 1st audition} \]
Linear Game 7 - Analysis

1) Answer is (B)

   The rule O1 < R1 eliminates answer choices (C), and the rule that we must have G and R together on one of the days eliminates (E). We can eliminate (A) as none of the actors audition on both Thursday and Saturday. Finally we can eliminate (D) as no one auditions on Friday, and at least one of the actors must audition on each day.

2) Answer is (B)

   Since O auditions on Thursday and Saturday, and R must audition at least one day after O first auditions, we can conclude that R auditions on Friday and Saturday. Now since G must audition with R on at least one of the days, and someone needs to audition on each day, G must audition on Wednesday and Friday.

3) Answer is (E)

   E must be false since if R's last audition is on Thursday, then R must audition on Wednesday and Thursday, which means that R cannot audition earlier than R as required. This is an example of how reading all five answer choices first can save you a lot of time!

4) Answer is (D)

   (D) and (E) are the most restrictive of the five choices, since once O1 is positioned for Thursday, R must audition on Friday and Saturday. In fact, if O auditions on Thursday and Friday, R must audition on Friday and Saturday, but then G must also audition on Saturday since we have to have at least one day where R and G audition together. But this means that G must audition on Thursday also (with O) since one of the actors must audition on Thursday and Saturday, however this means that no one is auditioning on Wednesday which violates the rules.

5) Answer is (C)

   (A) cannot be true since R1 cannot audition on Wednesday. (Because O1 < R1). (B) Is false since if all three actors audition on Friday, then there is only one audition on each of the remaining days and so the Thursday/Saturday rule is violated. (D) is false since R1 must audition after O1. (E) is false since O must audition before R.
6) Answer is (B)

Since G auditions on Wednesday and Saturday, we know R must audition with G on Saturday. (R cannot audition on Wednesday because O1 < R1.) Now the Thursday/Saturday rule states that R must audition on Thursday, and it follows that O auditions on Wednesday. O must have his second audition on Friday as that is the only day left without an audition. With this set-up it is clear to see that B is the only possibility.
Linear Game 8

Scenario

Each of seven television programs - H, J, L, P, Q, S, V - is assigned a different rank: from first through seventh (from most popular to least popular). The ranking is consistent with the following conditions:

Rules

1) J and L are each less popular than H.
2) J is more popular than Q.
3) S and V are each less popular than L.
4) P and S are each less popular than Q.
5) S is not seventh.

Questions

1) Which of the following could be the order of the programs, from most popular to least popular?

   (A) J, H, L, Q, V, S, P
   (B) H, L, Q, J, S, P, V
   (C) H, J, Q, L, S, V, P
   (D) H, J, V, L, Q, S, P
   (E) H, L, V, J, Q, P, S

2) If J is more popular than L, and S is more popular than P, then which one of the following must be true of the ranking?

   (A) J is second
   (B) J is third
   (C) L is third
   (D) Q is third
   (E) P is seventh

3) Which one of the following programs CANNOT be ranked third?

   (A) L
   (B) J
   (C) Q
   (D) V
   (E) P
4) If V is more popular than Q and J is less popular than L, then which one of the following could be true of the ranking?

(A) P is more popular than S.
(B) S is more popular than V.
(C) P is more popular than L.
(D) J is more popular than V.
(E) Q is more popular than V.

5) If Q is more popular than L, then each of the following must be true of the ranking EXCEPT:

(A) H is first
(B) L is fourth
(C) V is not fourth
(D) J is not third
(E) Q is third
Linear Game 8 - Diagram for Solution

Step 1 - list what is being placed in order and what the positions available are:

\[ \text{H I L P Q S V} \]

Step 2 - translate the scenario and rules to shorthand notation

Step 3 - add any obvious derived rules

Step 4 - check answers against diagram, add new rule if question introduces it
Linear Game 8 - Analysis

1) Answer is (C)

   From the tree diagram we see that H is the most popular so we can eliminate choice (A). Choice (B) is incorrect since J is more popular than Q. (D) is wrong as L is more popular than V, and finally (E) is false since we know that S is not ranked seventh.

2) Answer is (A)

   From the tree diagram it is clear that J is the second-most popular.

3) Answer is (E)

   From the original tree diagram we see that P is less popular than H, J, and Q and so cannot be ranked third.

4) Answer is (D)

   We can eliminate (B), (C), and (E) using the diagram, so initially it looks like both (A) and (D) could be possible – however we know that S is not seventh, so S must be more popular than P

5) Answer is (B)

   From the tree diagram we can see that (A), (C), (D), and (E) must be true, which leaves (B) that isn’t necessarily true.
GROUPING GAMES

STRATEGY

GENERAL OBSERVATION

Grouping games are the other mainstay of the LSAT besides linear games. Where linear games emphasize order and require that variables be placed in a sequence conforming to the rules, grouping games are based on placing variables into categories that likewise obey some conditions. If you are familiar with the ideas of sets and subsets, you can think of the defining task of a grouping game as the creation of subsets of variables under certain restrictions. We don’t have the before/after concept in grouping games, so we have to give up some of the automatic secondary deductions we used for linear games. But the good news is that there are replacement deductions of this sort available for grouping games built around the ideas of “must be with” and “must not be with”.

RECOGNITION KEYS

As we have mentioned, the very first task is to properly recognize the type of game you are dealing with. You have studied the major game types and have a battle plan for each, so it is important to avoid getting off on the wrong foot. With a pure grouping game, you should not be seeing words in the scenario or rules that have anything to do with sequencing. Instead there will words and phrases that indicate objects must be categorized, or put into classes, or aggregated some way...or other phrasing conveying the same effect. When you see rules that specify some variables must appear, can appear, or cannot appear with others, it is a safe bet that you have a grouping principle at the root of the game. Other constraints might be phrased conditionally, for example, “If A is in the first group, then B must be in the third group”.

Grouping games are more general than linear games in the following sense. The ordering property in linear games has only so many ways of being expressed realistically. After time, spatial position, and various artificial rankings (gold, silver, bronze, etc.), there aren’t too many sequencing principles that could be the basis for a realistic game. In contrast, grouping games can be framed in terms of just about
anything that can be sorted.

Our advice for detecting complex games holds here as well. If you see the grouping game language above in the scenario and rules...but you also see references to some sequencing activity...you have a hybrid or combination game. A pure grouping game is usually simpler than a combo game, so you may want to attack the pure linear and pure grouping games first. The test makers typically give you at least one of each.

Once you know you have hooked a grouping game, there are several standard moves to make in setting up your analytical diagram.

GAME FEATURES

A grouping game has variables to be distributed among categories, so there can be a mismatch of the number of variables and the number of categories. The big test prep firms seem to make a big issue out of this and introduce all sorts of special terminology for games where the number of variable exceeds, equals, or is less than the number of categories into which they can be put. We believe just a simple awareness of the underlying arithmetic of a game provides all the perspective you need. You just have to be clear on whether you must place all the variables (perhaps some do not need to be categorized at all) and whether you must use every category that is available (none are empty when all the sorting is done). Probably the simplest and most intuitively appealing grouping game is one in which there are just as many variables as categories, and all variables need to be placed with no category void. This turns into a matching game...one variable is matched to one category.

A common test-making principle in grouping games is to place restrictions on which variables must, can, or cannot be together in a given category. This is easy to diagram, and a good basic format is to make a horizontal dash for each category and stack the variables allowed into those categories vertically on the appropriate one. Restrictions of the “must or cannot” type are easily encoded as circled pairs (or triples, etc.) or the negations of those pairs. A “can” type restriction really isn’t a restriction at all, and in fact is a statement of freedom to ignore the relationship between those variables. In any case, we need to keep in mind that there is flexibility to place those variables.
Don’t underestimate the power of arithmetic for grouping games. Very often the rules are tied together by arithmetic in a way that is not immediately obvious, but which can provide immense help if it is discovered. For example, suppose you have variables A, B, and C and must distribute them between two categories 1 and 2. If there are absolutely no restrictions on the placement, then there are eight different placements possible. If we impose the rules that no category may be empty and A cannot be together with B, then the number of allowable configurations is cut in half. You are certainly appreciative by now of the benefits that reducing ambiguity provides.

Continuing with the preceding example, we can illustrate another principle that is frequently encountered in grouping games. Some forms of ambiguity never have to be totally sorted out to get a correct answer. If we imposed only the rule that no category can be empty, a good test question would be “How many distinct configurations are possible with exactly two variables in either category?” There are six. It isn’t necessary to write them all out (the example is so small that this is not impractical). If the distribution is always two in one and one in the other, then either A, B, or C can be alone in either category 1 or 2. These would all be different configurations, and so there is your six.

Occasionally it is possible, and always desirable, to link together rules that restrict the same variable. Perhaps you have noticed that in game statements some variables seem to pop up in the rules more than others. In our example again, if A must be in category 1 and B cannot appear together with A, then we immediately splice those rules together in a secondary deduction: B must be in category 2. Of course this is simplified just for the purposes of illustration, but quite a lot of valuable deductions can be teased out of combinations of grouping rules. Focus on the highly restricted variables. And if you see a conditional “if-then”, be sure to write down the contrapositive so it is on the radar.
**Grouping Game 1**

**Scenario**

Each of five students – Hubert, Lori, Paul, Regina, and Sharon – will visit exactly one of three cities – Montreal, Toronto, or Vancouver – for the month of March, according to the following conditions:

**Rules**

1) Sharon visits a different city than Paul.
2) Hubert visits the same city as Regina.
3) Lori visits Montreal or else Toronto.
4) If Paul visits Vancouver, Hubert visits Vancouver with him.
5) Each student visits one of the cities with at least one of the other four students.

**Questions**

1) Which one of the following could be true for March?

   (A) Hubert, Lori, and Paul visit Toronto, and Regina and Sharon visit Vancouver.
   (B) Hubert, Lori, Paul and Regina visit Montreal, and Sharon visits Vancouver.
   (C) Hubert, Paul, and Regina visit Toronto, and Lori and Sharon visit Montreal.
   (D) Hubert, Regina, and Sharon visit Montreal, and Lori and Paul visit Vancouver.
   (E) Lori, Paul, and Sharon visit Montreal, and Hubert and Regina visit Toronto.

2) If Hubert and Sharon visit a city together, which one of the following could be true in March?

   (A) Hubert visits the same city as Paul.
   (B) Lori visits the same city as Regina.
   (C) Paul visits the same city as Regina.
   (D) Paul visits Toronto.
   (E) Paul visits Vancouver.

3) If Sharon visits Vancouver, which of the following must be true for March?

   (A) Hubert visits Montreal.
   (B) Lori visits Montreal.
   (C) Paul visits Toronto.
   (D) Lori visits the same city as Paul.
   (E) Lori visits the same city as Regina.
4) Which one of the following could be false in March?

(A) Sharon must visit Montreal if Paul visits Vancouver.
(B) Regina must visit Vancouver if Paul visits Vancouver.
(C) Regina visits a city with exactly two of the other four students.
(D) Lori visits a city with exactly one of the other four students.
(E) Lori visits a city with Paul or else with Sharon.

5) If Regina visits Toronto, which one of the following could be true in March?

(A) Lori visits Toronto.
(B) Lori visits Vancouver.
(C) Paul visits Toronto.
(D) Paul visits Vancouver.
(E) Sharon visits Vancouver.

6) Which one of the following must be true for March?

(A) If any of the students visit Montreal, Lori visits Montreal.
(B) If any of the students visits Montreal, exactly two of them do.
(C) If any of the students visits Toronto, exactly three of them do.
(D) If any of the students visits Vancouver, Paul visits Vancouver.
(E) If any of the students visits Vancouver, exactly three of them do.
Grouping Game 1 - Diagram for Solution

Step 1 - list what is being grouped and what the categories available are:

\[ H \ L \ P \ R \ S \]
\[ \underline{Mo} \ To \ Va \]

Step 2 - translate the scenario and rules to shorthand notation

\[ H \ L \ P \ R \ S \]
\[ \underline{Mo} \ To \ Va \]
\[ L \rightarrow Va \quad P \rightarrow Va \rightarrow H \rightarrow Va \]

Step 3 - add any obvious derived rules

\[ \text{contropositive} \]
\[ H \rightarrow Va \Rightarrow P \rightarrow Va \]

Step 4 - check answers against diagram, add new rule if question introduces it
**Grouping Game 1 - Analysis**

1) Answer is (C)

We can rule out (A) since H and R must visit the same city. We can also rule out (B) as the grouping must be 3/2 and this is 4/1. We eliminate (D) since L cannot visit Vancouver, and finally it cannot be (E) because S and P cannot visit the same city.

2) Answer is (D)

Since this is a “could be true” type of question, we can start by eliminating the answer choices that “CANNOT be true”. Note that the two groups must be: H/S/R (3) and L/P (2) since H and R must visit the same city. Knowing this set up eliminates (A), (B), and (C) right away. We can also rule out (E), since L does not visit Vancouver.

3) Answer is (D)

We can reach this conclusion directly (rather than by process of elimination) since S visits Vancouver and neither L nor P can visit Vancouver, and only two of the three cities are visited, it follows that L and P visit the same city.

4) Answer is (A)

Re-writing this as “which of the following is not necessarily a “must be true” statement?” means we can find the four answer choices that “must be true” and eliminate those. (Note that these four “must be true” statements may be useful new global rules.) (C), (D), and (E) must be true from the grouping set up that we determined in the beginning, and (B) must be true, since if P visits Vancouver, then so does H and it follows that R does too.

5) Answer is (C)

This is a “could be true” question, so we need to eliminate the four that are false. (A) and (B) cannot be true since L must visit Montreal. (D) is false for two reasons – If P visits Vancouver then so does H, but H is visiting Toronto. Also, L cannot visit Vancouver.
6) Answer is (E)

Vancouver is a good starting point since we have two rules involving it. Since Lori cannot visit Vancouver, neither does her partner (she is part of a double set). This means that the triple must visit Vancouver.
Grouping Game 2

Scenario

Exactly eight consumers – F, G, H, J, K, L, M, and N - will be interviewed by market researchers. The eight will be divided into exactly two 4-person groups – group 1 and group 2 – before interviews begin. Each person is assigned to exactly one of the two groups according to the following conditions:

Rules

1) F must be in the same group as J.
2) G must be in a different group from M.
3) If H is in group 1, then L must be in group 1.
4) If N is in group 2, then G must be in group 1.

Questions

1) Group 1 could consist of:

(A) F, G, H, and J
(B) F, H, L, and M
(C) F, J, K and L
(D) G, H, L, and N
(E) G, K, M, and N

2) If K is in the same group as N, which of the following must be true?

(A) G is in group 1.
(B) H is in group 2.
(C) J is in group 1.
(D) K is in group 2.
(E) M is in group 1.

3) If F is in the same group as H, which one of the following must be true?

(A) G is in group 2.
(B) J is in group 1.
(C) K is in group 1.
(D) L is in group 2.
(E) M is in group 2.
4) If L and M are in group 2, then a person who could be assigned to either group 1 or, alternatively to group 2, is

(A) F
(B) G
(C) H
(D) J
(E) K

5) Each of the following is a pair of people who could be in group 1 together EXCEPT

(A) F and G
(B) F and H
(C) F and L
(D) H and G
(E) H and N

6) If L is in group 2, then each of the following is a pair of people who could be in group 1 together EXCEPT

(A) F and M
(B) G and N
(C) J and N
(D) K and M
(E) M and N
Grouping Game 2 - Diagram for Solution

Step 1 - list what is being grouped and what the categories available are:

Step 2 - translate the scenario and rules to shorthand notation

Step 3 - add any obvious derived rules

contrapositives

Step 4 - check answers against diagram, add new rule if question introduces it
**Grouping Game 2 - Analysis**

1) Answer is (D)

F and J must be in the same group, so this excludes (B). G and M cannot be together, this excludes (C) and (E). Finally, (A) is false since if H is in group 1, then L must be in group 1.

2) Answer is (B)

K and N together means that E and J are together in a *different* group (otherwise G and M would be forced together in the remaining group). H must be in group 2, since if H is in group 1 then L is also in group 1 and there is no room for five in one group.

3) Answer is (C)

Since we have F, J, and H together in one of the groups, the remaining member must be G or M (as G and M cannot be in the same group). Furthermore, this group must be group 2 since if H were in group 1, then L would have to be in group 1 also. Thus it is clear that K, L, and N must be in group 1 with either G or M. The only certainty of the five answer choices is that K is in group 1.

4) Answer is (E)

L in group 2 implies that H is in group 2 (this is the contrapositive of rule 3). There is no room left in group 2 for F and J, so they must be in group 1, with G (to keep G and M separated). This set-up rules out (A) – (D) and K is the only consumer who can be placed into either group 1 or group 2.

5) Answer is (B)

It is a good idea to start with answer choice (B) since we have a rule that pertains to if H is in group 1. We also know that F and J must be together. If F and H and together in group 1, J and L must be there also. However, this means that G and M would be together in group 2 which cannot happen.

6) Answer is (D)

If L is in group 2, then H is in group 2. Either G or M must be in group 2 (the other must be in group 1 with F and J). If K and M are together in group 1, G must be in group 2, but G in group 2 means that N must be in group 1 – but there is no more room as group 1 already contains F, J, K, and M.
**Grouping Game 3**

**Scenario**

A reporter is trying to uncover the workings of a secret committee. The committee has six members – French, Ghauri, Hsia, Irving, Magnus, and Pinsky – each of whom serves on at least one subcommittee. There are three subcommittees, each having three members, about which the following is known.

**Rules**

1) One of the members serves on all three subcommittees.
2) French does not serve on any subcommittee with Ghauri.
3) Hsia does not serve on any subcommittee with Irving.

**Questions**

1) If French does not serve on any subcommittee with Magnus, which one of the following must be true?

   - (A) French serves on a subcommittee with Hsia.
   - (B) French serves on a subcommittee with Irving.
   - (C) Irving serves on a subcommittee with Pinsky.
   - (D) Magnus serves on a subcommittee with Ghauri.
   - (E) Magnus serves on a subcommittee with Irving.

2) If Pinsky serves on every subcommittee on which French serves, and every subcommittee on which Ghauri serves, then which of the following could be true?

   - (A) Magnus serves on every subcommittee on which French serves and every subcommittee on which Ghauri serves.
   - (B) Magnus serves on every subcommittee on which Hsia serves and every subcommittee on which Irving serves.
   - (C) Hsia serves on every subcommittee on which French serves and every subcommittee on which Ghauri serves.
   - (D) French serves on every subcommittee on which Pinsky serves.
   - (E) Hsia serves on every subcommittee on which Pinsky serves.
3) If Irving serves on every subcommittee on which Magnus serves, which one of the following could be true?

(A) Magnus serves on all of the subcommittees.
(B) Irving serves on more than one subcommittee.
(C) Irving serves on every subcommittee on which Pinsky serves.
(D) French serves on a subcommittee with Magnus.
(E) Ghauri serves on a subcommittee with Magnus.

4) Which one of the following could be true?

(A) French serves on all three subcommittees.
(B) Hsia serves on all three subcommittees.
(C) Ghauri serves on every subcommittee on which Magnus serves and every subcommittee on which Pinsky serves.
(D) Pinsky serves on every subcommittee on which Irving serves and every subcommittee on which Magnus serves.
(E) Magnus serves on every subcommittee on which Pinsky serves, and Pinsky serves on every subcommittee on which Magnus serves.

5) Which of the following must be true?

(A) Ghauri serves on at least two subcommittees.
(B) Irving serves on only one subcommittee.
(C) French serves on a subcommittee with Hsia.
(D) Ghauri serves on a subcommittee with Irving.
(E) Magnus serves on a subcommittee with Pinsky.

6) Which of the following must be true?

(A) Every subcommittee has either French or Ghauri as a member.
(B) Every subcommittee has either Hsia or Irving as a member.
(C) No subcommittee consists of French, Magnus and Pinsky.
(D) Some committee member serves on exactly two subcommittees.
(E) Either Magnus or Pinsky serves on only one subcommittee.
Grouping Game 3 - Diagram for Solution

Step 1 - list what is being grouped and what the categories available are:

```
F G H I M P
```

Step 2 - translate the scenario and rules to shorthand notation

```
F G H I M P
```

Step 3 - add any obvious derived rules

```
1 double
1 triple
4 singles
9 committee positions
```

Step 4 - check answers against diagram, add new rule if question introduces it
**Grouping Game 3 - Analysis**

1) Answer is (C)

Since F cannot serve with M, this means that M is not the triple, and so it must be P. P being the triple means that P serves with everybody. In particular, P serves with I. So answer choice (C) must be true.

2) Answer is (C)

M cannot be the triple as this would force H and I together on a subcommittee. This means that P is the triple. The remaining 4 slots are to be filled by H, I, M and one of these repeated. (A) is false, since since if M serves with P & F on one subcommittee and with P & G on an other subcommittee, then H and I are forced together on a subcommittee. (B) is false since if H serves with M in a subcommittee with P, then I must serve on one of the subcommittees with either P & F, or P & G, and so all three spaces on the subcommittee would be taken up leaving no room for M. (C) could be true. (D) is false, since P is the triple, F would need to be a triple also and there can only be one triple. Finally, (E) is false because if P is the triple, H would need to be a triple also, and there can only be one triple.

3) Answer is (B)

If M always serves with I, then M cannot be the triple (as there is only 1), which means that P is the triple. Similarly, M cannot be the double as if he were, then I would also be a double (and there is only 1). This rules out (A) and (C). (D) and (E) are false since M only serves once and that is with P and I. The correct answer is (B) as I can serve twice. (M serves implies I also serves, but I can serve without M).

4) Answer is (D)

We know that either M or P is the triple, so (A) and (B) are false. (C) is also false since either P or M is the triple, it would mean that G is also a triple and there is only one. (D) is the correct answer by process of elimination. (E) is also false as M and P cannot both be triples which means that either M serves without P on at least one subcommittee, or P serves without M on at least one subcommittee.

5) Answer is (E)

Since either M or P is the triple, they must serve together on at least one subcommittee. We can use our previous work and diagrams to eliminate the other answer choices. For example, we saw in question 19 that it is possible for I to serve twice, thus (B) is false. The others can be eliminated in a similar way.
6) Answer is (D)

This is one of the original rules that we determined in the beginning. Look out for simple questions right at the end of a more difficult logic game.
**Grouping Game 4**

**Scenario**

Each of seven travelers – Norris, Oribe, Paulsen, Rosen, Semonelli, Tan and Underwood – will be assigned to exactly one of nine airplane seats. The seats are numbered 1 through 9 and arranged in rows as follows:

- **Front row:** 1, 2, 3
- **Middle row:** 4, 5, 6
- **Last row:** 7, 8, 9

Only seats in the same row as each other are immediately beside each other. Seat assignments must meet the following conditions:

**Rules**

1) Oribe’s seat is in the last row.
2) Paulsen’s seat is immediately beside Rosen’s seat and also immediately beside an unassigned seat.
3) Rosen’s seat is in the row immediately behind the row in which Norris’ seat is located.
4) Neither Semonelli nor Underwood is seated immediately beside Norris.

**Questions**

1) Which one of the following is a pair of travelers who could be assigned to seats 2 and 8 respectively?

   - (A) Norris, Semonelli
   - (B) Oribe, Underwood
   - (C) Paulsen, Oribe
   - (D) Rosen, Semonelli
   - (E) Underwood, Tan

2) If Semonelli and Underwood are not assigned to seats in the same row as each other, which of the following must be false?

   - (A) Norris is assigned to seat 2.
   - (B) Paulsen is assigned to seat 5.
   - (C) Rosen is assigned to seat 4.
   - (D) Tan is assigned to seat 2.
   - (E) Underwood is assigned to seat 1.
3) If Semonelli is assigned to a seat in the same row as Underwood, which of the following travelers could be assigned to a seat immediately beside one of the unassigned seats?

(A) Oribe  
(B) Rosen  
(C) Semonelli  
(D) Tan  
(E) Underwood

4) If the seat to which Tan is assigned is immediately beside a seat assigned to another traveler and also immediately beside one of the unassigned seats, which one of the following must be true?

(A) Tan is assigned to a seat in the front row.  
(B) Tan is assigned to a seat in the last row.  
(C) Oribe is assigned to a seat immediately beside Semonelli.  
(D) Oribe is assigned to a seat immediately beside Tan.  
(E) Semonelli is assigned to a seat immediately beside Underwood.

5) If Oribe is assigned to a seat immediately beside one of the unassigned seats, which of the following must be true?

(A) Oribe is assigned to seat 9.  
(B) Tan is assigned to seat 2.  
(C) Underwood is assigned to seat 1.  
(D) Seat 4 is unassigned.  
(E) Seat 9 is unassigned.
Grouping Game 4 - Diagram for Solution

Step 1 - list what is being grouped and what the categories available are:

1. NOPRSTU
2.  
3.  

Step 2 - translate the scenario and rules to shorthand notation

1. NOPRSTU
2.  
3.  

- NS - NU - OZ - R - RPO

Step 3 - add any obvious derived rules

- none -

Step 4 - check answers against diagram, add new rule if question introduces it
Grouping Game 4 - Analysis

1) Answer is (C)

We can rule out (A) since H and R must visit the same city. We can also rule out (B) as the grouping must be 3/2 and this is 4/1. We eliminate (D) since L cannot visit Vancouver, and finally it cannot be (E) because S and P cannot visit the same city.

2) Answer is (D)

Since this is a “Must be True” type of question, we can start by eliminating the answer choices that “cannot be true” and “aren’t necessarily true”.

Note that the two groups must be: H/S/R (3) and L/P (2) since H and R must visit the same city. Knowing this set up eliminates (A), (B), and (C) right away. We can also rule out (E), since L does not visit Vancouver.

3) Answer is (D)

We can reach this conclusion directly (rather than by process of elimination) since S visits Vancouver and neither L nor P can visit Vancouver, and only two of the three cities are visited, it follows that L and P visit the same city.

4) Answer is (A)

Re-writing this as “which of the following is not necessarily a “must be true” statement?” means we can find the four answer choices that “must be true” and eliminate those. (Note that these four “must be true” statements may be useful new global rules.) (C), (D), and (E) must be true from the grouping set up that we determined in the beginning, and (B) must be true, since if P visits Vancouver, then so does H and it follows that R does too.

5) Answer is (C)

This is a “could be true” question, so we need to eliminate the four that are false. (A) and (B) cannot be true since L must visit Montreal. (D) is false for two reasons – If P visits Vancouver then so does H, but H is visiting Toronto. Also, L cannot visit Vancouver.
6) Answer is (E)

Vancouver is a good starting point since we have two rules involving it. Since Lori cannot visit Vancouver, neither does her partner (she is part of a double set). This means that the triple must visit Vancouver.
**Grouping Game 5**

**Scenario**
In Crescentville there are exactly five record stores, whose names are abbreviated S, T, V, X, and Z. Each of the five stores carries at least one of four distinct types of music: folk, jazz, opera, and rock. None of the stores carries any other type of music. The following conditions must hold:

**Rules**

1) Exactly two of the five stores carry jazz.
2) T carries rock and opera but no other type of music.
3) S carries more types of music than T carries.
4) X carries more types of music than any other store in Crescentville carries.
5) Jazz is among the types of music S carries.
6) V does not carry any type of music that Z carries.

**Questions**

1) Which one of the following could be true?
   - (A) S carries folk and rock but neither jazz nor opera.
   - (B) T carries jazz but neither opera nor rock.
   - (C) V carries folk, rock, and opera, but not jazz.
   - (D) X carries folk, rock, and jazz, but not opera.
   - (E) Z carries folk and opera but neither rock nor jazz.

2) Which one of the following could be true?
   - (A) S, V, and Z all carry folk.
   - (B) S, X, and Z all carry jazz.
   - (C) Of the five stores, only S and V carry jazz.
   - (D) Of the five stores, only T and X carry rock.
   - (E) Of the five stores, only S, T, and V carry opera.

3) If exactly one of the stores carries folk, then which one of the following could be true?
   - (A) S and V carry exactly two types of music in common.
   - (B) T and S carry exactly two types of music in common.
   - (C) T and V carry exactly two types of music in common.
   - (D) V and X carry exactly two types of music in common.
   - (E) X and Z carry exactly two types of music in common.

4) Which one of the following must be true?
(A) T carries exactly the same number of types of music as V carries.
(B) V carries exactly the same number of types of music as Z carries.
(C) S carries at least one more type of music than Z carries.
(D) Z carries at least one more type of music than T carries.
(E) X carries exactly two more types of music than S carries.

5) If V is one of exactly three stores that carry rock, then which one of the following must be true?

(A) S and Z carry no types of music in common.
(B) S and V carry at least one type of music in common.
(C) S and Z carry at least one type of music in common.
(D) T and Z carry at least one type of music in common.
(E) T and V carry at least two types of music in common.

6) If S and V both carry folk, then which one of the following could be true?

(A) S and T carry no types of music in common.
(B) S and Z carry no types of music in common.
(C) T and Z carry no types of music in common.
(D) S and Z carry two types of music in common.
(E) T and V carry two types of music in common.
Grouping Game 5 - Diagram for Solution

Step 1 - list what is being grouped and what the categories available are:

\[ f, i, o, r \rightarrow \quad S \quad T \quad V \quad X \quad Z \]

Step 2 - translate the scenario and rules to shorthand notation

\[ 2j \quad \square \quad f \quad \square \quad \square \quad v \neq z \]

\[ f, i, o, r \rightarrow \ \square \quad o \quad \square \quad f \quad \square \quad \square \quad S \quad T \quad V \quad X \quad z \]

3 types

Step 3 - add any obvious derived rules

\[ \text{none} \]

Step 4 - check answers against diagram, add new rule if question introduces it
Grouping Game 5 - Analysis

1) Answer is (E)

We can eliminate (A) since we know that S carries jazz. We can eliminate (B) since we know T carries only opera and rock. (C) must be false since if V carries folk, rock and opera, there are no types remaining for store Z. (Jazz is not an option as only two of the stores carry jazz – and those stores are S and X). We can eliminate (D) since X must carry all four types. (E) could be true.

2) Answer is (D)

We can eliminate (A) since V and Z cannot carry any of the same types. We can eliminate (B) since only three of the stores carry jazz – S and X. We can eliminate (C) since V does not carry jazz. Only S and X do. Finally, we can eliminate (E) since X must carry opera also.

3) Answer is (B)

If exactly one of the stores carries folk music, then we know that store must be store X. This means that neither store V nor store Z carry jazz nor folk. Now since that only leaves rock and opera and they cannot carry the same types of music, V must carry rock or opera (not both) and Z carries the other (opera or rock). In particular, stores V and Z only carry one type of music which eliminates (A), (C), (D) and (E).

4) Answer is (C)

Since stores V and Z cannot carry the same types of music as each other, and they cannot carry jazz, that leaves folk, opera and rock to stock between them (but not all three need be stocked). This means store Z can carry at most two of these, but at least one of these. This implies that store S (which carries three types) must stock at least one more type than store Z.

5) Answer is (C)

If V carries rock, then Z cannot carry rock, and in fact Z must carry at least one of folk and opera. Since T and X already carry rock, then none of the others (in particular S), can carry rock. This means that S must carry folk, opera, and jazz. Thus (C) must be true.
6) Answer is (B)

We know that S carries three types, two of which are folk and jazz. We also know that T carries only rock and opera, and X carries all three. V carries folk and possibly one other – either rock or opera (but not both since store Z must carry at least one of rock/opera as well). This set-up means that (A), (C), (D) and (E) are in fact false, but (B) is possible since Z could carry opera and S could carry rock, jazz and folk.
**Grouping Game 6**

**Scenario**

There are exactly five pieces of mail in a mailbox: a flyer, a letter, a magazine, a postcard, and a survey. Each piece of mail is addressed to exactly one of three housemates: Georgette, Jana, or Rini. Each housemate has at least one of the pieces of mail addressed to her. The following conditions must apply:

**Rules**

1) Neither the letter nor the magazine is addressed to Georgette.
2) If the letter is addressed to Rini, then the postcard is addressed to Jana.
3) The housemate to whom the flyer is addressed has at least one of the other pieces of mail addressed to her as well.

**Questions**

1) Which of the following could be a complete and accurate matching of the pieces of mail to the housemates to whom they are addressed?

   (A) Georgette: the flyer, the survey
       Jana: the letter
       Rini: the magazine
   (B) Georgette: the flyer, the postcard
       Jana: the letter, the magazine
       Rini: the survey
   (C) Georgette: the magazine, the survey
       Jana: the flyer, the letter
       Rini: the postcard
   (D) Georgette: the survey
       Jana: the flyer, the magazine
       Rini: the letter, the postcard
   (E) Georgette: the survey
       Jana: the letter, the magazine, the postcard
       Rini: the flyer

2) Which one of the following is a complete and accurate list of the pieces of mail, any one of which could be the only piece of mail addressed to Jana?

   (A) the postcard
   (B) the letter, the postcard
   (C) the letter, the survey
   (D) the magazine, the survey
   (E) the letter, the magazine, the postcard
3) Which one of the following CANNOT be a complete and accurate list of the pieces of mail addressed to Jana?

(A) the flyer, the letter, the magazine
(B) the flyer, the letter, the postcard
(C) the flyer, the letter, the survey
(D) the flyer, the magazine, the postcard
(E) the flyer, the magazine, the survey

4) Which one of the following CANNOT be a complete and accurate list of the pieces of mail addressed to Rini?

(A) the magazine, the postcard
(B) the letter, the survey
(C) the letter, the magazine
(D) the flyer, the magazine
(E) the flyer, the letter

5) If the magazine and the survey are both addressed to the same housemate, then which of the following could be true?

(A) The survey is addressed to Georgette.
(B) The postcard is addressed to Rini.
(C) The magazine is addressed to Jana.
(D) The letter is addressed to Rini.
(E) The flyer is addressed to Jana.
Grouping Game 6 - Diagram for Solution

Step 1 - list what is being grouped and what the categories available are:

\[
\begin{align*}
& f, l, m, p, s \\
(1\ each) & \rightarrow \quad G \quad R \quad J
\end{align*}
\]

Step 2 - translate the scenario and rules to shorthand notation

\[
\begin{align*}
& Rl \Rightarrow Jp \\
& f, l, m, p, s \rightarrow \quad G \quad R \quad J
\end{align*}
\]

Step 3 - add any obvious derived rules

\[
\begin{align*}
& Jp \Rightarrow Rl \\
& \text{contrapositive}
\end{align*}
\]

Step 4 - check answers against diagram, add new rule if question introduces it
**Grouping Game 6 - Analysis**

1) Answer is (B)

   Checking rule 1, (C) is out since Georgette can't get the magazine. Rule 3 says the flyer doesn't go alone, so (E) is out. For rule 2 we look for Rini getting the letter and Jana NOT getting the postcard. This eliminates (D). Notice that there are only four pieces of mail delivered in (A), contrary to the scenario. (B) is left.

2) Answer is (B)

   Georgette doesn't get the letter, so either Rini or Jana gets it. If Rini gets it, then rule 2 says Jana gets the postcard. Apparently Jana gets either the letter or the postcard. The options besides (B) are all disqualified, since Jana cannot receive only the survey or magazine (Rini would get the letter, forcing Jana to get at least the postcard). Key concept here is “only” piece of mail.

3) Answer is (E)

   (E) is immediate. If Jana doesn't get the letter, then only Rini can, but then Jana must get the postcard.

4) Answer is (B)

   If Rini gets the letter, Jana must get the postcard. If Rini also gets the survey, Jana, not Georgette, must get the magazine. Georgette must get something, and it can only be the flyer. But the flyer cannot be the only piece of mail addressed to Georgette. It follows that (B) is impossible.

5) Answer is (E)

   It can't be Georgette who gets the magazine and survey by rule 1. If the letter goes to Rini, then Jana gets the postcard. Only the flyer is left, but it must be accompanied by another item, so we can safely say that Jana gets the letter. Now if Jana got the magazine and survey, in addition to the letter, the flyer goes to someone else. But there aren't enough items left to meet the rules (you would need three). So it must be Rini who gets the magazine and survey, and Jana the letter. Where can the flyer go? It could go to Jana, since she would have two items. That would leave the postcard for Georgette. This configuration works, and that is all we need.
**Grouping Game 7**

**Scenario**

A showroom contains exactly six new cars - T, V, W, X, Y, and Z - each equipped with at least one of the following three options: power windows, leather interior, and sunroof. No car has any other options. The following conditions must apply:

**Rules**

1) V has power windows and a sunroof.
2) W has power windows and a leather interior.
3) W and Y have no options in common.
4) X has more options than W.
5) V and Z have exactly one option in common.
6) T has fewer options than Z.

**Questions**

1) For exactly how many of the six cars is it possible to determine exactly which options each one has?

   (A) two  
   (B) three  
   (C) four  
   (D) five  
   (E) six

2) Which one of the following must be false?

   (A) Exactly five of the six cars have leather interiors.  
   (B) Exactly five of the six cars have sunroofs.  
   (C) Exactly four of the six cars have leather interiors.  
   (D) Exactly four of the six cars have power windows.  
   (E) Exactly four of the six cars have sunroofs.
3) If all the cars that have leather interiors also have power windows, which one of the following must be false?

(A) T has power windows.
(B) T has a sunroof.
(C) V has power windows.
(D) Z has power windows.
(E) Z has a sunroof.

4) If Z has no options in common with T but has at least one option in common with every other car, then which one of the following must be false?

(A) T has power windows.
(B) Z has a sunroof.
(C) Exactly four of the six cars have power windows.
(D) Exactly four of the six cars have leather interiors.
(E) Exactly four of the six cars have sunroofs.

5) Suppose that no two cars have exactly the same options as one another. In that case, each of the following could be true EXCEPT:

(A) Exactly three of the six cars have power windows.
(B) Exactly four of the six cars have power windows.
(C) Exactly three of the six cars have sunroofs.
(D) Exactly four of the six cars have sunroofs.
(E) Exactly four of the six cars have leather interiors.

6) If exactly four of the six cars have leather interiors, and exactly four of the six cars have power windows, then each of the following must be true EXCEPT:

(A) T and V have no options in common.
(B) T and Y have no options in common.
(C) T and Z have exactly one option in common.
(D) W and Z have exactly one option in common.
(E) Y and Z have no options in common.

7) Suppose that the condition requiring that X has more options than W is replaced by a new condition requiring that X and W have exactly two options in common. If all of the other original conditions remain in effect, which of the following must be false?

(A) T and X have no options in common.
(B) V and X have exactly one option in common.
(C) V and X have exactly two options in common.
(D) X and Z have no options in common.
(E) X and Z have exactly two options in common.
Grouping Game 7 - Diagram for Solution

Step 1 - list what is being grouped and what the categories available are:

\[ P \quad L \quad S \]
\[ T \quad V \quad W \quad X \quad Y \quad Z \]

Step 2 - translate the scenario and rules to shorthand notation

\[ X > W \]
\[ T < Z \]

Step 3 - add any obvious derived rules

\[ Q4 \text{ only} \]

Step 4 - check answers against diagram, add new rule if question introduces it
Grouping Game 7 - Analysis

1) Answer is (C)

   From the diagram we see that the options for V,W, X, and Y have been determined completely by the rules. We don’t know yet which one option T has, nor which options Z has.

2) Answer is (A)

   At most 4 of the cars can have leather interiors since we know that V and Y do not have leather interiors.

3) Answer is (E)

   Since Z only has two options, one of which is leather interiors, so the other must be power windows and cannot be a sunroof.

4) Answer is (D)

   If Z has at least one option in common with every other car, then Z must have a sunroof – since Y has only a sunroof. It follows that T has power windows (since T must have no options in common with Z). With this set-up, it is impossible for exactly four of the cars to have leather interiors.

5) Answer is (C)

   In this case, Z cannot have power windows, as it would have the same options as W. Z must have a leather interior and a sunroof. This proves that at least four of the cars (V, X, Y, and Z have sunroofs).

6) Answer is (D)

   If exactly four of the six cars have leather interiors, then T must have leather interiors. And if exactly four of the six cars have power windows, then Z must have power windows. Now with this set up we see that W and Z have the same two options.

7) Answer is (D)

   The change in this rule only changes one thing in the original diagram – that X may or may not have a sunroof. The only answer choice that must be false is that X and Z have no options in common, since at the very least they both have leather interiors. The other four choices all could be true.
**Grouping Game 8**

**Scenario**

In a repair facility there are exactly six technicians: Stacy, Urma, Wim, Xena, Yolanda, and Zane. Each technician repairs machines of at least one of the following three types - radios, televisions, and VCRs - and no other types. The following conditions apply:

**Rules**

1) Xena and exactly three other technicians repair radios.
2) Yolanda repairs both televisions and VCRs.
3) Stacy does not repair any type of machine that Yolanda repairs.
4) Zane repairs more types of machines than Yolanda repairs.
5) Wim does not repair any type of machine that Stacy repairs.
6) Urma repairs exactly two types of machines.

**Questions**

1) For exactly how many of the six technicians is it possible to determine exactly which of the three types of machines each repairs?

   (A) one  
   (B) two  
   (C) three  
   (D) four  
   (E) five

2) Which one of the following must be true?

   (A) Of the types of machines repaired by Stacy there is exactly one type that Urma also repairs.  
   (B) Of the types of machines repaired by Yolanda there is exactly one type that Xena also repairs.  
   (C) Of the types of machines repaired by Wim there is exactly one type that Xena also repairs.  
   (D) There is more than one type of machine that both Wim and Yolanda repair.  
   (E) There is more than one type of machine that both Urma and Wim repair.
3) Which one of the following must be false?

(A) Exactly one of the six technicians repairs exactly one type of machine.
(B) Exactly two of the six technicians repairs exactly one type of machine each.
(C) Exactly three of the six technicians repairs exactly one type of machine each.
(D) Exactly one of the six technicians repairs exactly two types of machines.
(E) Exactly three of the six technicians repairs exactly two types of machines each.

4) Which one of the following pairs of technicians could repair all and only the same type of machines as each other?

(A) Stacy and Urma
(B) Urma and Yolanda
(C) Urma and Xena
(D) Wim and Xena
(E) Xena and Yolanda

5) Which one of the following must be true?

(A) There is exactly one type of machine that both Urma and Wim repair.
(B) There is exactly one type of machine that both Urma and Xena repair.
(C) There is exactly one type of machine that both Urma and Yolanda repair.
(D) There is exactly one type of machine that both Wim and Yolanda repair.
(E) There is exactly one type of machine that both Xena and Yolanda repair.
Grouping Game 8 - Diagram for Solution

Step 1 - list what is being grouped and what the categories available are:

\[ r, t, v \rightarrow \]
\[ s u w x y z \]

Step 2 - translate the scenario and rules to shorthand notation

\[ 45 \]
\[ z > y \]
\[ s \neq y \quad w \neq s \]

Step 3 - add any obvious derived rules

\[ r \]
\[ s \quad u \]
\[ s u w x y z \]

Step 4 - check answers against diagram, add new rule if question introduces it
Grouping Game 8 - Analysis

1) Answer is (C)

   From our drawing, the only technicians where the entire list of what they can repair is known are S, Y, and Z.

2) Answer is (A)

   It is possible that X only repairs radios, in which case (B) and (C) are out. If W repairs either TVs or VCRs, but not both, (D) would not be true. U and W could share zero or one type of machine in common, but certainly not two, so (E) is rejected, leaving (A).

3) Answer is (D)

   Y and U repair exactly two types of machines each. It would therefore be impossible for exactly one of the technicians to repair two types of machines, so (D) must be false.

4) Answer is (C)

   From our drawing, we look for pairs of technicians that repair exactly the same number and types of machines. S repairs radios only, and U radios plus something else, so (A) is impossible. Y and U both repair two types of machines, but differ on one type at least, so (B) is out. X repairs radios but W does not, so (D) is out. X repairs radios and Y does not, so (E) is out, leaving (C).

5) Answer is (C)

   Y repairs TVs and VCRs. U repairs radios and one other type of machine. That would have to be a TV or VCR, so Y and U would have exactly one type in common only.
MULTILEVEL LINEAR GAMES

STRATEGY

GENERAL OBSERVATION

Multilevel linear games employ all the same deductive techniques as simple linear with one huge exception: there is always the need to coordinate the sequence at one level with the sequence at the other level (assuming a two level game). If this were not the case, you would simply have two simple linear games going on simultaneously.

RECOGNITION KEYS

As with simple linear games, the key words in the game statement have to deal with order or relative positions in some order scheme. It will usually be clear that there are two or more (usually two) sequences to construct. At least one rule will tie the two sequences together by introducing either required or forbidden configurations. Don't mistake a combo game, which has a grouping theme as well as a sequencing theme, for a pure multilevel linear game. A point of confusion might be the rules that require the sequences to be coordinated. They may superficially resemble some sort of selection or classification condition.

GAME FEATURES

After you have synchronized the multiple sequences, one on top of the other, you will want to examine the rules for secondary deductions that create “cross-blocks”. These are partial bits of two or more sequences where either two variables must appear at the same point in each sequence, or must not. Very frequently, the test makers impose some other conditions on the individual variables in a cross-block so that it begins to resemble an odd-shaped puzzle piece. The practice test diagrams will clarify this idea.

Cross-blocks are the main feature of multilevel games that distinguishes them from ordinary linear games. While they impose a complication on determining valid sequences, they also act to reduce the number of possible configurations, and this is always a welcome benefit.
Multilevel Linear Game 1

Scenario

Doctor Yamata works only on Mondays, Tuesdays, Wednesdays, Fridays and Saturdays. She performs four different activities – lecturing, operating, treating patients, and conducting research. Each working day she performs exactly one activity in the morning and exactly one activity in the afternoon. During each week her schedule must satisfy the following restrictions:

Rules

1) She performs operations on exactly three mornings.
2) If she operates on Monday, she does not operate on Tuesday.
3) She lectures in the afternoon on exactly two consecutive calendar days.
4) She treats patients on exactly one morning and exactly three afternoons.
5) She conducts research on exactly one morning.
6) On Saturday she neither lectures nor performs operations.

Questions

1) Which of the following must be a day on which Doctor Yamata lectures?
   (A) Monday
   (B) Tuesday
   (C) Wednesday
   (D) Friday
   (E) Saturday

2) On Wednesday Doctor Yamata could be scheduled to
   (A) conduct research in the morning and operate in the afternoon
   (B) lecture in the morning and treat patients in the afternoon
   (C) operate in the morning and lecture in the afternoon
   (D) operate in the morning and conduct research in the afternoon
   (E) treat patients in the morning and treat patients in the afternoon

3) Which of the following statements must be true?
   (A) There is one day on which the doctor treats patients both in the morning and in the afternoon.
   (B) The doctor conducts research on one of the days on which she lectures.
   (C) The doctor conducts research on one of the days on which she treats patients.
   (D) The doctor lectures on one of the days on which she treats patients.
   (E) The doctor lectures on one of the days on which she operates.
4) If Doctor Yamata operates on Tuesday, then her schedule for treating patients could be

(A) Monday morning, Monday afternoon, Friday morning, Friday afternoon.
(B) Monday morning, Friday afternoon, Saturday morning, Saturday afternoon.
(C) Monday afternoon, Wednesday morning, Wednesday afternoon, Saturday afternoon.
(D) Wednesday morning, Wednesday afternoon, Friday afternoon, Saturday afternoon.
(E) Wednesday afternoon, Friday afternoon, Saturday morning, Saturday afternoon.

5) Which one of the following is a pair of days on both of which Doctor Yamata must treat patients?

(A) Monday and Tuesday
(B) Monday and Saturday
(C) Tuesday and Friday
(D) Tuesday and Saturday
(E) Friday and Saturday
Multilevel Linear Game 1 - Diagram for Solution

Step 1 - list the levels and what objects are to be ordered in each level

Step 2 - translate the scenario and rules to shorthand notation

Step 3 - add any obvious derived rules

Step 4 - check answers against diagram, add new rule if question introduces it
**Multilevel Linear Game 1 - Analysis**

1) Answer is (B)

   Since she lectures on two consecutive calendar days, those days must either be Mon/Tues, Tues/Weds, or Fri/Sat, but since she does not lecture on Saturday it must be one of the first two options – both of which include Tuesday. * This is a new global rule. It also follows that since the consecutive lecture must be on either Monday or Wednesday, she must treat patients in the afternoon on both Friday and Saturday.

2) Answer is (C)

   “Could be true” – only one of these could be true, the rest are false. We can eliminate (A) since Doctor Yamata does not operate in the afternoons. We can eliminate (B) since she does not lecture in the mornings, and since she does not conduct research in the afternoons we can eliminate (D). We can eliminate (E) since we know that she operates on Wednesday mornings.

3) Answer is (E)

   We know that she operates on Wednesday morning and then on either Monday morning or Tuesday morning. We also know that she lectures on Tuesday afternoon and on either Monday afternoon or Wednesday afternoon. Suppose that she treats patients on Wednesday afternoon, then this means that she lectures on Monday afternoon and Tuesday afternoon, whichever one it is will coincide with a morning on which she operates.

4) Answer is (E)

   We can rule out answer choices (A) and (C) right away since we know that she treats patients on both Friday afternoon and Saturday afternoon. We can also eliminate (D) since she does not treat patients on Wednesday mornings. (B) is also incorrect since she only treats patients on one of the mornings.

5) Answer is (E)

   We determined that this must be true after completing question 8.
**Multilevel Linear Game 2**

**Scenario**

Eight physics students - four majors: Frank, Gwen, Henry, and Joan; and four nonmajors: Victor, Wanda, Xavier, and Yvette - are being assigned to four laboratory benches, numbered 1 through 4. Each student is assigned to exactly one bench, and exactly two students are assigned to each bench. Assignments of students to benches must conform to the following conditions:

**Rules**

1) Exactly one major is assigned to each bench.  
2) Frank and Joan are assigned to consecutively numbered benches, with Frank assigned to the lower-numbered bench.  
3) Frank is assigned to the same bench as Victor.  
4) Gwen is not assigned to the same bench as Wanda.

**Questions**

1) Which one of the following could be the assignment of students to benches?

   (A) 1: Frank, Victor, 2: Joan, Gwen, 3: Henry, Wanda, 4: Xavier, Yvette  
   (B) 1: Gwen, Yvette, 2: Frank, Xavier, 3: Joan, Wanda, 4: Henry, Victor  
   (C) 1: Henry, Wanda, 2: Gwen, Xavier, 3: Frank, Victor, 4: Joan, Yvette  
   (D) 1: Henry, Xavier, 2: Joan, Wanda, 3: Frank, Victor, 4: Gwen, Yvette  
   (E) 1: Henry, Yvette, 2: Gwen, Wanda, 3: Frank, Victor, 4: Joan, Xavier

2) If Victor is assigned to bench 2 and Wanda is assigned to bench 4, which one of the following must be true?

   (A) Frank is assigned to bench 1  
   (B) Gwen is assigned to bench 1  
   (C) Henry is assigned to bench 3  
   (D) Xavier is assigned to bench 1  
   (E) Yvette is assigned to bench 3

3) If Gwen and Henry are not assigned to consecutively numbered benches, which one of the following must be true?

   (A) Victor is assigned to bench 2.  
   (B) Victor is assigned to bench 3.  
   (C) Wanda is assigned to bench 1.  
   (D) Wanda is assigned to bench 3.  
   (E) Wanda is assigned to bench 4.
4) If Henry and Yvette are both assigned to bench 1, which one of the following could be true?

   (A) Gwen is assigned to bench 3.
   (B) Joan is assigned to bench 2.
   (C) Wanda is assigned to bench 2.
   (D) Wanda is assigned to bench 3.
   (E) Xavier is assigned to bench 3.

5) If Gwen is assigned to bench 4 and Xavier is assigned to bench 3, then any one of the following could be true EXCEPT:

   (A) Gwen is assigned to the same bench as Yvette.
   (B) Henry is assigned to the same bench as Wanda.
   (C) Henry is assigned to the same bench as Xavier.
   (D) Joan is assigned to the same bench as Xavier.
   (E) Joan is assigned to the same bench as Yvette.

6) If Wanda is assigned to a lower-numbered bench than Joan, then Henry must be assigned to a

   (A) lower-numbered bench than is Frank
   (B) lower-numbered bench than is Gwen
   (C) lower-numbered bench than is Xavier
   (D) higher-numbered bench than is Victor
   (E) higher-numbered bench than is Yvette

7) Which one of the following could be the assignments for bench 2 and bench 4?

   (A) 2: Gwen, Xavier
       4: Henry, Yvette
   (B) 2: Henry, Yvette
       4: Joan, Xavier
   (C) 2: Joan, Victor
       4: Gwen, Xavier
   (D) 2: Joan, Wanda
       4: Gwen, Xavier
   (E) 2: Joan, Xavier
       4: Henry, Yvette
Multilevel Linear Game 2 - Diagram for Solution

Step 1 - list the levels and what objects are to be ordered in each level

\[ \text{Step 2 - translate the scenario and rules to shorthand notation} \]

\[ \text{Step 3 - add any obvious derived rules} \]

\[ \text{Step 4 - check answers against diagram, add new rule if question introduces it} \]
Multilevel Linear Game 2 - Analysis

1) Answer is (C)

We can eliminate (B) and (D) because of the F/v/J triple. We can eliminate (E) because G cannot be with w. Finally, we eliminate (A) since x and y are on the same bench, yet there must be exactly one major assigned to each bench.

2) Answer is (B)

Because of the F/v/J triple we know that F and v must be on bench 2, which means that J must be on bench 3. Since w must be on bench 4, and G cannot be with w, G must be on bench 1.

3) Answer is (A)

Since the F/v/J triple must fill bench 2 and part of bench 3 (to keep G and H separate), we know that v must be seated at bench 2.

4) Answer is (D)

This additional rule creates a block of four: F/v/J/w (since G cannot sit with w) This block of four either takes up benches 2 and 3, or benches 3 and 4. So we can rule out (B) as J has to sit at a higher numbered bench than F, so J cannot sit at bench 2. We also rule out (C) because either F or G must sit at bench 2, and F sits with v, while G cannot sit with w, so either way w cannot sit at bench 2. We eliminate choice (E) because either F and v sit at bench 3, or J and 2 do. Finally we can eliminate (A) since x must be sat with G and (E) told us that x cannot sit at bench 3, therefore neither can G.

5) Answer is (E)

This set-up forces G to sit at bench 4 with y, which means (E) must be false.

6) Answer is (A)

If w must be seated at a lower numbered bench than J, then the F/v/J triple can either be at benches 2 and 3, or at benches 3 and 4 (since there needs to be a lower numbered bench left for w to sit at.) (See diagram). In the first option, obviously H is at a lower numbered bench than F, and in option 2, we see that w must be seated at bench 1 – with H, since G cannot sit with w. So again in this option, H must be seated at a lower numbered bench than F.
7) Answer is (D)

Answer choice (A), splits up the F/v/J triple which must take up consecutive benches. (B) and (E) must be false, since they both force G with w. We can eliminate (C) since J does not sit with v. (F does).
Multilevel Linear Game 3

Scenario

During three days - Monday through Wednesday - a health officer will inspect exactly six buildings - three hotels: Grace, Jacaranda, and Lido; and three restaurants: Seville, Vesuvio, and Zeno. Each day, exactly two buildings are inspected: one in the morning and one in the afternoon. Inspections must occur according to the following conditions:

Rules

1) Hotels are not inspected on Wednesdays
2) Grace is inspected sometime before Jacaranda.
3) Grace is not inspected on the same day as Seville.
4) If Zeno is inspected in the morning, Lido is also inspected in the morning.

Questions

1) Which of the following could be the order in which the buildings are inspected, listed in order from Monday morning through Wednesday afternoon?

(A) Grace, Seville, Jacaranda, Lido, Vesuvio, Zeno
(B) Grace, Vesuvio, Zeno, Jacaranda, Lido, Seville
(C) Lido, Jacaranda, Grace, Vesuvio, Zeno, Seville
(D) Lido, Seville, Grace, Jacaranda, Zeno, Vesuvio
(E) Zeno, Grace, Jacaranda, Lido, Seville, Vesuvio

2) Which of the following could be the buildings inspected in the mornings, listed in order from Monday through Wednesday?

(A) Grace, Jacaranda, Zeno
(B) Jacaranda, Vesuvio, Seville
(C) Lido, Jacaranda, Vesuvio
(D) Seville, Jacaranda, Vesuvio
(E) Seville, Lido, Zeno

3) Which one of the following is a pair of buildings that, if inspected on the same day as each other, must be inspected on Monday?

(A) Grace and Jacaranda
(B) Grace and Vesuvio
(C) Jacaranda and Lido
(D) Lido and Seville
(E) Lido and Vesuvio
4) If Grace is inspected on Tuesday, which one of the following could be the buildings inspected in the afternoons, listed in order from Monday through Wednesday?

(A) Lido, Jacaranda, Vesuvio
(B) Lido, Jacaranda, Zeno
(C) Lido, Vesuvio, Zeno
(D) Seville, Grace, Vesuvio
(E) Seville, Jacaranda, Lido

5) If Seville is inspected on Monday morning, which one of the following must be true?

(A) Grace is inspected on Tuesday afternoon.
(B) Jacaranda is inspected on Monday afternoon.
(C) Lido is inspected on Tuesday morning.
(D) Vesuvio is inspected on Wednesday morning.
(E) Zeno is inspected on Wednesday morning.

6) If Grace is inspected on Monday morning and Zeno is inspected on Wednesday morning, which one of the following must be true?

(A) Jacaranda is inspected before Lido is inspected.
(B) Jacaranda is inspected after Lido is inspected.
(C) Jacaranda is inspected after Seville is inspected.
(D) Lido is inspected before Seville is inspected.
(E) Lido is inspected before Vesuvio is inspected.
Multilevel Linear Game 3 - Diagram for Solution

Step 1 - list the levels and what objects are to be ordered in each level

Hotels: G, J, L
Rest: S, V, Z

Step 2 - translate the scenario and rules to shorthand notation

Step 3 - add any obvious derived rules

Q6 only:

Step 4 - check answers against diagram, add new rule if question introduces it
Multilevel Linear Game 3 - Analysis

1) Answer is (D)

   We can eliminate (A) since G and s cannot be inspected on the same day. (B) is false since hotels cannot be inspected on Wednesday. (C) has J before G, and (E) has z in the morning, but L in the afternoon.

2) Answer is (C)

   We can rule out (A) since if z is in the morning, then L should be in the morning also. (B) violates the rule that G must be inspected before J. (D) and (E) both result in G being inspected on Monday afternoon (in order to be inspected before J), but this violates the rule that G cannot be inspected the same day as s.

3) Answer is (B)

   It is clear that G and v cannot be inspected on Wednesday since G is a hotel, but this pair cannot be inspected together on Tuesday either since this would force J to be inspected on Wednesday, yet J is a hotel so this cannot happen.

4) Answer is (B)

   If G is inspected on Tuesday, we see right away that G must be inspected in the morning (since J would have to be inspected Tuesday afternoon). This rules out (C) and (D). We can also rule out (A) and (E) since if L is inspected in the afternoon, then z should also be inspected in the afternoon.

5) Answer is (D)

   s on Monday morning forces G to Tuesday, and as we saw in the last problem, G must be in the morning on Tuesday so that J can be inspected on Tuesday afternoon. It also follows that L must be inspected on Monday afternoon since L is a hotel and cannot be inspected on Wednesday. Finally, L in the afternoon implies that z is also in the afternoon, and so it follows that v is on Wednesday morning.

6) Answer is (D)

   z in the morning means that L must also be in the morning (Tuesday morning). For the afternoon slots there are two possibilities (see diagram). In both arrangement we see that L is inspected before s.
Multilevel Linear Game 4

Scenario

On the basis of an examination, nine students - Fred, Glen, Hilary, Ida, Jan, Kathy, Laura, Mike, and Nick - are each placed in one of three classes. The three highest scorers are placed in the level 1 class; the three lowest scorers are placed in the level 3 class. The remaining three are placed in the level 2 class. Each class has exactly three students.

Rules

1) Ida scores higher than Glen.
2) Glen scores higher than both Jan and Kathy
3) Jan scores higher than Mike.
4) Mike scores higher than Hilary.
5) Hilary scores higher than Nick.
6) Kathy scores higher than both Fred and Laura.

Questions

1) How many different combinations of students could form the level 1 class?
   
   (A) one
   (B) two
   (C) three
   (D) four
   (E) six

2) Which one of the following students could be in the level 2 class but cannot be in the level 3 class?
   
   (A) Fred
   (B) Glen
   (C) Jan
   (D) Kathy
   (E) Nick

3) Which one of the following students could be placed in any one of the three classes?
   
   (A) Fred
   (B) Jan
   (C) Kathy
   (D) Laura
   (E) Mike
4) The composition of each class can be completely determined if which one of the following pairs of students is known to be in the level 2 class?

(A) Fred and Kathy  
(B) Fred and Mike  
(C) Hilary and Jan  
(D) Kathy and Laura  
(E) Laura and Mike

5) Which one of the following pairs of students cannot be in the same class as Fred?

(A) Hilary and Nick  
(B) Jan and Laura  
(C) Kathy and Laura  
(D) Jan and Mike  
(E) Laura and Mike
Multilevel Linear Game 4 - Diagram for Solution

Step 1 - list the levels and what objects are to be ordered in each level

F, G, H, I, J, K, L, M, N

Step 2 - translate the scenario and rules to shorthand notation

Step 3 - add any obvious derived rules

Step 4 - check answers against diagram, add new rule if question introduces it
Multilevel Linear Game 4 - Analysis

1) Answer is (B)

We deduced that I and G had to be in level 1. J and K are below each of those, but we don't know the exact relation between J and K. Evidently either could be the third highest scoring student, so there would be two possibilities for the level 1 class roster.

2) Answer is (C)

M, H, and N all have scores lower then J, so J could not possibly be in level 3.

3) Answer is (C)

(B) is out, since we established that J can't be in level 3. I, G, and F are strictly above M, H, and N, so none of M, H, or N can be in level 1. This eliminates (E). Likewise, I, G, and K are strictly above F and L, so F and L can't be in level 1. This eliminates (A) and (D). (C) remains as the only possibility.

4) Answer is (C)

If F and K are in level 2, then I, G, and J are certainly in level 1, but either L or M could be in level 2...not definite, so (A) is out. If Fred and Mike or Laura and Mike are in level 2, there is no decision on whether J or K is in level 1, so (B) and (E) are out. If K and L are in level 2, then again it is certain that I, G, and J are in level 1, but there is no way to tell whether it is F or M that is the third student in level 2. So (D) is out and we are left with (C).

5) Answer is (E)

H, N, and F could all be in level 3, so (A) is out. I, G, and K could be the level 1 class, leaving J, F, and L as a possible level 2 class, with M, H, and N at the bottom, so (B) is out. Nothing wrong with I, G, J at the top and F, K, and L at level 2, so (C) is out. L could be down in level 3 with H and N, I, G, and K could be in level 1, and that would leave J, M, and F as a possible level 2 class, so (D) is out. We are left with (E).
Multilevel Linear Game 5

Scenario

Four lions - F, G, H, J - and two tigers - K and M - will be assigned to exactly six stalls, one animal per stall. The stalls are arranged as follows:

First Row:   1   2   3
Second Row:  4   5   6

The only stalls that face each other are stalls 1 and 4, stalls 2 and 5, and stalls 3 and 6. The following conditions apply:

Rules

1) The tigers’ stalls cannot face each other.
2) A lion must be assigned to stall 1.
3) H must be assigned to stall 6.
4) J must be assigned to a stall numbered one higher than K’s stall.
5) K cannot be assigned to the stall that faces H’s stall.

Questions

1) Which one of the following must be true?
   (A) F is assigned to an even-numbered stall.
   (B) F is assigned to stall 1.
   (C) J is assigned to stall 2 or else stall 3.
   (D) J is assigned to stall 3 or else stall 4.
   (E) K is assigned to stall 2 or else stall 4.

2) Which one of the following could be true?
   (A) F’s stall is numbered one higher than J’s stall.
   (B) H’s stall faces M’s stall.
   (C) J is assigned to stall 4.
   (D) K’s stall faces J’s stall.
   (E) K’s stall is in a different row than J’s stall.

3) Which one of the following must be true?
   (A) A tiger is assigned to stall 2.
   (B) A tiger is assigned to stall 5.
   (C) K’s stall is in a different row from M’s stall.
   (D) Each tiger is assigned to an even-numbered stall.
   (E) Each lion is assigned to a stall that faces a tiger’s stall.
4) If K’s stall is in the same row as H’s stall, which one of the following must be true?

(A) F’s stall is in the same row as J’s stall.
(B) F is assigned to a lower numbered stall then G.
(C) G is assigned to a lower numbered stall than M.
(D) G’s stall faces H’s stall.
(E) M’s stall is in the same row as G’s stall.

5) If J is assigned to stall 3, which one of the following could be true?

(A) F is assigned to stall 2.
(B) F is assigned to stall 4.
(C) G is assigned to stall 1.
(D) G is assigned to stall 4.
(E) M is assigned to stall 5.

6) Which one of the following must be true?

(A) A tiger is assigned to stall 2.
(B) A tiger is assigned to stall 4.
(C) A tiger is assigned to stall 5.
(D) A lion is assigned to stall 3.
(E) A lion is assigned to stall 4.
Multilevel Linear Game 5 - Diagram for Solution

Step 1 - list the levels and what objects are to be ordered in each level

Lions: F, G, H, J
Tigers: k, m

Step 2 - translate the scenario and rules to shorthand notation

\[
\begin{array}{c}
k & m \\
m & k \\
\end{array}
\]

J = k + 1

Step 3 - add any obvious derived rules

k not m 1, 3, 5, 6  \hspace{1cm} \text{Two options:}

1. \[
\begin{array}{c}
F/G \\
m \\
\end{array}
\hspace{1cm}
\begin{array}{c}
k \\
F/G \\
\end{array}
\hspace{1cm}
\begin{array}{c}
J \\
F/G \\
\end{array}
\hspace{1cm}
\begin{array}{c}
m \\
F/G \\
\end{array}
\hspace{1cm}
\begin{array}{c}
H \\
\end{array}
\]

2. \[
\begin{array}{c}
F/G \\
F/G \\
F/G \\
\end{array}
\hspace{1cm}
\begin{array}{c}
k \\
\end{array}
\hspace{1cm}
\begin{array}{c}
J \\
\end{array}
\hspace{1cm}
\begin{array}{c}
m \\
\end{array}
\hspace{1cm}
\begin{array}{c}
H \\
\end{array}
\]

Step 4 - check answers against diagram, add new rule if question introduces it
**Multilevel Linear Game 5 - Analysis**

The fact that we have been able to isolate the only two possible configurations is an enormous help in this game.

1) Answer is (E)

   From our diagram we can see immediately that the only valid choice is k in either stall 2 or stall 4.

2) Answer is (B)

   Run the choices past our valid options. The only choice that works is (B).

3) Answer is (C)

   Test the choices against the options.

4) Answer is (E)

   Since k and H are in the same row, we know that option two is the configuration that must be in place. M and G are in the same row, so (E).

5) Answer is (C)

   Since J is in stall 3, we know that option one is in play. Running the choices by this option reveals that G can be in stall 1 and F in stall 5, so (C).

6) Answer is (B)

   In either option, there is a tiger in stall 4.
Multilevel Linear Game 6

Scenario

On an undeveloped street, a developer will simultaneously build four houses on one side, numbered consecutively 1, 3, 5, and 7, and on the opposite side, numbered consecutively 2, 4, 6, and 8. Houses 2, 4, 6, and 8 will face houses 1, 3, 5, and 7 respectively. Each house will be exactly one of three styles - ranch, split-level, or Tudor - according to the following conditions:

Rules

1) Adjacent house are of different styles.
2) No split-level house faces another split-level house.
3) Every ranch house has at least one Tudor house adjacent to it.
4) House 3 is a ranch house.
5) House 6 is a split level house.

Questions

1) Any of the following could be a Tudor house EXCEPT house

(A) 1.
(B) 2
(C) 4
(D) 7
(E) 8

2) If there is a ranch house directly opposite another ranch house, which one of the following could be true?

(A) House 8 is a ranch house.
(B) House 7 is a split-level house.
(C) House 4 is a Tudor house.
(D) House 2 is a split-level house.
(E) House 1 is a ranch house.

3) If house 4 is a Tudor house, then it could be true that house

(A) 1 is a Tudor house.
(B) 2 is a Tudor house
(C) 5 is a ranch house
(D) 7 is a Tudor house
(E) 8 is a ranch house
4) On the street, there could be exactly

   (A) one ranch house
   (B) one Tudor house
   (C) two Tudor houses
   (D) four ranch houses
   (E) five ranch houses

5) If no house faces a house of the same style, then it must be true that house

   (A) 1 is a split-level house
   (B) 1 is a Tudor house
   (C) 2 is a ranch house
   (D) 2 is a split-level house
   (E) 4 is a Tudor house

6) If the condition requiring house 6 to be a split-level house is suspended but all other original conditions remain the same, then any of the following could be an accurate list of the styles of houses 2, 4, 6 and 8, respectively, EXCEPT:

   (A) ranch, split-level, ranch, Tudor
   (B) split-level, ranch, Tudor, split-level
   (C) split-level, Tudor, ranch, split-level
   (D) Tudor, ranch, Tudor, split-level
   (E) Tudor, split-level, ranch, Tudor
Multilevel Linear Game 6 - Diagram for Solution

Step 1 - list the levels and what objects are to be ordered in each level

\[
\begin{array}{c}
R, S, T \\
1 \\
2
\end{array} \quad \begin{array}{c}
1 \\
2
\end{array} \quad \begin{array}{c}
3 \\
4
\end{array} \quad \begin{array}{c}
5 \\
6
\end{array} \quad \begin{array}{c}
7 \\
8
\end{array}
\]

Step 2 - translate the scenario and rules to shorthand notation

\[
\begin{array}{c}
R \\
1 \\
2
\end{array} \quad \begin{array}{c}
3 \\
4
\end{array} \quad \begin{array}{c}
5 \\
6
\end{array} \quad \begin{array}{c}
7 \\
8
\end{array} \quad XRX \quad x = \frac{s}{t} \quad XSX \quad x = \frac{r}{t} \quad XTX \quad x = \frac{s}{r}
\]

Step 3 - add any obvious derived rules

\[
\begin{array}{c}
R \\
1 \\
2
\end{array} \quad \begin{array}{c}
R \\
3 \\
4
\end{array} \quad \begin{array}{c}
R \\
5 \\
6
\end{array} \quad \begin{array}{c}
R/S \\
7 \\
8
\end{array} \quad \begin{array}{c}
S/T \\
1 \\
2
\end{array} \quad \begin{array}{c}
R/T \\
3 \\
4
\end{array} \quad \begin{array}{c}
S \\
5 \\
6
\end{array} \quad \begin{array}{c}
T \\
7 \\
8
\end{array}
\]

Step 4 - check answers against diagram, add new rule if question introduces it
Multilevel Linear Game 6 – Analysis

1) Answer is (D)

From our diagram, we see that house 5 must be Tudor style. Adjacent (side by side, not across the street) houses must have different styles, so houses 3 and 7 cannot be Tudor. 3 doesn’t appear as a choice, but 7 does.

2) Answer is (B)

If two ranch houses are across from each other, that must happen only for houses 3 and 4, so (C) is out. The TR rule then forces house 2 to be Tudor, so (D) is out. Also, house 1 is split-level or Tudor, so (E) is out. We know house 8 is Tudor, so (A) is out. (B) remains.

3) Answer is (A)

If house 4 is Tudor, then house 2 cannot be, so (B) is out. House 5 is Tudor, so (C) is out. House 7 is split-level or ranch, so (D) is out. Finally, house 8 is known to be Tudor, so (E) is out. (A) works.

4) Answer is (A)

From our diagram, if house 1 is Tudor, 7 is split-level, 2 is split-level, and 4 is Tudor, there is exactly one ranch house...this is consistent with all the rules.

5) Answer is (E)

Since house 3 is ranch, this local rule prevents house 4 from being ranch, so it must be Tudor, choice (E).

6) Answer is (A)

This is the kind of question to skip because it looks messy. It is an acceptability question with a new set-up. Recall, though, every ranch is supposed to have a Tudor next to it. In (A), there is a split-level next to the ranch, which is forbidden. So this question was a hidden gift.
COMBINATION & MISC. GAMES

STRATEGY

GENERAL OBSERVATIONS

Combination games have both elements of ordering and grouping in them, and accordingly they require skill in solving both sequencing and grouping games. Very often they are the most difficult logic games that appear on the LSAT. There is usually a “killer” game among the four given each exam date, and it frequently is a combo game. This is mentioned not to discourage you, but to make you aware that the most efficient use of time on the logic games portion of the LSAT involves recognizing what you can confidently do and relegating the rest to informed guesses, where the number of answer choices per question can been reduced from the initial five.

RECOGNITION KEYS

You are looking for linear, grouping and multilevel games among the four you are faced with on the LSAT. This will let you start with something simpler and that you have experience with. If a game doesn’t seem to fit any of those profiles, and if it has both sequencing and grouping aspects, it is a hybrid or combo game. If the game you are looking at is even missing these hybrid characteristics, you have latched onto a miscellaneous game. Fortunately these are rare on the LSAT.

GAME FEATURES

There is very little advice to be given that is specific to combo games, other than saving them for last unless they are unnaturally simple looking. Using the techniques for generating secondary deductions for sequencing and grouping games is certainly a way to start, although attention must be paid to the possibility that a grouping rule, for example, may affect a sequencing option, or a sequencing rule may affect a grouping option. So you will want to be on the lookout for deductions of this sort that are themselves hybrids. The practice exams will illustrate how this works.
Combination Game 1

Scenario

Exactly five cars - Frank’s, Marquitta’s, Orlando’s, Taishah’s, and Vinquetta’s - are washed, each exactly once. The cars are washed one at a time, with each receiving exactly one kind of wash: regular, super, or premium.

Rules

1) The first car washed does not receive a super wash, though at least one car does.
2) Exactly one car receives a premium wash.
3) The second and third cars washed receive the same kind of wash as each other.
4) Neither Orlando’s nor Taishah’s is washed before Vinquetta’s.
5) Marquitta’s is washed before Frank’s but after Orlando’s.
6) Marquitta’s and the car washed immediately before Marquitta’s receive regular washes.

Questions

1) Which one of the following could be an accurate list of the cars in the order in which they are washed, matched with type of wash received?

(A) Orlando’s: premium; Vinquetta’s: regular; Taishah’s: regular; Marquitta’s: regular; Frank’s: super 
(B) Vinquetta’s: premium; Orlando’s: regular; Taishah’s: regular; Marquitta’s: regular; Frank’s: super 
(C) Vinquetta’s: regular; Marquitta’s: regular; Taishah’s: regular; Orlando’s: super; Frank’s: premium 
(D) Vinquetta’s: super; Orlando’s: regular; Marquitta’s: regular; Frank’s: regular; Taishah’s: super 
(E) Vinquetta’s: premium; Orlando’s: regular; Marquitta’s regular; Frank’s: regular; Taishah’s: regular

2) If Vinquetta’s car does not receive a premium wash, which one of the following must be true?

(A) Orlando’s and Vinquetta’s cars receive the same kind of wash as each other. 
(B) Marquitta’s and Taishah’s cars receive the same kind of wash as each other. 
(C) The fourth car washed receives a premium wash. 
(D) Orlando’s car is washed third. 
(E) Marquitta’s car is washed fourth.
3) If the last two cars washed receive the same kind of wash as each other, then which one of the following could be true?

(A) Orlando’s car is washed third.
(B) Taishah’s car is washed fifth.
(C) Taishah’s car is washed before Marquitta’s car.
(D) Vinquetta’s car receives a regular wash.
(E) Exactly one car receives a super wash.

4) Which one of the following must be true?

(A) Vinquetta’s car receives a premium wash.
(B) Exactly two cars receive a super wash.
(C) The fifth car washed receives a super wash.
(D) The fourth car washed receives a super wash.
(E) The second car washed receives a regular wash.

5) Which one of the following is a complete and accurate list of the cars that must receive a regular wash?

(A) Frank’s, Marquitta’s
(B) Marquitta’s, Orlando’s
(C) Marquitta’s, Orlando’s, Taishah’s
(D) Marquitta’s, Taishah’s
(E) Marquitta’s, Vinquetta’s

6) Suppose that in addition to the original five cars Jabrohn’s car is also washed. If all the other conditions hold as given, which of the following CANNOT be true?

(A) Orlando’s car receives a premium wash.
(B) Vinquetta’s car receives a super wash.
(C) Four cars receive a regular wash.
(D) Only the second and third cars washed receive a regular wash.
(E) Jabrohn’s car is washed after Frank’s car.
Combination Game 1 - Diagram for Solution

Step 1 - list the objects and the blank configuration

Cars: F, M, O, T, V
Wash: R, S, P

Step 2 - translate the scenario and rules to shorthand notation

Cars: F, M, O, T, V
Wash: R, S, P

Y < O
V < T
O < M < F

Step 3 - add any obvious derived rules

O → M → F
V → T

Step 4 - check answers against diagram, add new rule if question introduces it

Q3 only:

<table>
<thead>
<tr>
<th>1</th>
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<tbody>
<tr>
<td>V</td>
<td>R</td>
<td>M</td>
<td>S</td>
<td>S</td>
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</table>

Q6 only:

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<tbody>
<tr>
<td>F</td>
<td>I</td>
<td>M</td>
<td>O</td>
<td>T</td>
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</tbody>
</table>
Combination Game 1 - Analysis

1) Answer is (B)

We can eliminate (A) since V must be the first car washed. We can also eliminate (C) since O must be washed before M. Option (D) has no p wash, and (E) has no s wash.

2) Answer is (A)

V must be first with r, then we know the r/r/M triple has to go 2\textsuperscript{nd} and 3\textsuperscript{rd} otherwise there would be no room for both p and s. So M goes with r in third position, which forces O to go with r in second position. Hence, V and O both go with r.

3) Answer is (B)

We know that V must go with p and the two doubles will be r/r and s/s and in fact since M cannot be the last car washed the r/r/M triple must be 2\textsuperscript{nd} and 3\textsuperscript{rd}. This forces the 4\textsuperscript{th} and 5\textsuperscript{th} cars to have s washes, and also the second car washed must be O. This set-up rules out (A), (C), (D), and (E).

4) Answer is (E)

If the second car washed receives an s wash (the only alternative since we know it isn’t p), then the third car washed also receives an s wash. This forces the r/r/M triple into positions 4 and 5 which cannot be, since F or T has to be washed last.

This is a new global rule: The second car washed has an ‘r’ wash. This rule however is not actually helpful in answering the remaining questions.

5) Answer is (B)

We saw from questions 11 and 12 that V can either go with p or r, so V is not one of the cars that receive an r wash. This rules out (E). Question 13 showed us that F and T can have an s wash, so these need not have an r wash. This eliminates (A), (C), and (D).

6) Answer is (A)

Even with the introduction of J, the second and third cars washed receive the same type of wash (which still cannot be p since there is only one p wash).
However, if J comes after O in the order, then O must be 2nd or 3rd, but then O would not be able to have a p wash. If J comes before O in the order, then O must either be third (in which case again, O can not have a p wash), or O must come immediately prior to M, but we know that that car receives an r wash. Thus it is impossible for O to have a p wash.
**Combination Game 2**

**Scenario**

The six messages on an answering machine were each left by one of Fleure, Greta, Hildy, Liam, Pasquale, or Theodore, consistent with the following:

**Rules**

1) At most one person left more than one message.
2) No person left more than three messages.
3) If the first message is Hildy’s, the last is Pasquale’s.
4) If Greta left any message, Fleure and Pasquale did also.
5) If Fleure left any message, Pasquale and Theodore did also, all of Pasquale’s preceding any of Theodore’s.
6) If Pasquale left any message, Hildy and Liam did also, all of Hildy’s preceding any of Liam’s.

**Questions**

1) Which one of the following could be a complete and accurate list of the messages left on the answering machine, from first to last?

   (A) Fleure’s, Pasquale’s, Theodore’s, Hildy’s, Pasquale’s, Liam’s
   (B) Greta’s, Pasquale’s, Theodore’s, Theodore’s, Hildy’s, Liam’s
   (C) Hildy’s, Hildy’s, Hildy’s, Liam’s, Pasquale’s, Theodore’s
   (D) Pasquale’s, Hildy’s, Fleure’s, Liam’s, Theodore’s, Theodore’s
   (E) Pasquale’s, Hildy’s, Theodore’s, Hildy’s, Liam’s, Liam’s

2) The first and last messages on the answering machine could be the first and second messages left by which one of the following?

   (A) Fleure
   (B) Hildy
   (C) Liam
   (D) Pasquale
   (E) Theodore

3) If Greta left the fifth message, then which one of the following messages CANNOT have been left by Theodore?

   (A) the first message
   (B) the second message
   (C) the third message
   (D) the fourth message
   (E) the sixth message
4) Each of the following must be true EXCEPT:

   (A) Liam left at least one message
   (B) Theodore left at least one message
   (C) Hildy left at least one message
   (D) Exactly one person left at least two messages
   (E) At least four people left messages

5) If the only message Pasquale left is the fifth message, then which one of the following could be true?

   (A) Hildy left the first message
   (B) Theodore left exactly two messages
   (C) Liam left exactly two messages
   (D) Liam left the second message
   (E) Fleure left the third and fourth messages
Combination Game 2 - Diagram for Solution

Step 1 - list the objects and the blank configuration

\[ \text{F G H L P T} \]

Step 2 - translate the scenario and rules to shorthand notation

1 ≤ persons with multiple msg

\[ \text{F G H L P T} \]

\[ \begin{array}{cccccc}
1 & 2 & 3 & 4 & 5 & 6 \\
\end{array} \]

H1 → P6  
G → F  
F → P < T  
P6 → H1  
G → P  
P → H < L

Step 3 - add any obvious derived rules

\[ \begin{align*}
F & \rightarrow G \\
P & \rightarrow G \\
P \times T & \rightarrow F \\
H \times L & \rightarrow F \\
G & \rightarrow P < T \\
P & \rightarrow H < L \\
\end{align*} \]

at least 4 left messages

Step 4 - check answers against diagram, add new rule if question introduces it
Combination Game 2 - Analysis

1) Answer is (D)

We can eliminate (A) because since F left a message, all of P's messages should be before T's message. We eliminate (B) since G left a message and yet F did not. (C) is false since when H is first, P must be last. (E) can be eliminated since both H and L have left more than one message.

2) Answer is (A)

B) must be false, since H first means that P must be last. (C) is invalid since we know P left a message, and so all of H's messages must come before L's message. To eliminate (D) and (E), we need to notice that the question states that the last message left was some person's second message. (ie – not their third). Looking at (D) we see that if P is first and last, then T left a message before P's second message and so F must not have left a message. It follows that G didn't leave a message either and we are down to just 4 people: H, L, P, and T, but to have six messages from 4 people, the person with multiple messages must have left 3 messages. This is why it was important to notice that P left his second message last (and didn't leave a third). (E) is similar. If T left his first message first and his second message last, then there is a message from P after T's first message. This means there is no message from F and also no message from G which again leaves us with only 4 people, none of whom left 3 messages so the math doesn’t add up to six.

3) Answer is (A)

G in 5th place means that all of P’s messages should be before any of T’s messages, and so T cannot have left the first message.

4) Answer is (D)

It is possible that each person left exactly one message, and so no one left two messages. Thus (D) need not be true.

5) Answer is (C)

(A) is false since if P didn’t leave the last message, then H didn’t leave the first message. (B) can be eliminated since if T leaves two messages, then at least one of these was left before P left the 5th message, which means that F didn’t leave a message and neither did G. Once again we are down to 4 people – one of whom must have left three messages. (D) is false since L cannot have left the second message as it would force H to have left the first message, but we already know (from (A)) that H didn’t leave the first message. (E) can be ruled out since T would have to have left the 6th message, but now H and L must have
left the first two messages (H the second and L the first, since we know H didn’t leave the first one), but if L is before H then P didn’t leave a message which leads to a contradiction.
Combination Game 3

Scenario

A child eating alphabet soup notices that the only letters left in her bowl are one each of these six letters: T, U, W, X, Y, and Z. She plays a game with the remaining letters, eating them in the next three spoonfuls in accord with certain rules. Each of the six letters must be in exactly one of the next three spoonfuls, and each of the spoonfuls must have at least one and at most three of the letters. In addition, she obeys the following restrictions:

Rules

1) The U is in a later spoonful than the T.
2) The U is not in a later spoonful than the X.
3) The Y is in a later spoonful than the W.
4) The U is in the same spoonful as either the Y or the Z, but not both.

Questions

1) Which of the following could be an accurate list of the spoonfuls and the letters in each of them?

   (A) first: Y
       second: T, W
       third: U, X, Z
   (B) first: T, W
       second: U, X, Y
       third: Z
   (C) first: T
       second: U, Z
       third: W, X, Z
   (D) first: T, U, Z
       second: W
       third: X, Y
   (E) first: W
       second: T, X, Z
       third: U, Y

2) If Y is the only letter in one of the spoonfuls, then which one of the following could be true?

   (A) The Y is in the first spoonful.
   (B) The Z is in the first spoonful.
   (C) The T is in the second spoonful.
(D) The X is in the second spoonful.
(E) The W is in the third spoonful.

3) If the Z is in the first spoonful, then which of the following must be true?

(A) The T is in the second spoonful.
(B) The U is in the third spoonful.
(C) The W is in the first spoonful.
(D) The W is in the second spoonful.
(E) The X is in the third spoonful.

4) Which one of the following is a complete list of letters, any one of which could be the only letter in the first spoonful?

(A) T
(B) T, W
(C) T, X
(D) T, W, Z
(E) T, X, W, Z

5) If the T is in the second spoonful, then which one of the following could be true?

(A) Exactly two letters are in the first spoonful.
(B) Exactly three letters are in the first spoonful.
(C) Exactly three letters are in the second spoonful.
(D) Exactly one letter is in the third spoonful.
(E) Exactly two letters are in the third spoonful.
Combination Game 3 - Diagram for Solution

Step 1 - list the objects and the blank configuration

T, U, W, X, Y, Z

Step 2 - translate the scenario and rules to shorthand notation

W < Y
T < U
U ≤ X

UY or UZ but UYZ

Step 3 - add any obvious derived rules

Step 4 - check answers against diagram, add new rule if question introduces it
Combination Game 3 - Analysis

Note that “later” means not in the same spoonful.

1) Answer is (B)

Checking the rules, T and U cannot be in the same spoonful, so (D) is out. U cannot be later than X, so (E) is out. Y must be later than W, so (A) is out. W and Y cannot be in the same spoonful so (C) is out, leaving (B).

2) Answer is (D)

Y can never be in the first spoonful, since W is ahead of it, so (A) is out. Since Y is alone, Z must always be with U. But U can never be in the first spoonful because T must precede it, so (B) is out. Looking at available configurations, T always appears in the first spoonful, so (C) is out. W can never be in the third spoonful, because it precedes Y. (D) is the only viable choice.

3) Answer is (E)

If Z is in the first spoonful, then, since U must go with either Z or Y and U must go after T, it follows that U cannot be in the first spoonful. Also, we now know that U and Y are in the same spoonful. There are two possible cases: (I) spoon 1: Z, W, and T; spoon 2: U, Y; spoon 3: X or (ii) spoon 1: Z; spoon 3: U, Y, and X, and T or W in spoon 1 or spoon 2. The common thread is that X is in spoon 3, which is (E).

4) Answer is (D)

What is asked for is a list of letters that could be alone in the first spoonful. From the previous question, we know Z is certainly one of them. His eliminates (A), (B), and (C).

5) Answer is (A)

If T is in spoon 2, then U is in spoon 3, since it has to come after T. This forces X into spoon 3, since it cannot be eaten before U. We can now see that spoon 3 contains either U, X, and Y or U, X, and Z. (D) and (E) are both out because there must be three letters in the third spoonful. (B) and (C) are out, because there cannot be two spoonfuls with three letters in each. (A) is the only consistent choice.
Combination Game 4

Scenario

On a Tuesday, an accountant has exactly seven bills - numbered 1 through 7 - to pay by Thursday of the same week. The accountant will pay each bill only once according to the following rules:

Rules

1) Either three or four of the seven bills must be paid on Wednesday, the rest on Thursday.
2) Bill 1 cannot be paid on the same day as bill 5.
3) Bill 2 must be paid on Thursday.
4) Bill 4 must be paid on the same day as bill 7.
5) If bill 6 is paid on Wednesday, bill 7 must be paid on Thursday.

Questions

1) If exactly four bills are paid on Wednesday, then those four bills could be
   (A) 1, 3, 4, and 6
   (B) 1, 3, 5, and 6
   (C) 2, 4, 5, and 7
   (D) 3, 4, 5, and 7
   (E) 3, 4, 6, and 7

2) Which one of the following is a complete and accurate list of the bills any one of which could be among the bills paid on Wednesday?
   (A) 3, 5, and 6
   (B) 1, 3, 4, 6, and 7
   (C) 1, 3, 4, 5, 6, and 7
   (D) 2, 3, 4, 5, 6, and 7
   (E) 1, 2, 3, 4, 5, 6, and 7

3) If bill 2 and bill 6 are paid on different days from each other, which one of the following must be true?
   (A) Exactly three bills are paid on Wednesday.
   (B) Exactly three bills are paid on Thursday.
   (C) Bill 1 is paid on the same day as bill 4.
   (D) Bill 2 is paid on the same day as bill 3.
   (E) Bill 5 is paid on the same day as bill 7.
4) If bill 6 is paid on Wednesday, which one of the following bills must also be paid on Wednesday?

(A) 1  
(B) 3  
(C) 4  
(D) 5  
(E) 7

5) If bill 4 is paid on Thursday, which one of the following is a pair of bills that could also be paid on Thursday?

(A) 1 and 5  
(B) 1 and 7  
(C) 3 and 5  
(D) 3 and 6  
(E) 6 and 7

6) Which one of the following statements must be true?

(A) If bill 2 is paid on Thursday, bill 3 is paid on Wednesday.  
(B) If bill 4 is paid on Thursday, bill 1 is paid on Wednesday.  
(C) If bill 4 is paid on Thursday, bill 3 is paid on Wednesday.  
(D) If bill 6 is paid on Thursday, bill 3 is also paid on Thursday.  
(E) If bill 6 is paid on Thursday, bill 4 is also paid on Thursday.
Combination Game 4 - Diagram for Solution

Step 1 - list the objects and the blank configuration

1 2 3 4 5 6 7

Wed    Thu

Step 2 - translate the scenario and rules to shorthand notation

3/4 or 4/3 split

or

6 W → 7 T

Wed    Thu

Step 3 - add any obvious derived rules

(none)

Step 4 - check answers against diagram, add new rule if question introduces it
Combination Game 4 - Analysis

1) Answer is (D)

Checking the rules, bill 1 and bill 5 cannot be paid on the same day, so (B) and (E) are out. (C) is out because bill 2 must be paid on Thursday. (A) is out because bill 4 and bill 7 are to paid on the same day. This leaves (D).

2) Answer is (C)

Bill 2 has to paid on Thursday, but (D) and (E) both have it being paid on Wednesday. From the preceding question, bills 4 and 7 could have been among those paid on Wednesday, but in the current question, (A) rules this out, so (A) has to go. Likewise, choice (B) doesn’t allow for bill 5 to be paid on Wednesday, so it must be incorrect. By elimination, (C) is left.

3) Answer is (A)

Bill 2 must be paid on Thursday, so by the new local rule, bill 6 must be paid on Wednesday. That forces bill 7 to be paid on Thursday and in turn that implies bill 4 is also paid on Thursday. We are left with bills 1 and 5, which cannot be paid on the same day, so it is either 1 on Wednesday and 5 on Thursday or vice versa. In either case, we would have exactly three bills paid on Wednesday, which is choice (A).

4) Answer is (B)

The logic for the preceding question shows that bill 3 has to be paid on Wednesday. Notice that while the local rule in question 3 is not repeated verbatim in this question, the action of the local rule for question 4 still has the same effect in distributing bills between the two days.

5) Answer is (B)

Since bill 4 is paid on Thursday according to the local rule, then bill 7 is also paid on Thursday. Bill 2 is always paid on Thursday. One or the other of bills 1 and 5 must be paid on Thursday. This makes four bills paid on Thursday, so three are paid on Wednesday. Bill 6 can’t be paid Thursday - too many bills - so (D) and (E) are out. Bill 3 can’t be paid on Thursday for the same reason, so (C) is out. (A) is out immediately by the global rule that they can’t be on the same day, so (B) is correct.
6) Answer is (C)

We can recycle the argument in the last three questions one more time. Bill 4 on Thursday forces bill 3 on Wednesday.
Miscellaneous Game 1

Scenario

Each nonstop flight offered by Zephyr Airlines departs from one and arrives at another of five cities: Honolulu, Montreal, Philadelphia, Toronto, and Vancouver. Any two cities are said to be connected with each other if Zephyr offers nonstop flights between them. Each city is connected with at least one other city. The following conditions govern Zephyr’s nonstop flights:

Rules

1) Montreal is connected with exactly one other city.
2) Honolulu is not connected with Toronto.
3) Any city that is connected with Honolulu is also connected with Toronto.
4) If Philadelphia is connected with Toronto, then Philadelphia is not connected with Vancouver.

Questions

1) Which one of the following could be a complete and accurate list of Zephyr Airlines’ connected cities?

(A) Honolulu and Vancouver; Montreal and Toronto; Philadelphia and Vancouver; Toronto and Vancouver
(B) Honolulu and Vancouver; Montreal and Philadelphia; Montreal and Toronto; Philadelphia and Toronto; Toronto and Vancouver
(C) Honolulu and Philadelphia; Montreal and Toronto; Philadelphia and Toronto; Philadelphia and Vancouver; Toronto and Vancouver
(D) Honolulu and Philadelphia; Montreal and Toronto; Philadelphia and Toronto; Philadelphia and Vancouver; Toronto and Vancouver
(E) Honolulu and Philadelphia; Honolulu and Toronto; Montreal and Philadelphia; Philadelphia and Vancouver

2) If exactly three cities are each connected with Philadelphia, then which one of the following could be a pair of connected cities?

(A) Honolulu and Montreal
(B) Honolulu and Vancouver
(C) Montreal and Toronto
(D) Montreal and Vancouver
(E) Philadelphia and Vancouver
3) Which of the following is a pair of cities that CANNOT be connected?

   (A) Honolulu and Montreal
   (B) Honolulu and Philadelphia
   (C) Montreal and Philadelphia
   (D) Montreal and Vancouver
   (E) Philadelphia and Toronto

4) Which of the following could be true?

   (A) Montreal and Philadelphia are connected with each other, but neither is connected with any other city.
   (B) Montreal and Toronto are connected with each other, but neither is connected with any other city.
   (C) Philadelphia and Toronto are connected with each other, but neither is connected with any other city.
   (D) Philadelphia and Vancouver are connected with each other, but neither is connected with any other city.
   (E) Toronto and Vancouver are connected with each other, but neither is connected with any other city.

5) If Toronto is the only city that is connected with Philadelphia, then which one of the following could be true?

   (A) Exactly one city is connected with Toronto.
   (B) Exactly one city is connected with Vancouver.
   (C) Exactly two cities are connected with Honolulu.
   (D) Exactly two cities are connected with Toronto.
   (E) Exactly four cities are each connected with Toronto.

6) At most how many pairs of cities could be connected?

   (A) four
   (B) five
   (C) six
   (D) seven
   (E) eight

7) If four of the cities are each connected to the remaining city, then the cities in which one of the following pairs must be connected with each other?

   (A) Honolulu and Montreal
   (B) Honolulu and Philadelphia
   (C) Honolulu and Vancouver
   (D) Montreal and Philadelphia
   (E) Montreal and Toronto
Miscellaneous Game 1 - Diagram for Solution

Step 1 - list the variables and draw a base configuration, if possible

Step 2 - translate the scenario and rules to shorthand notation

Step 3 - add any obvious derived rules

Step 4 - check answers against diagram, add new rule if question introduces it

Q4 only:

Q5 only:
Miscellaneous Game 1 - Analysis

1) Answer is (A)

We can eliminate (B) since M can only be connected to one other city. (C) is invalid since H and M connected means that T and M should also be connected. We can rule out (D) since if P and T are connected, then P and V are not. Finally, (E) is false since H and T cannot be connected.

2) Answer is (B)

Since P can only be connected to exactly one of T and V (not both), we know that P must be connected to M, H, and only one of T and V. This means that we can rule out (A), (C) and (D). (Note – we could also rule out (A) since H and M can never be connected.) We can narrow down the situation further by noticing that since P is connected to H, P must be connected to T, so P and V are not connected and we can rule out (E).

3) Answer is (A)

We noticed this in the beginning. Since M can only be connected to one city, that city cannot be H.

4) Answer is (A)

We can eliminate (B), (C), (D) and (E) since H would be unconnected. (At least one city must be connected to H and that city must also be connected to T). However, it is easier to construct a valid diagram for option (A) to show that (A) could be true. (See diagram).

5) Answer is (D)

V must be connected to H since neither T nor M can be and we are told P is only connected to T. It follows that V is connected to T. (Any city connected to H must also be connected to T.) We know from the beginning that H and T are not connected, so T is connected to at least two cities, and M can be connected to either T or V without violating any rules. Since this is a “could be true” problem, we see that (D) could be true.

6) Answer is (B)

Connections that we can never have: H-T, H-M, Both of: P-T and P-V. We have three options: Connect P & T (and not P & V). It follows that H can be connected to both P and V (and so V must also be connected to T). M also has one connection making a total of five connections. Connect P & V (and not P and T). V must be connected to both H and T in order for those two cities to be connected to somewhere else. We know P and H cannot be connected since anywhere connected to H must also be connected to T, and P and T are not connected in this situation. M also has one connection making a total of four connections. Connect neither P & T nor P & V. This means that P cannot be connected to H either. H could be connected to V, and V to T, and M to P. This
leaves a total of 3 pairs.

7) Answer is (C)

We know the city connected to four of the others cannot be M (since M is only connected to one other), neither H nor T (since H is not connected to T), nor P (since P cannot be connected to both T and V). This leaves V which must be connected to all of the remaining four cities, in particular H.
**Miscellaneous Game 2**

**Scenario**

The population of a small country is organized into five clans - N, O, P, S, and T. Each year exactly three of the five clans participate in the annual harvest ceremonies. The rules specifying the order of participation of the clans in the ceremonies are as follows:

**Rules**

1) Each clan must participate at least once in any two consecutive years.
2) No clan participates for three consecutive years.
3) Participation takes place in cycles, with each cycle ending when each of the five clans has participated three times. Only then does a new cycle begin.
4) No clan participates more than three times within any cycle.

**Questions**

1) If the clans participating in the first year of a given cycle are N, O, and P, which one of the following could be the clans participating in the second year of that cycle?

   (A) N, O, S  
   (B) N, O, T  
   (C) N, P, S  
   (D) O, P, T  
   (E) O, S, T

2) Which one of the following can be true about the clans’ participation in the ceremonies?

   (A) N participates in the first, second, and third years.
   (B) N participates in the second, third, and fourth years.
   (C) Both O and S participate in the first and third years.
   (D) Both N and S participate in the first, third, and fifth years.
   (E) Both S and T participate in the second, third, and fifth years.

3) Any cycle for the clans participation in the ceremonies must be completed at the end of exactly how many years?

   (A) five  
   (B) six  
   (C) seven  
   (D) eight  
   (E) nine
4) Which one of the following must be true about the three clans that participate in the ceremonies the first year?

(A) At most two of them participate together in the third year.
(B) At least two of them participate together in the second year.
(C) All three of them participate together in the fourth year.
(D) All three of them participate together in the fifth year.
(E) None of them participates in the third year.

5) If, in a particular cycle, N, O, and S participate in the ceremonies in the first year, which one of the following must be true?

(A) N participates in the second and third years.
(B) O participates in the third and fourth years.
(C) N and O both participate in the third year.
(D) P and T both participate in the fifth year.
(E) S and T both participate in the fifth year.

6) If, in a particular cycle, N, O, and T participate in the first year and if O and P participate in the fourth year, any of the following could be a clan that participates in the third year except:

(A) N
(B) O
(C) P
(D) S
(E) T

7) If, in a particular cycle, N, O, and S participate in the ceremonies in the first year and O, S, and T participate in the third year, then which one of the following could be the clans that participate in the fifth year?

(A) N, O, P
(B) N, O, S
(C) N, P, S
(D) O, P, S
(E) P, S, T
Miscellaneous Game 2 - Diagram for Solution

Step 1 - list the levels and what objects are to be ordered in each level

\[ N, O, P, S, T \text{ - clans} \]

\[
\begin{array}{cccc}
\boxed{} & \boxed{} & \boxed{} & \boxed{} \\
\end{array}
\]

\[ 3 \text{ clans/yr} \]

\[ 5 \text{ yrs/cycle} \]

Step 2 - translate the scenario and rules to shorthand notation

- hard to encode rules -

Step 3 - add any obvious derived rules

Q2 only:

D: \[
\begin{array}{cccc}
\boxed{} & \boxed{} & \boxed{} & \boxed{} \\
N & O & P & T \\
\end{array}
\]

E: \[
\begin{array}{cccc}
\boxed{} & \boxed{} & \boxed{} & \boxed{} \\
N & O & P & T \\
\end{array}
\]

neither works

Step 4 - check answers against diagram, add new rule if question introduces it
**Miscellaneous Game 2 - Analysis**

1) Answer is (E)

S and T must participate in year 2, since they did not participate in year 1.

2) Answer is (C)

(A) and (B) are false since a clan cannot participate for 3 consecutive years. We can eliminate (D) since if N and S participate in years 1, 3, and 5, then we know that O, P, and T must participate in the in-between years (years 2 and 4). However, one of either O, P, or T must join N and S in years 1, 3, and 5, but this forces one of them to participate in three consecutive years (years 2, 3, and 4). To eliminate (E) we see that if S and T participate in years 2, 3, and 5, then neither can participate in years 1 or 4 (because no clan can participate three years in a row, nor more than 3 times per cycle). This means that N, O, and P must participate in years 1 and 4. The problem arises when no clan can take off for more than one year. (We are told that each clan must participate at least once during every two consecutive years). But we see that one of N, O, or P will not participate again until year 4 since there is only one slot left in years 2 and 3.

3) Answer is (A)

We derived this rule based on the original rule where each clan participates exactly 3 times per cycle.

4) Answer is (A)

(A) must be true since one of the three that participate in year 1, must also participate in year 2 with the other two clans that didn’t participate in year 1. This clan cannot participate in year 3 as well, since no clan can participate for three consecutive years. This leaves at most two of the original three that participated in year 1, to participate together in year 3.

But we could also have ruled out (B) and (E) right away: (B) is false, since only one of them will also participate in year 2 because the two that don’t participate in year 1 must participate in year 2. (E) is false since one of them must participate in the third year since there is only a total of 5 and at least 3 must participate every year.

5) Answer is (D)

Since we know that P and T must participate in the second year, they must also participate two more times each within the five year cycle. They will participate once again on either year 3 or year 4 (but not both since they cannot participate three years in a row), and their third participation will be in year 5.
6) Answer is (C)

P and S must participate in year 2 (since they don’t participate in year 1), and we are told that O and P participate in year 4, this means that P cannot also participate in year 3 or else this would violate the 3 in a row rule.

7) Answer is (E)

We know that N, P and T must participate in the second year. (P and T since they didn’t participate in the first year, and N since both O and S are participating in years 1 and 3 and can’t participate three years in a row.) This leaves one N, one O, one T, one S and two P’s to participate in years 4 and 5 (to ensure that each clan participates 3 times in the cycle). It follows that P must participate in both years 4 and 5, and T must participate in year 5 (since T is already participating in years 2 and 3 and cannot participate three years in a row). The only answer choice that has both P and T participating in year 5 is (E).
TIPS & TACTICS

BUBBLE SHEET BINGO

• You are not penalized for guessing, so don’t leave any row on the answer bubble sheet unmarked. Budget thirty seconds at the end of the exam to make sure this doesn’t happen. Bear in mind that if you are sure of only a third of your answers and you guess on two thirds, statistically, you should get about half right overall, and this would put you at a 150 for the LSAT if your performance on the other sections was comparable.

• Questions that seem to require that you check every one of the five answer choices in a process of elimination are designed to waste your time. If you have to guess, guess C, D, or E. Statistically, they are slightly more likely to be the correct choices for questions of this nature. You can see why.

• If you can eliminate any of the answer choices, your odds of guessing correctly improve. If you are stuck on a question but have ruled out some answers, put a tiny “X” below any answer bubble you know is incorrect and move on. If you have time at the end, you can return to either nail the answer or make an informed guess. Make sure to erase the x’s.

• Stay aware of time, but don’t be obsessed with it. Your average response time for any question should be about ninety seconds if you are going to attempt every question. Don’t lock up on a question...three minutes tops, then force yourself to move on.

• If you go into the exam with the plan of writing off what appears to be the most difficult game, your time budget per question goes to two minutes. Of course you would still bubble answers for the difficult game, but they would be last second guesses.
DECIDING WHERE TO START

- Classify the four games. Almost always, the high difficulty game will be a combination (order and grouping elements together) or miscellaneous game. That is because there are more things to coordinate in a combo game and usually less familiarity with miscellaneous game types. Rarely do the test makers NOT include a straight linear game, and most often they give you a linear and grouping game. Find them and start with them.

- The usual number of overall questions is twenty-four. Typically, the test makers give you a five question game, two six question games, and a seven question game. This is not guaranteed...but we have studied the last sixty exams and this is a noticeable trend. Absorbing and understanding the scenario and rules requires a time investment, and (provided it is not the killer game) it is most efficient to tackle the seven question game first.

- Look for time or relative importance words like “first” and “last” or “before” and “after” to indicate that a game is based on ordering or sequencing. Sometimes the test makers try to hide the nature of a game, and sometimes they are completely open about it. The former are usually simpler games and the latter are usually more complex and require more extensive rules.

- Grouping games are characterized by rules that say what can go with what. They are conspicuously lacking in statements that require some sort of ordering or sequencing. If you see language that refers to both grouping and ordering, then you have a hybrid or combination game.

- Matching type games are just grouping games where each variable is assigned to a category or group all by itself.

DIAGRAMS

- Don’t try to wing it without some kind of basic diagram.

- Write small and write fast. The only scratch paper you have is the question sheet itself. The game scenario, rules, and questions always appear together only on one page. Keep all diagrams for a specific game
on the sheet which presents that game.

• Horizontal seems to work better than vertical in diagramming games.

• The test makers pay attention to how much diagramming space you may need. If there is little space, it is because they don’t feel an elaborate diagram is called for. If there is a lot of space, that is a clue that the game may be diagram intensive.

• Try to get your base diagram with all the global rules in one easily readable place.

• Try not to clutter your base diagram with speculative drawings that refer to specific questions or use a local rule. A quick re-do of the primary features of your basic drawing will do as a starting point for these situations.

• Notation is personal...do what works for you.

• If you need to make your own abbreviations, make sure you don’t accidentally add or omit a letter just because there appears to be a natural order. The test makers will introduce Al, Bob, Charlie, and Ed expecting you to abbreviate them as A, B, C, D, and E. There is no D.

• The test makers come up with strange names from time to time, so the best thing to do is reduce everything to single letter abbreviations at the first opportunity.

• If you have two types of objects that you need to keep track of, use upper case for one and lower case for the other. Try to resist writing things out. These are just “notes to self” that have to be relevant for ten minutes tops.

• Don’t forget to make all the obvious deductions from the basic rules as given. At the very least, write down the contrapositives of every conditional rule. If sequential order is involved, string together, if appropriate, any statements of what comes before what.
THE QUESTIONS

• The first question is almost always an “acceptability” question that asks if a configuration of variables is consistent with the rules. Generally, it is the easiest question, although some work is required to answer it. You can usually answer acceptance questions by checking them against the basic global rules without making any further deductions. An efficient way to do this is to take each rule in the order given and see how it affects the five answer choices. Most commonly, one rule will disqualify several answers at once.

• Don’t forget that the scenario part of the game statement may contain an implied rule by limiting the number of objects or requiring all objects to be used in some configuration...that sort of thing.

• Scan all the questions in a game before you begin. It may happen that the statement of a later question provides a hint at the answer to an earlier question. This typically happens with the second or third question presenting an “if such and such is true”. If no local rules have been introduced, whatever this question says is true must carry back to the acceptance question. That may eliminate some answer choices right out of the box. There also may be a glaringly obvious “silver bullet” type of question where you see immediately what must be true from a single rule.

• Earlier answers may make later questions easier as well. A “could be true” type of question, if you can find a configuration that could, in fact, be true, may allow you to instantly answer subsequent questions that ask for specifics like “which pair could be together”, or “which object could go first”.

• For “could be true” type questions, start with what must be true. Usually, the variables that appear multiple times in the rules are the most constrained...you have limited options where to place them or group them. These form the backbone of what must be true. The variables that are lightly constrained or even not at all are “floaters”. You have
flexibility in placing or grouping them, and they round out the “could be true” configurations. Don’t be put off by the fact that there may be several acceptable variable configurations and that you cannot narrow them down to just one. What is important on the “could be true” questions is that just a single one of the configurations presented as an answer choice is valid. That may be the best you can do, but it is enough to determine the answer.

• Unless a “CANNOT be true” question is immediately obvious...the silver bullet...skip over it and do any “could be true” questions first. An allowed configuration for a “could be true” may immediately rule out several answer choices for a “CANNOT be true”.

• If you see a lot of “must be true/false” type questions, that is an indication that a lot of secondary deductions can be made so that the possible variable configurations are very limited in number. Try to squeeze as much juice out of the rules as you can before attempting the questions.

HANDY DEDUCTIONS

• In a sequencing game...linear or multilevel linear...when one variable must appear before another, the first variable can never be the absolute last in a sequence, and the second variable can never be the absolute first. There would be no position available for the other variable. This is a principle that the test makers use repeatedly. If one variable has to be two positions ahead of another, then the limitations on where each can appear are even more stringent.

• In sequencing games, try to deduce as many relative positions as you can, even if you cannot initially tie any variables to absolute positions. Rules that state “A is before B” and “B is before C” allow you to immediately conclude that “A is before C” even if you are not sure where they all belong in the overall sequence. Once you locate one variable absolutely, the rest click into place, more or less.

• Remember, if you have a sequencing game that features mornings and afternoons of days in sequence, one variable can be before another by
either being on an earlier day, or by being earlier in a given day.

- In sequencing games that have a break in consecutive positions, watch out for rules that are stated definitely in terms of consecutive positions. For example, if B has to follow A on consecutive days, and the only days available are Monday, Tuesday, and Thursday, then the only possibility is that A happens on Monday and B happens on Tuesday.

- In multilevel linear games watch for a hard link or tie-in between one sequence and another. This will be a key to useful secondary rules (deductions) because the preceding principle will operate on both sequence levels at once.

- Don’t forget that basic arithmetic is behind many games. For example, if three variables have to fill five positions and each variable must appear at least once, then you can immediately say that either one variable will appear three times or two will appear twice.

- Even if it may seem premature, write down the contrapositive form of every “if-then” statement given in the rules. You are, in effect, doubling the number of rules of that type, and contrary to what first may seem desirable, more rules means fewer possible configurations allowed and therefore a greater degree of certainty.

- Watch for statements in games that are “loophole closers”. These are words or phrases like “exactly” or “one each” or “at most two” that act to sharpen or remove the ambiguity of the rules. These often contribute significantly to the strength of the deductions you can make from the basic global rules. Anything that reduces the number of allowable variable configurations is a good thing.
Here are four garden variety logic games culled from past examinations. Although they did not appear together in a single test, they are representative of a complete logic games section for a typical LSAT. Try to simulate real world conditions and attempt them all within a 35 minute total allotted time. The answers follow the games, but don’t peek.

You should have a good level of confidence in dealing with these games now. No one says you have to do the games in the order given, and no one says you have to do the questions for an individual game in the order given. It often makes sense, however, to do the latter, since later questions may be made easier by earlier answers. But for the games themselves, it is typical for the test makers to plant a particularly difficult game somewhere in the mix. Finding it and saving it for last is something you will want to do. Look all the games over and start with the one that your gut tells you is going to be the least trouble for you. This will conserve time and boost your confidence in dealing with the rest. Good luck on this...and especially good luck on your real exam.
SECTION IV
Time—35 minutes
23 Questions

Directions: Each group of questions in this section is based on a set of conditions. In answering some of the questions, it may be useful to draw a rough diagram. Choose the response that most accurately and completely answers each question and blacken the corresponding space on your answer sheet.

Questions 1–6

A fruit stand carries at least one kind of the following kinds of fruit: figs, kiwis, oranges, pears, tangerines, and watermelons. The stand does not carry any other kind of fruit. The selection of fruits the stand carries is consistent with the following conditions:

If the stand carries kiwis, then it does not carry pears.
If the stand does not carry tangerines, then it carries kiwis.
If the stand carries oranges, then it carries both pears and watermelons.
If the stand carries watermelons, then it carries figs or tangerines or both.

1. Which one of the following could be a complete and accurate list of the kinds of fruit the stand carries?
   (A) oranges, pears
   (B) pears, tangerines
   (C) oranges, pears, watermelons
   (D) oranges, tangerines, watermelons
   (E) kiwis, oranges, pears, watermelons

2. Which one of the following could be the only kind of fruit the stand carries?
   (A) figs
   (B) oranges
   (C) pears
   (D) tangerines
   (E) watermelons

3. Which one of the following CANNOT be a complete and accurate list of the kinds of fruit the stand carries?
   (A) kiwis, tangerines
   (B) tangerines, watermelons
   (C) figs, kiwis, watermelons
   (D) oranges, pears, tangerines, watermelons
   (E) figs, kiwis, oranges, pears, watermelons

4. If the stand carries no watermelons, then which one of the following must be true?
   (A) The stand carries kiwis.
   (B) The stand carries at least two kinds of fruit.
   (C) The stand carries at most three kinds of fruit.
   (D) The stand carries neither oranges nor pears.
   (E) The stand carries neither oranges nor kiwis.

5. If the stand carries watermelons, then which one of the following must be false?
   (A) The stand does not carry figs.
   (B) The stand does not carry tangerines.
   (C) The stand does not carry pears.
   (D) The stand carries pears but not oranges.
   (E) The stand carries pears but not tangerines.

6. If the condition that if the fruit stand does not carry tangerines then it does carry kiwis is suspended, and all other conditions remain in effect, then which one of the following CANNOT be a complete and accurate list of the kinds of fruit the stand carries?
   (A) pears
   (B) figs, pears
   (C) oranges, pears, watermelons
   (D) figs, pears, watermelons
   (E) figs, oranges, pears, watermelons

GO ON TO THE NEXT PAGE.
Questions 7–11

Four people—Grace, Heather, Josh, and Maria—will help each other move exactly three pieces of furniture—a recliner, a sofa, and a table. Each piece of furniture will be moved by exactly two of the people, and each person will help move at least one of the pieces of furniture, subject to the following constraints:

Grace helps move the sofa if, but only if, Heather helps move the recliner.
If Josh helps move the table, then Maria helps move the recliner.
No piece of furniture is moved by Grace and Josh together.

7. Which one of the following could be an accurate matching of each piece of furniture to the two people who help each other move it?
   (A) recliner: Grace and Maria; sofa: Heather and Josh; table: Grace and Heather
   (B) recliner: Grace and Maria; sofa: Heather and Maria; table: Grace and Josh
   (C) recliner: Heather and Josh; sofa: Grace and Heather; table: Josh and Maria
   (D) recliner: Heather and Josh; sofa: Heather and Maria; table: Grace and Maria
   (E) recliner: Josh and Maria; sofa: Grace and Heather; table: Grace and Maria

8. If Josh and Maria help each other move the recliner, then which one of the following must be true?
   (A) Heather helps move the sofa.
   (B) Josh helps move the sofa.
   (C) Maria helps move the sofa.
   (D) Grace helps move the table.
   (E) Heather helps move the table.

9. If Heather helps move each of the pieces of furniture, then which one of the following could be true?
   (A) Grace helps move the recliner.
   (B) Maria helps move the recliner.
   (C) Josh helps move the sofa.
   (D) Maria helps move the sofa.
   (E) Grace helps move the table.

10. Which one of the following could be a pair of people who help each other move both the recliner and the table?
    (A) Grace and Josh
    (B) Grace and Maria
    (C) Heather and Josh
    (D) Heather and Maria
    (E) Josh and Maria

11. If Josh and Maria help each other move the sofa, then which one of the following could be true?
    (A) Heather and Josh help each other move the recliner.
    (B) Heather and Maria help each other move the recliner.
    (C) Grace and Josh help each other move the table.
    (D) Grace and Maria help each other move the table.
    (E) Heather and Maria help each other move the table.

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SECTION II
Time—35 minutes
24 Questions

Directions: Each group of questions in this section is based on a set of conditions. In answering some of the questions, it may be useful to draw a rough diagram. Choose the response that most accurately and completely answers each question and blacken the corresponding space on your answer sheet.

Questions 1–7

A car drives into the center ring of a circus and exactly eight clowns—Q, R, S, T, V, W, Y, and Z—get out of the car, one clown at a time. The order in which the clowns get out of the car is consistent with the following conditions:

V gets out at some time before both Y and Q.
Q gets out at some time after Z.
T gets out at some time before V but at some time after R.
S gets out at some time after V.
R gets out at some time before W.

1. Which one of the following could be the order, from first to last, in which the clowns get out of the car?
   (A) T, Z, V, R, W, Y, S, Q
   (B) Z, R, W, Q, T, V, Y, S
   (C) R, W, T, V, Q, Z, S, Y
   (D) Z, W, R, T, V, Y, Q, S
   (E) R, W, T, V, Z, S, Y, Q

2. Which one of the following could be true?
   (A) Y is the second clown to get out of the car.
   (B) R is the third clown to get out of the car.
   (C) Q is the fourth clown to get out of the car.
   (D) S is the fifth clown to get out of the car.
   (E) V is the sixth clown to get out of the car.

3. If Z is the seventh clown to get out of the car, then which one of the following could be true?
   (A) R is the second clown to get out of the car.
   (B) T is the fourth clown to get out of the car.
   (C) W is the fifth clown to get out of the car.
   (D) V is the sixth clown to get out of the car.
   (E) Y is the eighth clown to get out of the car.

4. If T is the fourth clown to get out of the car, then which one of the following must be true?
   (A) R is the first clown to get out of the car.
   (B) Z is the second clown to get out of the car.
   (C) W is the third clown to get out of the car.
   (D) V is the fifth clown to get out of the car.
   (E) Y is the seventh clown to get out of the car.

5. If Q is the fifth clown to get out of the car, then each of the following could be true EXCEPT:
   (A) Z is the first clown to get out of the car.
   (B) T is the second clown to get out of the car.
   (C) V is the third clown to get out of the car.
   (D) W is the fourth clown to get out of the car.
   (E) Y is the sixth clown to get out of the car.

6. If R is the second clown to get out of the car, which one of the following must be true?
   (A) S gets out of the car at some time before T does.
   (B) T gets out of the car at some time before W does.
   (C) W gets out of the car at some time before V does.
   (D) Y gets out of the car at some time before Q does.
   (E) Z gets out of the car at some time before W does.

7. If V gets out of the car at some time before Z does, then which one of the following could be true?
   (A) R is the second clown to get out of the car.
   (B) T is the fourth clown to get out of the car.
   (C) Q is the fourth clown to get out of the car.
   (D) V is the fifth clown to get out of the car.
   (E) Z is the sixth clown to get out of the car.

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Questions 20–24

Exactly six piano classes are given sequentially on Monday: two with more than one student and four with exactly one student. Exactly four females—Gimena, Holly, Iyanna, and Kate—and five males—Leung, Nate, Oscar, Pedro, and Saul—attend these classes. Each student attends exactly one class. The following must obtain:

Iyanna and Leung together constitute one class. Pedro and exactly two others together constitute one class. Kate is the first female, but not the first student, to attend a class. Gimena’s class is at some time after Iyanna’s but at some time before Pedro’s. Oscar’s class is at some time after Gimena’s.

20. Which one of the following students could attend the first class?
   (A) Holly
   (B) Leung
   (C) Oscar
   (D) Pedro
   (E) Saul

21. Which one of the following is a complete and accurate list of classes any one of which could be the class Gimena attends?
   (A) the fourth, the fifth
   (B) the fourth, the sixth
   (C) the second, the fourth, the fifth
   (D) the third, the fifth, the sixth
   (E) the second, the third, the fourth

22. Which one of the following pairs of students could be in the class with Pedro?
   (A) Gimena and Holly
   (B) Holly and Saul
   (C) Kate and Nate
   (D) Leung and Oscar
   (E) Nate and Saul

23. If Oscar and Pedro do not attend the same class as each other, then which one of the following could be true?
   (A) Gimena attends the fifth class.
   (B) Holly attends the third class.
   (C) Iyanna attends the fourth class.
   (D) Nate attends the fifth class.
   (E) Saul attends the second class.

24. Suppose the condition that Oscar attends a class after Gimena is replaced with the condition that Oscar attends a class before Gimena and after Kate. If all the other conditions remain the same, then which class must Holly attend?
   (A) the second
   (B) the third
   (C) the fourth
   (D) the fifth
   (E) the sixth

STOP

IF YOU FINISH BEFORE TIME IS CALLED, YOU MAY CHECK YOUR WORK ON THIS SECTION ONLY. DO NOT WORK ON ANY OTHER SECTION IN THE TEST.
Answers to Practice Test

Game 1  B, D, E, C, E, C

Game 2  A, D, B, B, E

Game 3  E, D, C, D, D, E, E

Game 4  E, A, B, D, E