

QUANT

Logical Puzzles

eBook

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Chapter 1: Analytical Reasoning

In Analytical Reasoning every question is based on a set of conditions or passage given. They begin with a setup, followed by clues and the rules of the questions which cannot be violated. Sometimes a question may provide an additional clue for that particular question but it doesn't break the original rule. These questions also happen to be the most speed-sensitive questions on the test.

Importance in Written Tests

This section tries to test following aspects in a candidate:

- 1) Analytical abilities
- 2) Methodology adopted to tackle problems
- 3) Speed with which data is organized in mind or paper

Types of Analytical Sets

There are four basic types usually asked:

- Maps
- Conditional Sets
- Assignment Games
- Math Type Games

1.1 Maps

In these sets, a connection between given element is described - along with directionality at times. Let us look at the examples given below.

Example 1:

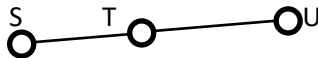
An island has exactly seven villages – S, T, U, V, X, Y, and Z – and three roads – Routes 1, Route 2, and Route 3. The following is a complete listing of the road connections on the island:

- Route 1 has its ends at S and U and passes through T only.
- Route 2 has its ends at T and U and passes through V only
- Route 3 has its ends at X and Z and passes through Y only.
- Directly connected villages are those villages between which there is a road connection that passes through no other village on the way from one to the other.

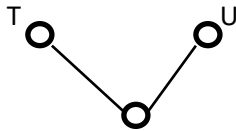
1. Which one of the following villages are directly connected to the most other villages?
 - A. T
 - B. U

- C. V
- D. X
- E. Y

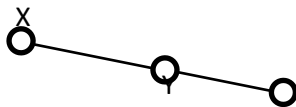
As with most problems involving spatial relationships, this question can be answered with the aid of a simple map. Route 1 can be sketched out as follows, based on the information that it “has its ends at S and U, and passes through T only”:



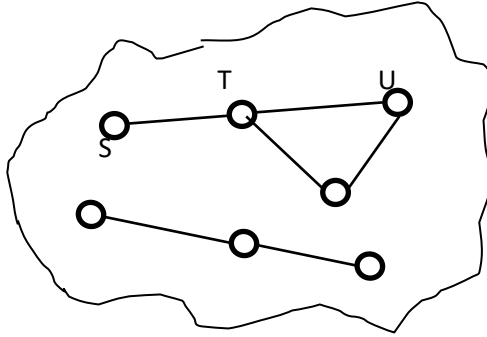
Route 2 is defined by the information that it “has its ends at T and U, and passes through V only”:



Route 3 can be drawn from the condition that it has its ends at X and Z, and passes through Y only:



Combining the sketches of the three roads, a completed map of the island might look like this:



Looking at the map, we can see that village T is directly connected to three other villages, the most of any village, and that (1) is therefore the correct response. U, V, and Y are each directly connected to two other villages, and S, X, and Z are each directly connected to only one other village.

1.2 Conditional Sets

Clues given in such problems are all conditional ("if...then") in nature.

Example 2

A medical clinic has a staff of five doctors—Drs. Albert, Burns, Calogero, Defeo, and Evans. The national medical society sponsors exactly five conferences, which the clinic's doctors attend, subject to the following constraints:

- If Dr. Albert attends a conference, then Dr. Defeo does not attend it.
 - If Dr. Burns attends a conference, then either Dr. Calogero or Dr. Defeo, but not both, attends it.
 - If Dr. Calogero attends a conference, then Dr. Evans does not attend it.
 - If Dr. Evans attends a conference, then either Dr. Albert or Dr. Burns, but not both, attends it.
2. If Dr. Burns attends one of the conferences, then which one of the following could be a complete and accurate list of the other members of the clinic who also attend that conference?
- A. Dr. Albert and Defeo
 - B. Dr. Albert and Evans
 - C. Drs. Calogero and Defeo
 - D. Dr. Defeo

Explanation:

This question requires you to determine, from the conditions given, which doctors can attend the same conferences. The question tells us that “Doctor Burns attends one of the conferences,” and we are asked to

choose the response that could be a list of all and only those doctors who attend the conference with Dr. Burns.

Since we are asked what could be a “complete and accurate list” of those doctors who attend the conference with Dr. Burns, we can eliminate as incorrect those responses which either are inaccurate (that is, cannot be true), or incomplete (that is, do not include everyone who must accompany one or more of the doctors going to the conference). This can be determined easily without the use of a diagram.

Response (1) states that, along with Dr. Burns, Drs. Albert and Defeo also attend the conference. But the first condition tells us that “if Dr. Albert attends a conference, then Dr. Defeo does not attend it.” So, Drs. Burns, Albert, and Defeo cannot all attend the same conference. Response (1), then, is incorrect.

Response (2) is incorrect for a similar reason. The fourth condition tells us what must be true if Dr. Evans attends a conference, namely, that “either Dr. Albert or Dr. Burns, but not both, attends it.” Since we know that Dr. Burns attends the conference, we know that it cannot be true that both Drs. Albert and Evans also attend that conference.

Response (3) is also incorrect. The second condition tells us what must be true if Dr. Burns attends a conference. Since we know that Dr. Burns does attend the conference,

we also know that “either Dr. Calogero or Dr. Defeo, but not both, attends it.”

Responses (4) must be evaluated slightly differently. No condition rules out Dr. Burns’s and Dr. Defeo’s going to the same conference—response (4)—and no condition forbids Dr. Evans’s going with Dr. Burns to a conference. But recall that the question asks for what could be a “complete and accurate list” of the doctors who attend the conference with Dr. Burns. We know from the second condition that at least one other person must accompany Dr. Burns, and that among those who accompany Dr. Burns are either Dr. Calogero or else Dr. Defeo. Since the conditions do not require anyone to accompany Dr. Defeo, it is possible that Dr. Defeo is the only person to accompany Dr. Burns. Thus, response (4) is an accurate response, in that it is possible that Drs. Burns and Defeo attend the same conference, and it is a complete response, in that Drs. Burns and Defeo could be the only doctors of the five to attend the conference. So response (4) is correct.

Example 3

From a group of seven people—J, K, L, M, N, P, and Q—exactly four will be selected to attend a diplomat’s retirement dinner. Selection conforms to the following conditions:

- Either J or K must be selected, but J and K cannot both be selected.
- Either N or P must be selected, but N and P cannot both be selected.
- N cannot be selected unless L is selected.
- Q cannot be selected unless K is selected.

3. If P is not selected to attend the retirement dinner, then exactly how many different groups of four are there each of which would be an acceptable selection?

- A. One
- C. Three

- B. Two
- D. Four

Explanation:

This question essentially adds a new assumption to the original set of conditions—"P is not selected to attend the retirement dinner." The test taker is supposed to determine all of the different possible selections that are compatible with this new assumption. A compatible solution is one that violates neither the new assumption nor the original conditions.

Since the second condition states "either N or P must be selected ...," we can infer from the new assumption and the second condition that N is selected. And since N is selected, we know from the third condition that L is selected. In other words every acceptable selection must

include both L and N. We are now in a good position to enumerate the groups of four which would be acceptable selections. Notice that K may or may not be selected. We need to examine what happens in either case. First, assume that K is not selected. In this case, J is selected (since the first condition indicates that one of J or K must be selected) and Q is not selected (since the fourth condition implies that if K is not selected, then Q cannot be selected either). Since exactly four people must be selected, and since P, K, and Q are not selected, M, the only remaining person, must be selected. Since M's selection does not violate any of the conditions or the new assumption, N, L, J, and M is an acceptable selection; in fact, it is the only acceptable selection when K is not selected. So far we have one acceptable selection, but we must now examine what holds in the case where K is selected.

Suppose that K is selected. In this case J is not selected (as one can see by the first condition), but Q may or may not be selected. Again we look at both possibilities.

If Q is selected, it is part of an acceptable selection—N, L, K, and Q. If Q is not selected, remembering that J and P are also not selected, M must be selected. This gives us our final acceptable selection—N, L, K, and M.

Thus there are exactly three different groups of four which make up acceptable selections, and (3) is the correct response.

4. There is only one acceptable group of four that can be selected to attend the retirement dinner if which one of the following pairs of people is selected?

A. J and L
C. L and N

B. K and M
D. M and Q

Explanation:

The way in which this question is phrased is rather complex, and so it is important to get very clear what exactly is being asked. Unlike other questions which give the test taker a new assumption to consider in conjunction with the original conditions, this question asks the test taker to determine what assumption is needed, in addition to the original conditions, to guarantee that only one group of four is acceptable. There is probably no better way to approach this question than to consider each option individually, and determine for each option whether only one acceptable group of four can be selected when the pair indicated in the option is selected. The test taker may wish to vary the order in which the options are considered according to personal

preferences. We will consider the options in order from (1) through to (4).

Option (1): When both J and L are selected, K cannot be selected (first condition). Consequently Q cannot be selected (fourth condition). More than one group of four is acceptable under these circumstances however. J, L, M, and N may be selected, and J, L, M, and P may be selected.

Option (2): When K and M are both selected, J cannot be selected (first condition). Other than that, anyone else could be selected. This leaves more than one acceptable group of four. K, L, M, and N may be selected; K, L, M, and P may be selected; and K, M, P, and Q may be selected.

Option (3): When L and N are both selected, P cannot be selected (second condition), but, as in the case of option (2), anyone else can be selected. This leaves more than one acceptable group of four. J, L, M, and N may be selected; K, L, M, and N may be selected; and K, L, N, and Q may be selected.

Option (4): When M and Q are both selected, K must be selected (fourth condition), and hence J cannot be selected (first condition). Furthermore, N cannot be selected: if N were selected, then L would also have to be

selected (third condition), and this would violate the restriction that exactly four people are to be selected. And since N cannot be selected, P must be selected (second condition). Thus when M and Q are both selected, both K and P must be selected as well, and only one group of four—K, M, P, and Q—is acceptable. (4) is, therefore, the correct response.

1.3 Assignment Sets – 3D Grid

Example 4

Seven piano students—T, U, V, W, X, Y, and Z—are to give a recital, and their instructor is deciding the order in which they will perform. Each student will play exactly one piece, a piano solo. In deciding the order of performance, the instructor must observe the following restrictions:

- X cannot play first or second.
- W cannot play until X has played.
- Neither T nor Y can play seventh.
- Either Y or Z must play immediately after W plays.
- V must play either immediately after or immediately before U plays.

5. If V plays first, which one of the following must be true?

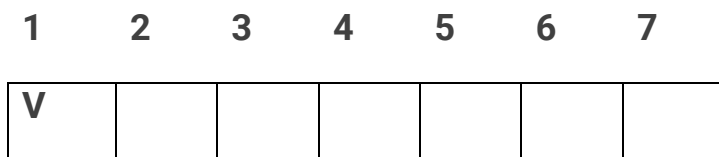
- A. T plays sixth.
- C. Z plays seventh.

- B. X plays third.
- D. T plays immediately after Y.

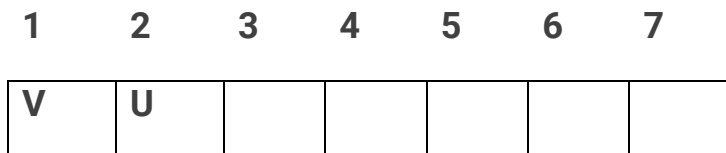
Explanation:

This question deals with an ordering relationship defined by a set of conditions as to when the seven piano students will perform. As an aid in visualizing this problem we can draw a simple diagram that shows the seven recital slots arranged in order from left to right.

Student V is shown in the first slot, as specified by the condition that “V plays first”:



We can immediately fill in one of the empty slots in the diagram. The condition that “V must play either immediately after or immediately before U plays” tells us that U must occupy the second slot in the recital schedule. This is shown below:



Since the question asks us what must be true, we can eliminate incorrect responses by showing that they could be false without violating the conditions. Response (1) is incorrect because the statement that “T plays sixth” is not necessarily true—we can place T in one of the slots other than sixth and still meet all the conditions of the problem. One such recital schedule, with T playing third, is shown in the diagram below:

1	2	3	4	5	6	7
V	U	T	X	W	Y	Z

We can develop this schedule as follows. With V, U, and T in the first three positions, there are four positions left for W, X, Y, and Z.

W must come after X—because of the condition that “W cannot play until X has played”—so if we put X fourth and W fifth, this condition will be met.

This leaves two possible slots for Y and Z. Y cannot play seventh because of the condition that “Neither T nor Y can play seventh,” so we will place Y sixth and Z seventh.

A check will verify that this schedule meets the given conditions of the problem, including the one that “Either Y or Z must play immediately after W plays.”

The schedule shown in the diagram also demonstrates that response (2) is incorrect. In it, X plays fourth, so it is not correct that the statement, “X plays third,” must be true.

Response (3), “Z plays seventh,” is the credited response. We can show this by demonstrating that: all the conditions can be met with Z in the seventh slot, and some of the conditions would be violated with Z in any slot other than seventh.

To demonstrate that Z can play seventh, we can refer to the schedule that was developed for the discussion of response (1), above. In it, Z plays seventh, and all the conditions in the problem are met.

To demonstrate that Z cannot play in a slot other than seventh, we can attempt to find another student to play seventh. We already know that neither U nor V can play seventh. Hence, there are four remaining players: T, W, X, and Y. However, a review of the given conditions shows that none of those players can play seventh:

The third condition states that “Neither T nor Y can play seventh.” W can’t play seventh, because there must be a slot following W’s in order to meet the condition, “Either Y or Z must play immediately after W plays.” If W plays seventh, then there is no such slot left for Y or Z.

For a similar reason X can’t play seventh, because there must be a slot following X’s in order to meet the condition, “W cannot play until X has played.”

Since Z can play seventh and no other player can, then the statement that Z must play seventh is correct and (3) is the credited response.

Response (4) is incorrect because it is not necessarily true that “T plays immediately after Y.” In our discussion of response (1), we developed a schedule in which T plays third and Y plays sixth, yet all conditions are satisfied.

A review will show that all of the given conditions are met by this schedule.

1	2	3	4	5	6	7
V	U	T	X	Y	W	Z

6. If U plays third, what is the latest position in which Y can play?

- A. first B. second
C. Fifth D. sixth

Explanation:

This question involves the same original conditions as the previous problem, but it begins with a different assumption: “U plays third.” The test taker must determine what effect this assumption would have on the possible positions in which Y can appear in the recital schedule.

The correct response is (4), because student Y can play as late as sixth under the given constraint that “U plays third.” The diagram below shows a recital order that meets all the given conditions and has Y performing in the sixth position.

1	2	3	4	5	6	7
T	V	U	X	W	Y	Z

One strategy for arriving at this solution is to work backward to see which position is the latest in which we can place Y and at the same time produce a recital schedule that meets all the given conditions.

Using that approach, we immediately see that Y cannot play as late as seventh, because of the condition that

“Neither T nor Y can play seventh.” Backing up and placing Y sixth, we can begin to fill in the schedule, as follows:

1	2	3	4	5	6	7
		U			Y	

This schedule has five empty slots, into which we must fit players T, V, W, X, and Z. The following is a series of reasoning steps that can be used:

From our analysis of the previous question, we know that players T, W, and X cannot play seventh, but that Z can, so we can tentatively place Z in the seventh slot.

We also know that “Either Y or Z must play immediately after W plays.” If we place W in the fifth slot, this condition will be met.

By placing V in the second slot, we can meet the condition that “V must play either immediately after or immediately before U plays.”

We must place the remaining two players, T and X, in the two remaining slots, the first and the fourth. Because the first condition states that “X cannot play first ..,” we will place X in the fourth slot and T in the first. These positions will meet the conditions that apply to T and X:

T will avoid playing seventh and X will play before W. Since Y can play as late as sixth, response (4) is the correct solution.

Chapter 2: Strategy for Analytical Questions

1. Get an overview: Read carefully the introduction and rules, to establish the cast of characters, the action and the number limit governing the problem.
2. Visualize and map out the problem: Make a mental picture of the problem and let it guide you to as you create a sketch or some other kind of scratch works if need to help you to keep track of rules and handle new information.
3. Consider the rules individually: After you've thought through the meaning and implication of each rule, you have three choices:
 - a) Build it directly into a sketch of your problem situation.
 - b) Jot down the rule in shorthand form to help you remember it.
 - c) Underline or circle those rules, which don't lend themselves to the first two techniques.
4. Combine the rules: Look for common elements among the rules; that's what will lead you to make deductions. Treat these deductions as additional rules, good for the whole exercise.

5. Work on the questions systematically: Read the question stem carefully! Take special notice of such words as must, could, cannot, not, impossible and except. As always, use the hypothetical information offered in if-clauses to set off a chain of deductions.

Things to Master

1. Spend more time thinking through and analyzing the setup and the rules. It saves time in the long run.
2. Understand what a rule means, not just what it says. You got to know the rules of logic set cold-what they mean, how they impact other rules, what implications they have in the context of that scenario.
3. Use scratch work and shorthand to make a visual representation of a mental thought process.
4. Trial and error with answer choices can also be practised, as it is much quicker to follow a chain of deduction until it leads you to the answer.

Chapter 3: Solved Examples

Directions for Set 1: *Study the given information carefully and answer the questions that follow:*

- (i) There are six friends A, B, C, D, E and F.
- (ii) Each one is proficient in one of the games, namely Badminton, Volleyball, Cricket, Hockey, Tennis and Polo.
- (iii) Each of the six friends owns a car of a different colour, those being red, yellow, blue, green, white and black.
- (iv) D plays Polo and owns a yellow coloured car.
- (v) C does not play either Tennis or Hockey and owns neither blue nor yellow coloured car.
- (vi) E owns a white car and plays Badminton.
- (vii) B does not play Tennis, he owns a red coloured car.
- (viii) A plays cricket and owns a black car.

1. Who plays Volleyball?

A. B

B. C

C. F

D Data inadequate

2. Which colored car F owns?

A. Green

B. Blue

C. White

D. Either green or blue.

3. Which of the following combinations of the colour of car and game played is not correct.

A. Yellow – Polo

B. Green – Tennis

C. Black – Cricket

D. Red – Hockey

Solution: This question is of arrangement type, where we have to arrange the given information in the form of a table or a linear arrangement. As in this question, there are two variables corresponding to each of the six persons, we will make a table.

First of all, make a 3×6 table and write down the information in the table which is directly given in the question.

Name	Game	Car Colour
A	Cricket	Black
B		Red
C		
D	Polo	Yellow
E	Badminton	White
F	Cricket	Black

Now we will think about the remaining information. As it is given that B and C does not play tennis, So F will play tennis. Also among the remaining two games Hockey and Volleyball, C does not play Hockey, so he plays Volleyball and B plays Hockey. Also, we are left with Blue and Green colour and it is given that C does not own blue colour car, so he owns Green coloured car and F owns Blue coloured car.

So the final table will be as follows:

Name	Game	Car Colour
A	Cricket	Black
B	Hockey	Red
C	Volleyball	Green
D	Polo	Yellow
E	Badminton	White

F	Tennis	Blue
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Now the above three questions can be solved directly from the above table.

Directions for Set 2: *Study the given information carefully and answer the questions that follow:*

- (a) There are five friends.
- (b) They are standing in a row facing south.
- (c) Jayesh is to the immediate right of Alok.
- (d) Parmodh is between Bhagat and Subodh.
- (e) Subodh is between Jayesh and Pramod.

1. Who is at the extreme left end?

- A. Alok B. Bhagat
- C. Subodh D. None of these

2. Who is in the middle?

- A. Bhagat B. Jayesh
- C. Pramodh D. Subodh

Solution: In this question, we have to arrange the persons in a line. In such questions, the first thing to check is the direction to which they are facing. From the first statement, we can write the arrangement Jayesh Alok.

Condition (d) says that Bhagat/ Parmodh/ Subodh or Subodh/Parmodh/Bhagat. If we combine statements (d) with (e) we get the arrangement as Bhagat/ Parmodh/Subodh/Jayesh/Alok. From this arrangement, we can solve the questions.

Sometimes questions are based on certain conditions. In these questions, the information cannot be arranged in the form of tables or linearly as done in the previous examples. Such questions will be solved by checking individual conditions given in the question. Each question in such a block will be considered as an individual question independent of others unless stated in a question that you can take the help from the previous question.

Directions for Set 3: *Study the information given below carefully and answer the questions that follow:*

Madhu and Shobha excel in Computer science and Dramatics. Madhu and Anjali excel in physics and Computer science. Poonam, Anjali and Nisha excel in history and Physics. Nisha and Anjali excel in Mathematics and Physics. While Shobha and Poonam excel in Dramatics and History.

1. Who is does well in computer science, History and
dramatics?
A. Anjali
C. Shobha
B. Madhu
D. Nisha
2. Who does well in History, Physics, Computer
science and Mathematics?
A. Nisha
C. Madhu
B. Poonam
D. Anjali
3. Who does well in physics, History and Dramatics?
A. Anjali
C. Madhu
B. Poonam
D. None of these
4. Who does well in Physics, History and Mathematics
but not in Computer Science?
A. Anjali
C. Nisha
B. Madhu
D. Poonam
5. Who does well in Physics, Dramatics and Computer
science?
A. Shobha
C. Anjali
B. Poonam
D. Madhu

Solution: You need to make the table in the following manner and then the answers can be marked quickly.

	Dramatics	Computer	Physics	History	Math
Madhu	✓	✓	✓		
Shobha	✓	✓		✓	
Anjali		✓	✓	✓	✓
Poonam	✓		✓	✓	
Nisha			✓	✓	✓

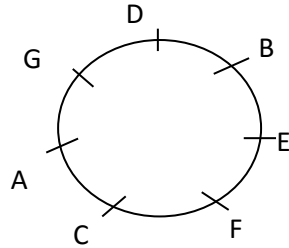
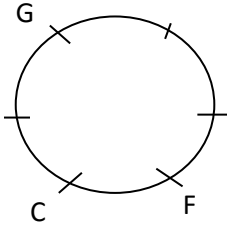
Directions for Set 4: Read the following information carefully and answer the questions given below:

1. A, B, C, D, E, F and G are sitting around a circle and are facing the centre.
 2. G is second to the left of C, who is to the immediate left of F.
 3. A is third to the left of E.
 4. B is between D and E.
1. Which of the following is false?
- A. A is fourth to the right of E.
- B. G is to the immediate right of D.

- C.F is third to the right of D.
- D.B is to the immediate left of D.

2. Which of the following is true?
- A. C is fourth to the left of B.
 - B. A is to the immediate right of G.
 - C. D is second to the left of E.
 - D. B is second to the right of G.
 - E. None of these
3. Which of the following pairs has the first person sitting to the immediate left of the second person?
- A. BE B. CA C. GD D. DG
4. Which of the following has the middle person sitting between the remaining two?
- A. FCE B. EFB C. DEB D. GDA
5. Which of the following is the position of F?
- A. Fourth to the right of D
 - B. To the immediate left of C.
 - C. Between A and E
 - D. To the immediate right of A
 - E. None of these

Solution: We, first of all, mark the seven blank positions around a circle. Now G is second to the left of C and C is



to the immediate left of F. We mark their positions as shown.

Also, B is between D and E. Thus, D, B, E sit together and occupy the three consecutive blank positions. Now, only one position remains blank between G and C, and this must be occupied by A. Now, D, B, E, may sit in any of the positions (D, B, E) or (E, B, D). But A is third to the left of E only when they sit in the order (D, B, E). Thus we mark their positions as shown.