TATA McGRAW HILL'S WE SERIES

How to Prepare *for*

Logical Reasoning *for the* CAT

COMMON ADMISSION TEST

Arun Sharma

McGRAW HILL EDUCATION WINNING WE EDGE SERIES

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Preface

As a trainer and an author of various books on aptitude, I have always noticed the lack of a quality resource for students trying to develop their skills in solving reasoning questions. Students preparing for the CAT and other aptitude tests usually struggle for appropriate study material and advisory resources when it comes to preparing for this all important area of the examination.

THE CRUCIAL ROLE OF LOGICAL REASONING IN THE CAT

Logical Reasoning has always been an integral part of the CAT and indeed of all other MBA entrance examinations. However, ever since the CAT went online in 2009, the emphasis of the exam on Logical Reasoning questions has drastically increased. The following table would show you how the CAT has moved on to an exam with greater role in Logical Reasoning.

This shift can be gauged from the following table which shows the number of Logical Reasoning questions in the three-section format of the CAT (where Data Interpretation and Logical Reasoning formed one of the three sections):

Year	Number of Sets in Logical Reasoning	Number of Questions in Logical Reasoning (out of the total DI & Logical Reasoning section)
2006	1	5/25
2007	0	0/25
2008	1	3/25
2009 & 2010	3–4	6–7/20

The increased emphasis can be further gauged from the following:

In the exams before 2009, in order to qualify you typically needed to solve anywhere between 10 to 12 questions correct out of 25—which in effect meant that the key qualifying factor for the section was essentially the Data Interpretation questions.

In the online CATs of 2009 and 2010, the number of questions one needed to solve in order to qualify the DI & LR section was around 12–14 out of 20, which naturally made Logical Reasoning an important component of your process of qualification for this section.

Importance of Logical Reasoning in the two-section CAT:

From the year 2011 onwards, the CAT has shifted to the two-section format namely:

(i) Quantitative Aptitude and Data Interpretation comprising 30 questions

(ii) Verbal Ability and Logical Reasoning comprising 30 questions

In my view, this has significantly increased the strategic importance of Logical Reasoning in cracking the CAT. The reasons for this view point are not hard to trace. Consider the following:

(i) Out of 30 questions in the Verbal Ability and Logical Reasoning section, typically every test paper has around 20 questions on Verbal Ability/Reading Comprehension and 10 questions on Logical Reasoning.

(ii) An aspirant needs to attempt around 18+ questions all correct to score a 99+ percentile. At the same time, at an accuracy level of around 90%, (which has been seen to be the normal level for good students) he/she needs to attempt around 22-24 questions.

(iii) Given the fact that all questions in Verbal Ability/ Reading Comprehension would not be attemptable, it naturally means that Logical Reasoning becomes a critical component in order to crack one of the two sections in the exam.

This can be further looked at in two ways:

(a) For the student who is weak at solving Verbal Ability/ Reading Comprehension questions.

If you were to look at it from another angle, suppose one is able to solve all 10 questions on Logical Reasoning correctly (which I may add here, is not very difficult to achieve) the consequence would be that the pressure would be off when you come around to solving the Verbal Ability/ Reading Comprehension questions in the section. Out of 20 questions in these, you would need to be able to solve only 8–10 all correct and you would be heading to a pretty strong score.

Naturally, this would allow you to be stress free during the exam and help you achieve better scores in this section.

(b) For the student who is good at solving Verbal Ability/ Reading Comprehension questions.

Let's assume you are able to solve around 15 questions, with a maximum of one error out of the 20 questions from these areas. In such a case, you would need to be able to 'attack' the logical reasoning questions in order to maximise your scores in this section.

Another aspect to be noted is that the questions on Logical Reasoning included in all the papers of the online CAT have been pretty complex with conditions which needed a lot of thinking to be matched in the correct places. Moreover, each set typically contained a maximum of two questions and a lot of sets had only one question in them. Thus, working on your reasoning solving skills becomes a key imperative if you are a serious CAT aspirant.

THE CRUCIAL ROLE OF REASONING IN OTHER MBA EXAMS AND OTHER PARALLEL APTITUDE EXAMS

Reasoning also forms one of the main parts of parallel MBA entrance examinations like

(i) XAT—where there are two full sections where there is a role for Reasoning namely:
   (a) A section on Analytical Reasoning and Decision Making &
   (b) A section called Verbal Ability and Logical Reasoning.

(ii) SNAP—which has one full section of 25 to 30 questions regularly titled as 'Analytical and Logical Reasoning'

(iii) IIFT—which has one section dedicated to Reasoning and contains around 20 to 25 questions on an average.

(iv) IRMA—which again has one full section of around 40 questions based entirely on reasoning titled 'Analytical Reasoning'.

(v) CET Maharashtra—has close to 75 to 80 questions (out of 200 in the entire paper) which are solely dedicated to reasoning.

Besides, all other competitive aptitude exams like the Civil Services Aptitude test (CSAT), Bank PO Exams, etc. have a fair abundance of reasoning questions.

Thus, even if you are a CAT aspirant who is also aiming for some or all of these other exams, you would ignore reasoning preparation at your own peril.

THE SKILLS DEVELOPMENT APPROACH TO REASONING

Unlike proper theory-oriented subjects, like physics, biology or mathematics where a substantial part of your preparation would involve studying the theory of the subject

before moving to its applications, Reasoning is largely an experientially learnt subject, i.e. a subject learnt largely through experience. Hence, the standard objective while solving a reasoning question has to hover around being able to develop your skills in being able to process and solve reasoning questions.

This entire book tries to help you:

(a) Experience what the different question types on reasoning are all about

(b) Develop the best processes and thinking patterns in order to be able to solve the questions;

(c) Experience enough situations of each question type such you can say with confidence "Now, I can solve any question of this type".

However, I would first like to bring your attention to a very less understood issue about the preparation for the Reasoning section.

The degree of control you have while solving a Reasoning question is a crucial aspect of decision making while attempting Reasoning questions.

My experience and observation of preparation trends and student processes used in solving reasoning questions tell me that most aspirants lose a degree of control they have on a question. Whether a question is within one's grasp and one would be able to solve a question or not, is something that aspirants realise too late into the question. By the time they realise that a question set was not worth investing the time, they would have already invested too much time in a futile attempt to solve the question.

In the question sets that appear as a part of the Reasoning in the CAT and other non-CAT exams, realising early whether a question set is going to get solved by you should be a crucial aspect of your preparation objectives.

Hence, the ability to pinpoint whether you would be able to solve a question set while you are going through it for the first time could be a big differentiator and could go a long way towards improving your test scores.

There are a few concrete steps you can specifically do for Reasoning:

(a) **Work on developing an advanced warning system about the difficulty level of a question.**

The problem that students face in segregating reasoning questions is that since they are all language intensive, they all look the same. This is the reason test-takers face a problem in understanding whether a question set is to be solved or not.

(b) **You would have to use all the information in most reasoning questions that you come across.**

This assumption holds true because redundant data questions are very rarely

found.

(c) **The first thing you should look at in the question is the number of variables involved.**

Typically, more the variables, more difficult the question is likely to be.

Given this, your approach to every reasoning question should be based on a sentence-by-sentence analysis of the question. Look at the clues closely and for each statement you come across, try to see whether it is a direct or an indirect clue. Direct clues would typically give you direct relationships between the variables involved and hence are easy to place (something like, "Amit is wearing the red shirt," is a direct clue).

Indirect clues, on the other hand, are much more difficult to place and have to be used at specific points in solving a problem. (A typical indirect clue would read something like: "The person wearing the blue shirt lives somewhere to the right of the person who hates coffee and he is not Amar")

Naturally, higher the proportion of direct clues, the easier the question would be. On the other hand, if the indirect clues are higher, the question starts becoming more and more difficult to solve and this single fact should go a long way towards helping you distinguish the tough reasoning questions from the easy ones.

THE STRUCTURE AND SALIENT FEATURES FOR THIS BOOK

This book is divided into the following parts:

Part 1: Logical Reasoning

This part is divided into three broad sections:

Section (1) Logical Reasoning: This section starts with an introduction to logical reasoning and then moves on to cover the various question types that one is likely to encounter under Logical Reasoning. These are: Logical Reasoning based on Arrangements, Logical Reasoning based on Rankings, Team Formations, Quantitative Reasoning and Puzzle test.

The objective of this section is to help you understand the various question types that one would typically see under Logical Reasoning—which is the most common question type inside the CAT and is also commonly seen in all other major aptitude exams.

Section (2) Verbal Reasoning: The question types covered under the Verbal Reasoning Section are: Syllogisms; Logical Deductions; Set Theory, Venn Diagrams and Network Diagrams; Binary Logic; Critical Reasoning.

Again, the objective in this section is to help the reader to understand the various

question types that are classified under verbal reasoning (and which are relevant from the CAT view point).

Section (3) Reasoning Exercises based on Level of Difficulty: In this section of the book you would find exercises in increasing level of difficulty starting from LOD 1 to LOD 2 to LOD 3 (where LOD = Level Of Difficulty). These exercises help you put a final stamp on your understanding and ability to solve reasoning questions at varying levels of difficulty.

Part 2: Reasoning Question Types from Other MBA Exams

This part of the book takes you through the reasoning question types that have not been popular in the CAT but have been a constant presence in other MBA entrance exams. However, these have been covered inside this book for two reasons:

(a) With the evolving nature of the CAT, it is a good idea to know what kind of surprise questions can crop up in each

(b) In my experience, I have seen that a lot of people who appear for the CAT also appear for at least one or more of the other MBA entrance exams listed above (if not, also for other parallel aptitude tests like PO, CSAT, GATE, etc). Hence, in order to provide completeness to the resources in the book, I decided to include the following topics too (even though they have been rarely asked in the CAT):

Sequences and series; Blood relations; Direction Test; Statement and Conclusions; Statement and Assumptions; Assertion and Reason; Statement—Courses of Action; Mathematical Operations.

Part 3: Reasoning Archives

Part 3 of this book which is "Reasoning Archives" takes the readers through an entire gamut of experience that the reasoning questions/section has taken aspirants through in the CAT and three other major MBA entrance exams (XAT, IIFT and SNAP). While CAT questions on reasoning are covered from 1999 to 2008, XAT, IIFT and SNAP exams are covered over the last 5 to 6 years. This coverage gives you a feel of the level of difficulty of the reasoning questions asked in each of these exams.

Going through the questions in the archives and the solutions to those questions would help you put a final seal in your quest for mastering the all important reasoning area of your test preparation.

A FINAL WORD

One final thing I would like to tell you about this book before you embark on your

journey for the preparation of reasoning. The solutions contained in this book for the most part give you a step-by-step solution to every question thereby helping you understand exactly what you need to do and how you need to organise your thinking while you are dealing with a reasoning question. I call this step-by-step approach to explaining how to solve a reasoning question as the "REACTION TRACKER". In the easy direct questions, the 'REACTION TRACKER' might just help you get clarity in terms of how you thought and what were the things that you did correct in order to get to the answer of the question. In the slightly more difficult questions, this approach to explaining how a question gets solved would actually help you upgrade your skills in reasoning.

I would encourage you to use the unique 'REACTION TRACKER' approach in this book to solve reasoning problems. All the best for a fruitful learning experience!!

Arun Sharma

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Model Test Paper (Based on the Latest Online Pattern)

Part 1

Reasoning for the CAT

Section 1

Logical Reasoning

- Introduction to Logical Reasoning
- Logical Reasoning Based on Arrangements
- Logical Reasoning Based on Rankings
- Team Formations
- Quantitative Reasoning
- Puzzle Test

1

Important Concepts in Logical Reasoning

OUTLINE

Learning Objectives

- Get acquainted with few thumbrules required to solve logical reasoning questions
- Learn to think in a structured fashion
- Learn to handle complexities involved in problem solving
- Learn to organise information in a pictorial form to clearly conceive the problem

Chapter Highlights

- Logic and Language
- Solved Examples

Ever since the start of time, man has always been surrounded by logic (time and logic seems to have coexisted) — it exists all around us, and is all encompassing. There is implicit logic in all human and natural activity—right from the primary level of logic seen in our day-to-day lives to its very advanced form which operates the machines & tools we use for our day-to-day work. Every subject we study, every product we build, every activity we undertake is guided by its own inherent logic.

For instance, when faced with the situation of starting a car, switching on an electric appliance like an electric bulb, etc. we use logic inherently. In fact, it would be difficult to imagine life today without even a thought on most of the logical structures that we use inherently.

LOGIC AND LANGUAGE

The ancient Greeks were the first to study logic as a subject in depth. The lack of any systematic notation for the process of logic during its initial development led the Greeks to rely extensively on the use of language to explain logic. Each one of us even today instinctively uses language to explain what we are doing. Thus we use logical language in each of the following cases—

1. Where is my key?

Ans: It's on the blue table.

Or

It's in the second shelf from the bottom inside your cupboard.

2. Could you direct me to Mr Mehta's house?

Ans: Proceed straight from here and take the right turn from the second crossing. Move about 100 metres after the right turn and you will reach a 'Y' junction. Take the left leg of the Y and this road leads to a dead end. Mr Mehta lives on the second floor of the second last house on the left of this road.

3. If I put water in a working refrigerator it will become cold.
4. To turn on the car, one needs to switch on the ignition.

Thus, each of us comes across millions of such everyday situations where we use logic inherently as part of our day-to-day language.

The study of logic by the Greeks was largely confined to the study and documentation of logical language. However, the problems of understanding logic through language are very high, since this approach becomes extremely complex and unwieldy the moment the logical string becomes longer. This complexity was the reason that when Aristotle summed up Greek logic in his Treatise on Logic in the 4^{th} century BC, many of the greatest minds were at a loss to understand it.

Symbolic logic

It was only in the late 19^{th} century when Gottlob Frege brought about a revolution in the whole field of reasoning by inventing 'symbolic logic'— the use of symbols to represent ideas; that the next phase of development in logical thought started. With this improvement of notation, logical and mathematical ideas could be precisely written down for perhaps the first time. The inconsistencies and vagueness of language were overcome through the use of symbols to denote logical thoughts. The development of symbolic logic further led to the development of 'logical thinking'.

Consider the statement " If a car has poor air conditioning or low fuel efficiency then it is not a nice car, then the fact that a car is nice means that it will have neither poor air

conditioning nor low fuel efficiency.

This long language string used to express the above logic can be condensed using the following symbols:

P (poor A/C) & L (low fuel efficiency) & N(C) (Nice car).

Thus, if P or L then not N (C) then N (C) means not P or L.

The words OR, NOT & AND all can have their own logical symbols.

Thus OR is 'V', NOT is ~ AND is +.

Thus , the above sentence can be condensed in its logical form as:

(PvL) Æ (~N(C)) Æ N(C) Æ (~P) & (~L).

In fact, to reduce ambiguity, tediousness and complexity of language based interpretation, solving logical problems involves as its first step the interpretation of the language of the question and conversion of the language of the question into symbolic form. Moreover, this also aids in cutting down the time required to solve complex reasoning questions.

Thus, when the language of logic is converted to symbolic form, then the truth of such a sentence depends only on its logical form and not on its content.

Any similar sentence, (using totally different language) which uses the same logical form will be true under the same circumstances. The process of mastering reasoning then has to take as its first step the understanding of the process of conversion of language into symbolic logic. In fact, the process of solving logical problems is greatly eased through the use of symbols to document the language.

Some Standard Symbols that You can Use for Logical Language

NOT	~
OR	v
AND	+
If and Only if	∫
Not, if	π
If, Then	…

Besides, you would do well to keep in mind the following factors while creating a symbolic framework for your question:

- Æ Proper Nouns should always be denoted by capitals.
- Æ In Questions where the sex of the proper noun is crucial to the solving of the question, you can denote the female by underlining the capital letter used.

Æ As you start solving Reasoning Questions, create your own set of symbols for standard relational sentence structures. (*See the highlighted box*):

(1) Is next to

Thus, A is next to B can be: AB v BA

(2) (a) Is to the immediate left of

Thus, A is to the immediate left of B can be: AB

(b) Is to the left of

Thus, A is to the left of B can be: A___B

(3) (a) Are at the ends

Thus A and B are at the ends means:

(A _____ B) v (B _____A)

(b) Is at the extreme left

Thus A is at the extreme left means:

(A_____)

(4) Is more than/taller than/greater than

Thus A is greater than/ taller than/ more than B & C can be symbolically represented by:

A > (B + C) [Note here that we do not know the relationship between B & C]

(5) Is less than/shorter than/lower than

Thus A is less than/shorter than/lower than B & C can be symbolically represented by:

A < (B + C) [Again, note here that we do not know the relationship between B & C]

(6) Is between

Thus, A is between B & C means that A can be anywhere between B & C.

(B___A ___C) v (C___A ___B)

(7) Is the son of

Thus, A is the son of Æ $\frac{B}{A}$

(8) Is the daughter of

Thus, A is the daughter of B Æ $\frac{B}{A}$

(9) Is the Parent of

Thus, A is the parent of B Æ $\begin{matrix} A \\ B \end{matrix}$ v $\frac{A}{B}$

(10) Is the spouse of

Thus, A is the spouse of B Æ A—B v A—B

(11) Is the wife of

Thus, A is the wife of B Æ A—B

(12) Is the sibling of

Thus, A is the sibling of B Æ (A..B) v (*A* .. B) v (A..B) v (A..*B*)

Some Important Logical Manoeuvers:

(1) If, Then

The condition If A, then B leads to the following valid conclusions

Valid Reasoning 1: A therefore B.

Valid Reasoning 2: Not B, therefore not A.

At the same time If A then B also throws up the following invalid conclusions.

Invalid Reasoning 1: B, therefore A.

Invalid Reasoning 2: Not A, therefore not B.

The above structures of logical thought can be illustrated through the following examples:

If A teaches, B will go to the movies.

Valid Reasoning 1: A teaches, therefore B will go to the movies.

Valid Reasoning 2: B has not gone to the movies, therefore A did not teach.

Invalid Reasoning 1: B went to the movies, therefore A must have taught. This is an invalid line of reasoning.

Invalid Reasoning 2: A did not teach, therefore B did not go to the movies. This too is invalid.

(2) If and Only If

The condition If and Only If A, then B leads to the following valid conclusions.

Valid Reasoning 1: A, therefore B.

Valid Reasoning 2: Not B, therefore not A.

Valid Reasoning 3: B therefore A.

Valid Reasoning 4: Not B therefore not A.

The above structures of logical thought can be illustrated through the following examples:

If and only if A teaches, B will go to the movies.

Valid Reasoning 1: A teaches, therefore B will go to the movies.

Valid Reasoning 2: B has not gone to the movies, therefore A did not teach.

Valid Reasoning 3: B went to the movies, therefore A must have taught.

Valid Reasoning 4: A did not teach, therefore B did not go to the movies.

(3) Either Or

Either A or B

Valid Reasoning 1: Not A then B

Valid Reasoning 2: Not B then A

Invalid Reasoning 1: A then Not B

Invalid Reasoning 2: B then Not A

The above structures of logical thought can be illustrated through the following examples:

Either A teaches or B goes to the movies.

Valid Reasoning 1: A does not teach, therefore B will go to the movies.

Valid Reasoning 2: B has not gone to the movies, therefore A must have taught.

Invalid Reasoning 1: A taught, then B did not go to the movies.

Invalid Reasoning 2: B went to the movies, then A did not teach.

(4) If, Then Not

If A then Not B:

Valid Reasoning 1: A then not B

Invalid Reasoning 1: Not B then A

Invalid Reasoning 2: B then Not A

The above structures of logical thought can be illustrated through the following examples:

If A teaches, then B will not go to the movies.

Valid Reasoning 1: A teaches, therefore B will not go to the movies.

Invalid Reasoning 1: B has not gone to the movies, therefore A taught.

Invalid Reasoning 2: B went to the movies, therefore A did not teach.

As a student it is important for you to follow a few standard steps while solving logical questions:

1. Take a complete ‘preview of the situation’ clearly understanding the context.

Remember to accept the situation as it is given.

2. Read each and every part of the question carefully. You should concentrate hard and focus fully while reading the question. This is a very important prerequisite for solving questions on logic since very often in long sentences there will be individual single words which will transform the meaning of the sentences. If you fail to take into account these words, the end result will be errors in logic & deduction.

Let us now proceed to understand how all this applies to real life problem solving through examining questions which have been asked in different competitive exams and CAT.

Example 1 A party is held at the house of the Mehtas. There were five other couples present (besides Mr and Mrs Mehta), and many, but not all, pairs of people shook hands. Nobody shook hands with anyone twice, and nobody shook hands with his/her spouse. Both the host and hostess shook some hands.

At the end of the party, Mr Mehta polls each person present to see how many hands each person (other than himself) shook. Each person gives a different answer. Determine how many hands Mrs Mehta must have shaken.

(Can we prove that it was not Mrs Mehta who shook 10 hands?)

Solution Let there be 5 couples:

A — *A*

B — *B*

C — *C*

D — *D*

E — *E*

& M — *M*

Deduction 1 From the condition that nobody shook hands with his/her spouse, it is clear that none of the twelve people in the party shook more than 10 hands.

(Since, nobody shakes hands with himself or his/her spouse, it leaves a maximum of 10 people to shake hands with).

Deduction 2 Mr Mehta has asked the question to eleven different people and each of them has given a different answer. Also, the highest answer anyone could have possibly given is 10. Hence, the only way to distribute different numbers of hand shakes amongst the 11 people is:

0,1,2,3,4,5,6,7,8,9,10. [*Note*: somebody shook 0 hands and somebody shook 10].

Deduction 3 Since, the host & hostess have both shaken some hands, the person who

shook ‘0’ hands cannot be either M or M. It has to be one of the other 10 people in the party.

[At this point you need to realise that in the context of this problem A,A B,B,C, C, D, D, E & E are alike, i e. there is no logical difference amongst these 10 and you have exactly the same information about each of these 10 people. However, Mrs Mehta is different because she stands out as the hostess as well as the wife of the person who has asked the question].

Since all ten guests are the same, assume ‘A’ shook no hands. This leads us to the following deduction.

Deduction 4 Take any one person apart from A & A; say B. B will not shake hands with himself & his wife. Besides B will also not shake hands with A (who has shaken no hands). Thus, B can shake a maximum of 9 hands and will thus not be the person to shake 10 hands.

What applies to B, applies to B, C, C, D, D, E, E and M.

Hence, A is the only person who could have shaken 10 hands. Hence, amongst the couple A & A, if we suppose that A had shaken 0 hands, then A must have shaken 10 hands.

Note: The main result here is that, out of the people to whom M has asked the question, and amongst whom we have to distribute the numbers 0 to 10 there has to be a couple who has had 0 & 10 handshakes. It could be any of the five couples, but it cannot be M who has either 0 or 10 handshakes.

We now proceed, using the same line of reason as follows.

Deduction 5 Suppose B has 1 handshake — he must have shaken hands with A (who has shaken everybody’s hands she can).

Then, B wouldn’t have shaken hands with anyone out of A, B, C, C, D, D, E, E & M. At this point the following picture emerges:

A	—		A	—	10
B	—	1	B	—	
C	—		C	—	
D	—		D	—	
E			E		
M					

Numbers left to be allocated — 2, 3, 4, 5, 6, 7, 8, 9.

Considering C, as a general case, he cannot shake hands with C, A (Who shook no hands) & B (Who shook hands only with A. This is mandatory since A has shaken hands with 10 people).

Thus, C can shake hands with a maximum of 8 people and this deduction will be true for C, D, D ,E , E & M too. Hence, the only person who could get 9 handshakes is B.

Thus, we conclude that just like 0 and 10 handshakes were in one pair, similarly 1 and 9 handshakes too have to be part of one pair of husband and wife.

Similar deductions, will lead to the realisation that 2 & 8, 3 & 7 and 4 & 6 handshakes will also occur for couples amongst the 11 people questioned.

Hence, M must have shaken 5 hands.

The above question was solved on the basis of a series of deductions, which were based on a series of Logical Form (LF), then logical structures.

Let us consider another example:

Example 2 Consider the following grid:

L		**P**
M	O	Q
N		R

Each letter in the above grid represents a different digit from 0 to 9, such that

L ¥ M ¥ N = M ¥ O ¥ Q = P ¥ Q ¥ R. Find the value of 'O'.

Solution In order to solve such a question, one needs to proceed systematically making one deduction at a time.

Deduction 1 There are seven alphabets and ten digits. We need to somehow eliminate 3 of these 10 to define the 7 digits required to be allocated.

It is obvious, that '0' cannot be used since if we make any alphabet '0' we will end up with a product that '0' in one or a maximum of two of the three cases.

Deduction 2 You need to find a product which can be made in three different ways.

Deduction 3 Two of these three ways have to be independent of each other with no matching digits and the third way has to be drawn out of one digit each from the first two ways and one independent digit that has not been used.

Also, at this point there are 9 digits and 2 more to be eliminated.

Now we move to the process of Trial & Error.

Notes on Interpretation

Trial & Error is one of the most useful processes for solving questions based on reasoning. Principally there are three ways for carrying out trial & error search.

(1) Complete trial & error.

(2) Directed trial & error.

(3) Blind trial & error.

The blind trial and error is what most students practice and hence are unable to solve logical questions. Since they do not use their deductive logic to do a more focused search, they end up going round in circles while trying to solve such questions.

Instead directed trial & error and comprehensive trial & error are superior problem solving processes and therefore score above the complete trial and error method.

Application of Directed Trial & Error The question above is a classical situation warranting a directed trial & error. Hence, this is best illustrated through the example.

At this stage we are at a situation where we know: 1, 2, 3, 4, 5, 6, 7, 8 and 9 have to be allocated to L, M, N, O, P, Q and R.

At this point, take a call as to whether you want to use 9 or not? Nine and 1 are different from the other numbers primarily because they are the highest and lowest numbers respectively and also because 9 gives us "maximum room for manoeuvering" the question as compared to the other numbers, while 1 is a useful tool for a third multiplier if we do not want to change the value of the multiplication.

Note: The student should analogise the thinking process applied here to the thinking process used to unravel a ball of wool which has got entangled.

To disentangle an entangled ball of wool, we need to search the end of the ball. Once you identify either end, the remaining process of disentangling the ball requires very elementary logic coupled with patience and perseverance. The logic for picking up the end point of the ball of wool is that it is different from all other points in the ball.

Similarly, in reasoning questions, we need to identify things/objects/people which are different from other things/objects/ people and start our solution from there.

After that, the whole process becomes one of use of elementary logic for elementary deductions coupled with patience and perseverance.

In the question under consideration, if we take a call on using '9' and decide to do so, we can then deduce that the required product has to be a multiple of 9.

[Remember that at this point of time we have ignored the line of thinking that neglects 9. We will have to consider it, if we do not get an answer by using 9].

Since the product has to be a multiple of 9, assume that the product is 36. But, this product eliminates the use of 8,7 & 5 and leaves only 6 digits. Going below 36 as a product for further trial and error will further reduce the number of possibilities. Hence, let us try to go to the higher extreme & try to experiment with the number 72.

We see that $72 = 3^2 ¥ 2^3$ and can be formed by 9 ¥ 8 ¥ 1 or 6 ¥ 3 ¥ 4 or 9 ¥ 4 ¥ 2.

This satisfies our deduction that 72 gives three ways of solving the question. Also, the

second requirement that there should be two ways which are independent of each other and a third way which uses one term each from the two independent ways and one unique term is also satisfied.

Since 6 ¥ 3 ¥ 4 is independent of 9 ¥ 8 ¥ 1 in all its digits. Also, 9 ¥ 4 ¥ 2 uses the no. 9 from 9 ¥ 8 ¥ 1 & 4 from 6 ¥ 3 ¥ 4.

Hence, the following possibility emerges:

L = 6	P = 8	
M = 4	O = 2	Q = 9
N = 3	R = 1	

You need to understand here that, the digit '2' is the only one which is fixed to its place in the grid. All the other digits can be changed. Thus, we can have alternative arrangements like:

L = 3		P = 1
M = 4	O = 2	Q = 9
N = 6		R = 8
OR		
L = 6		P = 6
M = 9	O = 2	Q = 4
N = 1		R = 3

The only thing that is fixed is the number 2 for O.

Example 3 Let us now consider another question, which is a classic case of complete or comprehensive trial & error method.

Two people A & B are playing a game. Both A & B are logical people. There are two boxes on the table. One of them contains 9 balls, the other contains 4 balls. In this game, the players are supposed to take alternate turns of picking up balls according to the following rules:

(a) Pick up as many balls as you want to from any box.

(b) Pick up an equal number of balls from both boxes.(if you pick from both boxes).

The person who picks up the last ball wins the game. In his/her turn it is mandatory to pick up at least one ball. A has to play first. What should he do to ensure a win?

Solution

Deduction 1 The rules of the game define that there are two legal moves:

Picking up an equal number from each box or picking up any number from either box (at least 1).

Deduction 2 A has 17 possible moves to make and since the question asks for one particular move that will ensure a win, one of these 17 must be the winning move. It is at this stage that you should realise that the question calls for a comprehensive trial & error which should result in the elimination of 16 possibilities.

The starting position is 9, 4.

A's options at the start of the game can be basically divided into three options:

I Pick up balls from the first box.	II Pick up balls from the second box.	III Pick up balls from both the boxes.

The position after A plays his move can be documented as follows (in terms of the number of balls B has in front of him.):

[There are 9 moves in option I.] (Balls from first box are picked by A.) If

(a) A picks up 1 ball, B will be left with 8, 4.
(b) A picks up 2 balls, B will be left with 7, 4
(c) A picks up 3 balls, B will be left with 6, 4
(d) A picks up 4 balls, B will be left with 5, 4
(e) A picks up 5 balls, B will be left with 4, 4
(f) A picks up 6 balls, B will be left with 3, 4
(g) A picks up 7 balls, B will be left with 2, 4
(h) A picks up 8 balls, B will be left with 1, 4
(i) A picks up 9 balls, B will be left with 0, 4

Similarly, if he picks up balls from the second box(option II) he will have an end result of: If

(a) A picks up 1 ball, B will be left with 9, 3
(b) A picks up 2 balls, B will be left with 9, 2
(c) A picks up 3 balls, B will be left with 9, 1
(d) A picks up 4 balls, B will be left with 9, 0

And for option III, If:

(a) A picks up one ball each from both boxes, B is left with 8, 3
(b) A picks up two balls each from both boxes, B is left with 7, 2
(c) A picks up three balls each from both boxes, B is left with 6, 1
(d) A picks up four balls each from both boxes, B is left with 5, 0

Out of these 17 options, the options of leaving (0,4), (9,0) and (5,0) are infeasible since

it will result in an immediate win for B, who can clean up the board in one move. Similarly leaving (4, 4) will also cause an immediate win for B. *This leaves A with 13 options which he needs to consider. These are:*

I	II	III
8, 4	9, 3	8, 3
7, 4	9, 2	7, 2
6, 4	9, 1	6, 1
5, 4		
3, 4		
2, 4		
1, 4		

From these 13, the easiest option to check is 1,4. *If B gets 1,4 he has the following options:*

I	II	III
0, 4	1, 3	0, 3
	1, 2	
	1, 1	
	1, 0	

Obviously, he cannot play (0, 4), (1, 0) , (1, 1) or (0, 3). This means he can leave A with ((1, 2) or (1, 3). These need to be further investigated.

If B leaves (1, 2):

A has the following options to leave for B

I	II	III
0, 2	1, 1	0, 1
	1, 0	

Obviously, if he plays any of this, A will lose. Hence, if B leaves A with (1, 2) A will definitely lose.

Deduction 3 A cannot leave B with a situation in which B can make into (1, 2) or (2, 1).

Evaluating the 13 options left for A, we get that (1, 4), (2, 4), (3, 4), (5, 4), (9, 1) , (9, 2), (6, 1) & (6, 2) are situations from which B can reach (2, 1) or (1, 2) in one move. This means B will win if A leaves him with any of these eight situations.

Thus, A will eliminate these eight options from his list of 13 and come down to five options which need further checking. These are: (6, 4), (7, 4), (8, 4), (9, 3) and (8, 3).

At this stage we further need to eliminate four of these five options to come to the correct answer.

Now let us start our investigation with (6, 4). *If B is left with (6, 4) he has the following options:*

I	II	III
5, 4	6, 3	5, 3
4, 4	6, 2	4, 2
3, 4	6, 1	3, 1
2, 4	6, 0	2, 0
1, 4		
0, 4		

Of this, B cannot play (0,4), (1, 4), (2, 4), (3, 4), (4, 4), (5, 4), (6, 0), (6, 1), (6, 2), (2, 0), (3, 1) & (4, 2) [Since these lead to a (2, 1) or a clean win in one move.] Thus, B can either leave (6, 3) or (5, 3).

If B leaves (5, 3) for A, A's options are:

I	II	III
4, 3	5, 2	4, 2
3, 3	5, 1	3, 1
2, 3	5, 0	2, 0
1, 3		
0, 3		

In each of these cases, B will either win in one move or get to (2, 1) in one move. Thus, A cannot do anything if B leaves (5, 3) in return for A leaving (6, 4).

Deduction 4 Just like being left with (2, 1) means a definite loss, so does being left with (5, 3).

Hence, A cannot allow a situation in which B can make it (5, 3) in one move.

Thus, A cannot leave B with (6, 4), (9, 3) or (8,3) since, each of these will result in B giving back (5, 3) in one move.

Thus A's option are down to (7, 4) or (8, 4). These need to be further investigated now:

Let us consider A leaving (7, 4) for B.

B's options:

I	II	III
(6, 4)		

(5, 4)	(7, 3)	(6, 3)
(4, 4)	(7, 2)	(5, 2)
(4, 4)	(7, 1)	(4, 1)
(3, 4)	(7, 0)	(3, 0)
(2, 4)		
(1, 4)		
Or (0, 4)		

After closely evaluating each of these, all possible options will get eliminated because in one move they lead to either a straight win or a (2, 1) situation or a (5, 3) situation.

If A does any of this, then B cannot do anything to stop from losing the game.

The above question obviously is extremely long and complicated. However, what needs to be noticed is that even for this extremely long question, at no point of time is there any big logical jump i.e. from one logic emerges the next one and so on.

Notes on Interpretation

Normally CAT questions only use 10% of this logic. However, let us now consider a question (Example 1.4) which appeared in CAT 2004 and was found to be extremely tough to crack. In fact, the question has been put down as unsolvable by most famous national level coaching centres on their website.

Example 4 The year was 2006. All six teams in Pool A of World Cup Hockey play each other exactly once. Each win earns a team three points, a draw earns one point and a loss earns zero points. The two teams with the highest points qualify for the semifinals. In case of a tie, the team with the highest goal difference (goals for–goals against) qualifies. In the opening match, Spain lost to Germany. After the second round (after each team played two matches),the (pool A) table looked as shown on the next page.

In the third round, Spain played Pakistan, Argentina played Germany, and New Zealand played South Africa. All the third round matches were drawn. The following are some results from the fourth and fifth round matches.

(a) Spain won both the fourth and fifth round matches.

(b) Both Argentina and Germany won their fifth round matches by 3 goals to 0.

(c) Pakistan won both the fourth and fifth round matches by 1 goal to 0.

Solution For solving the above question, one requires tremendous alacrity, logical consistently and above all a cool head.

Also, the solution of the above question is dependent on your ability to interpret the

table and find out the appropriate linkages (something that might not be as easily done as said).

Let us look at the table and create our interpretations:

Deduction 1 Germany and Argentina have both won their matches while New Zealand and South Africa have lost both theirs.

Let us start by making tables for the possible result of the first two rounds for each of the six teams.

Germany

Round one Opponent	Result
1. Spain	Won 1–0/2–1
2. Pak/New Zealand/South Africa	Won 2–1/1–0
3. Argentina	

It is given that Germany has played Spain in the opening match (and obviously won that game).

Looking at the goals for & goals against columns and the fact that Germany has won both the first and second round matches, we deduce that its two wins must have been in one of the following combinations:

(Pool A)

Team	Games Played	Won	Drawn	Lost	Goals For	Goals Aganist	Points
Germany	2	2	0	0	3	1	6
Argentina	2	2	0	0	2	0	6
Spain	2	1	0	1	5	2	3
Pakistan	2	1	0	1	2	1	3
New Zealand	2	0	0	2	1	6	0
South Africa	2	0	0	2	1	4	0

Won 1 – 0 & Won 2 – 1

Or

Won 1 – 0 & Won 2 – 1

Notes on Interpretation

Germany cannot win either match by 2–0 or 3–0 or 3–1 margins since it will not be able to win the other match and maintain a 3–1 goals for goals against situation.

Deduction If Germany had won the first game 2–1 against Spain, Spain would have won its second round match by 4–0, while if Germany won by 1–0, then Spain would have won its second round match 5–1 (since Spain has Goals For = 5 and Goals Against = 2).

Further, since only two teams — New Zealand and South Africa have conceded 4 or more goals, Spain must have played one of them. Looking into South Africa's G.F/G.A columns, if South Africa had conceded 4 goals in the second round, then it should have won the first round (1,0). But, South Africa has lost both rounds.

Hence, Spain played its second round against New Zealand. Further, if this is true, no other team can play New Zealand in round two.

At this stage, the following possibilities emerge.

		Team Germany		
Round 1	vs.	Spain	Won	1–0 or 2–1
Round 2	vs.	Pak/S.A.	Won	2–1 or 1–0
Round 3	vs.	Argentina	Draw	
		Team Spain		
Round 1	vs.	Germany	Lost	0–1 or 2–1
Round 2	vs.	New Zealand	Won	5–1 or 4–0
Round 3	vs.	Pakistan	Draw	
		Team New Zealand		
Round 1	vs.	Arg/Pakistan	Lost	0–1 or 1–2
Round 2	vs.	Spain	Lost	1–5 or 0–4
Round 3	vs.	South Africa	Draw	

Deduction Team Pakistan won one round and lost one and GF/GA 2/1. Hence, won 2–0 and lost 0–1.

Now, since New Zealand played its first round against Pakistan or Argentina it could not have lost 1–2. This is because in the case of Pakistan, if Pakistan had won 2–1 against NZ in round 1, its round 2 would have been a draw.

Further, Argentina has conceded no goals. Hence, it could not have won 2–1 against N.Z.

This means that N.Z. must have lost 0–1 in its first match to Argentina (that cannot happen against Pakistan, because Pakistan cannot win 1–0 in the first round since it will result in a 1–1 draw in round 2).

Consequently N.Z. lost 1–5 in its second match to Spain and hence Spain must have lost

0–1 to Germany.

The following scenario emerges from these deductions:

		Team Germany		
Round 1	vs.	Spain	Won	1–0
Round 2	vs.	S.A.	Won	2–1
Note: Here Germany's round 2 has to be vs. S.A., since Pakistan cannot lose 2–1				
		Team Spain		
Round 1	vs.	Germany	Lost	0–1
Round 2	vs.	N.Z.	Won	5–1
		Team N.Z.		
Round 1	vs.	Argentina	Lost	0–1
Round 2	vs.	Spain	Lost	1–5
		Team Pakistan		
Round 1	vs.	S.A.	Won	2–0
Round 2	vs.	Argentina	Lost	0–1
The first three rounds are as under:				
		Round 1 matches:		
Germany	beat	Spain	1–0	
Argentina	beat	N.Z.	1–0	
Pakistan	beat	S.A.	2–0	
		Round 2 matches:		
Spain	beat	N.Z.	5–1	
Argentina	beat	Pak	1–0	
Germany	beat	S.A.	2–1	

Putting all deductions into one table, the following picture emerges:

	Germany	**Argentina**	**Spain**	**Pak**	**New Zealand**	**S. Africa**
Germany	—	D#3	W(1–0)#1			W(2–1)#
Argentina	D#3	—		W(1–0)#2	W(1–0)#1	
Spain	L(0–1)#1		—	D#3	W(9–1)#2	
Pakistan		L(0–1)#2	D#3	—		W(2–0)#1
New Zealand		L(0–1)#1	L(1–5)#2	—	D#3	
S. Africa	L(1–2)#2			L(0–2)#1	D#3	—

According to the information available about the fourth and fifth round of matches:

Germany	—	Pakistan, Loss (0–1) & N.Z. won (3–0)
Argentina	—	Spain, Loss by 'x' goals & S.A. won (3,0)
Spain	—	Argentina won by 'x' goals & S.A. won by 'y' goal
Pakistan	—	Germany won (1–0) & N.Z. won 1–0
N.Z.	—	Germany loss (0–3) & Pakistan lost (0–1)
S.A.	—	Argentina lost (0–3) & Spain lost by 'y' goals

And the goal differences for the six teams are:

Germany	+1+1+0–1+3=+4
Argentina	+1+1+0–x+3=5–x=Max. 4 or less
Spain	–1+4+0+x+y=3+x+y=Min. 5 or more
Pakistan	2–1+0+1+1=+3
N.Z.	–1–4+0–3–y=–6–y

Based on these deductions, the following questions can be answered.

1. Which one of the following statements is true about the matches played in the first two rounds?

   (a) Pakistan beat South Africa by 2 goals to 1.

   (b) Argentina beat Pakistan by 1 goal to 0.

   (c) Germany beat Pakistan by 2 goals to 1.

   (d) Germany best Spain by 2 goals to 1.

2. Which one of the following statements is true about the matches played in the first two rounds?

   (a) Germany beat New Zealand by 1 goal to 0.

   (b) Spain beat New Zealand by 4 goals to 0.

   (c) Spain beat South Africa by 2 goals to 0.

   (d) Germany beat South Africa by 2 goals to 1.

3. Which team finished at the top of the pool after five rounds of matches?

   (a) Argentina (b) Germany

   (c) Spain (d) Cannot be determined

   Spain must be top of the pool since it has the best goal difference even in it's

worst case scenario.

4. If Pakistan qualified as one of the two teams from Pool A, which was the other team that qualified?

   (a) Argentina (b) Germany

   (c) Spain (d) Cannot be determined

Notes on Interpretation

This question has an ambiguity since according to the deductions, Spain and Germany both should be above Pakistan in terms of goal difference and hence Pakistan cannot qualify. However, if Pakistan qualifies, so do both Spain and Germany.

The above question was basically testing the ability of the student to analyse data. In the very same paper (CAT 2004), another question on data analysis went as follows:

Example 5 Prof. Singh has been tracking the number of visitors to his homepage. His service provider has provided him with the following data on the country of origin of the visitors and the university they belong to:

Number of Visitors/Day

University	*1*	*2*	*3*
University 1	1	0	0
University 2	2	0	0
University 3	0	1	0
University 4	0	0	2
University 5	1	0	0
University 6	1	0	1
University 7	2	0	0
University 8	0	2	0

Number of Visitors/Day

Country	**1**	**2**	**3**
Canada	2	0	0
Netherlands	1	1	0
India	1	2	0
UK	2	0	2
USA	1	0	1

Deduction 1 Looking at Day 3, University 4 must belong to the UK and University 6 must belong to the USA.

Deduction 2 From Day 2 it is clear that University 8 has to be an Indian University while University 3 has to be from Netherlands.

Deduction 3 From the analysis of Day 1 data , University 2 and University 7 should be distributed amongst UK and Canada in either order, i.e. 2 belongs to UK and 7 to Canada or 2 belongs to Canada and 7 to UK. [Symbolically, (2UK + 7 Canada) vs (2 Canada + 7 UK)]

Deduction 4 The visitor from USA on Day 1 must come from University 6. Hence, University 1 and University 5 should be distributed between India and Netherlands.

With this set of deductions, we get the following table. Using this table the answers to the following questions become quite elementary.

Number of Visitors/Day

University	*1*
University 1	I v N
University 2	UK v C
University 3	N
University 4	UK
University 5	N v I
University 6	USK
University 7	C v UK
University 8	I

1. To which country does University 5 belong?
   (a) India or Netherlands but not USA
   (b) India or USA but not Netherlands
   (c) Netherlands or USA but not India
   (d) India or USA but not UK
2. University 1 can belong to:
   (a) UK (b) Canada
   (c) Netherlands (d) USA
3. Which among the listed countries can possibly host three of the eight listed universities?

(a) None (b) Only UK

(c) Only India (d) Both India and UK

4. Visitors from how many universities from UK visited Prof. Singh's homepage in three days?

(a) 1 (b) 2

(c) 3 (d) 4

2

Logical Reasoning based on Arrangements

Arrangement questions are one of the most common question types in logical reasoning. As the name suggests, questions on arrangements typically involve arranging people or objects in straight lines or around circles/squares or other geometrical shapes.

The key skills involved in solving questions on arrangements include but are not limited to:

(i) the ability to visualise the geometrical shape of the arrangement situation.

(ii) the ability to order the clues in the correct order of usage (as explained in the theory of logical reasoning).

(iii) the ability to perceive what indirect clues are talking about – and how to use them.

(iv) the ability to convert clues written in language form into visual cues so that you do not need to read the text again and again. Also, converting the language clues to visual cues is critical for the purpose of being able to 'see' all the clues at one go.

Illustrated below are the solutions to a few typical questions on arrangements. We would advise you to first have a look at the question and try to solve the same on your own before looking at the step by step process of solving the same – illustrated through the revolutionary "Reaction Tracker" mechanism which is an integral part of this section of the book.

Note: The Reaction tracker is a blow by blow account of exactly what reaction should go on in your mind as you solve an individual question in reasoning.

Look at the following questions and try to solve them:

Example 1 Question at an easy level of difficulty

Directions: Study the information given below to answer these questions.

(i) Arnold's fitness schedule consists of cycling, rowing, gymnasium, jogging and boxing from Monday to Saturday, each workout is on one day, one day being a rest day.

(ii) Gymnasium workout is done neither on the first nor on the last day but is done earlier than rowing.

(iii) Jogging is done on the immediate next day of the rowing day.

(iv) Cycling is done on the immediate previous day of the rest day.

(v) Jogging and boxing were done with a two-day gap between them.

(vi) Boxing was done on the following day the rest day.

1. Which of the following is a rest day?

   (a) Wednesday (b) Tuesday

   (c) Friday (d) Thursday

2. Cycling and jogging days have a gap of how many days between them?

   (a) Nil (b) Two

   (c) Three (d) Four

3. On which day is boxing done?

   (a) Thursday (b) Friday

   (c) Monday (d) Wednesday

4. Which of the following is a wrong statement?

   (a) Gymnasium workout is done on the immediate previous day of rowing.

   (b) Jogging is done three days after the day on which boxing was done.

   (c) There is a gap of three days between the days on which cycling and rowing are done.

   (d) There is a two days' gap between the rest day and the day on which gymnasium workout is done.

5. Which of the following is the correct statement?

   (a) Jogging competition is done after rowing.

   (b) Cycling is done on Thursday.

   (c) No workout is done on Wednesday.

   (d) Rowing is done earlier than cycling.

REACTION TRACKER

The starting figure we start with when we read the first statement is:

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

Workouts are cycling, rowing, gymnasium, jogging and boxing.

From the second and third clues (gymnasium workout is done neither on the first nor on the last day but was done earlier than rowing and jogging was done on the day immediately following the rowing day), we know that rowing and jogging should be together and also that gymnasium has to be somewhere before this.

Visually this can be represented as:

From the fourth and sixth clues we have:

C-Rest day-B

Note: Putting it in a box signifies that there is no break between the items in the box.

Once we have these two visual representations we can go back to our original figure and think as follows:

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

Since gymnasium has to precede rowing and jogging, and gymnasium is not on the first day we can have 3 possibilities for placing gymnasium—viz: Tuesday, Wednesday or Thursday.

Possibility 1:

Monday	
Tuesday	Gymnasium
Wednesday	
Thursday	
Friday	
Saturday	

This case is rejected because, once we place gymnasium we would need to place rowing and boxing in either **Wednesday-Thursday** or **Thursday-Friday** or **Friday-Saturday**. In each of these cases, we would also need to place a 3 day period having

Cycling-Rest day-Boxing. It can be easily seen that in any of these 3 situations under Possibility 1, we do not have a completely free 3 day period anywhere in the week. Thus, we can reject Possibility 1.

Possibility 2:

Monday	
Tuesday	
Wednesday	Gymnasium
Thursday	
Friday	
Saturday	

Rejected on the same logic as Possibility 1. There is no availability of a 3 day window to place **Cycling-Rest day-Boxing.**

Possibility 3:

Monday	
Tuesday	
Wednesday	
Thursday	Gymnasium
Friday	
Saturday	

This is the only possibility that would work as in this case, the respective work outs ordering would be

Monday	Cycling
Tuesday	Rest Day
Wednesday	Boxing
Thursday	Gymnasium
Friday	Rowing
Saturday	Jogging

Thus, the answers are:

1. (b); Tuesday is the rest day.
2. (d); 4 days
3. (d); Boxing is done on Wednesday.
4. (d); The statement in option (d) is incorrect.
5. (a); Only the statement in option (a) is correct.

Example 2

Directions: Study the following information to answer these questions.

(i) Alex, Betsy, Chloe, Dennis, Edward, Fiona, Giles and Herbert are gamblers sitting around a round table facing the centre.

(ii) Dennis is the neighbour of Alex but not of Herbert.

(iii) Betsy is the neighbour of Fiona and 4^{th} to the left of Dennis.

(iv) Edward is the neighbour of Herbert and 3^{rd} to the right of Fiona.

(v) Chloe is neither the neighbour of Alex nor of Giles.

1. Which of the following is wrong?

   (a) Betsy is to the immediate left of Herbert.

   (b) Herbert is to the immediate left of Edward.

   (c) Dennis is 4^{th} to the right of Fiona.

   (d) All are correct.

2. Which of the following is correct?

   (a) Dennis is to the immediate left of Giles.

   (b) Alex is between Chloe and Dennis.

   (c) Fiona is 3^{rd} to the right of Dennis.

   (d) Edward is between Herbert and Betsy.

3 Which of the following groups has the 2^{nd} person sitting between the 1^{st} and the 3^{rd}?

   (a) Alex-Fiona-Chloe

   (b) Giles-Alex-Dennis

   (c) Betsy-Edward-Herbert

   (d) Herbert-Fiona-Betsy

4 Which of the following pairs has the 1^{st} person sitting to the immediate right of the second?

   (a) Betsy-Herbert (b) Fiona-Betsy

   (c) Edwards-Giles (d) Alex-Dennis

5. Which of the following pairs are fourth to one another?

   (a) Chloe-Edwards (b) Fiona-Herbert

   (c) Dennis-Chloe (d) Dennis-Betsy

6. If Chloe and Giles interchange their positions, which of the following will indicate Alex's position?

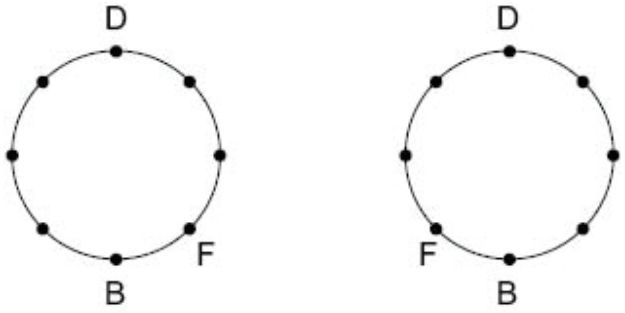
(a) To the immediate right of Giles

(b) 4th to the right of Chloe

(c) 2nd to the left of Giles

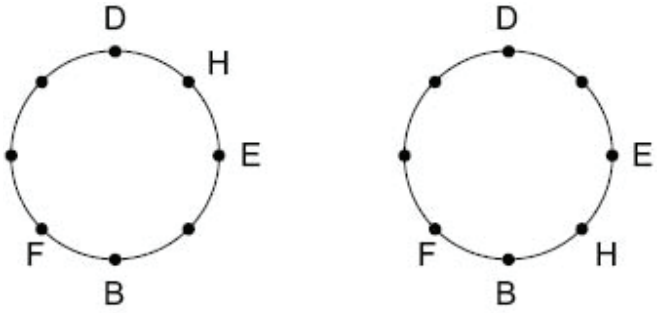
(d) To the immediate left of Chloe

6-11 :From clues (i) and (iii), we get following two possibilities:



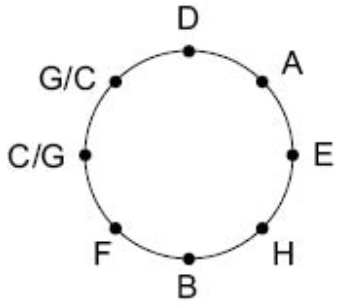
Case I Case II

Now, read clue (iv): Edward is third to the right of Fiona. This information rejects Case I. Using clue (iv), we get the following two possibilities, i.e. Case II (a) and Case lI (b).

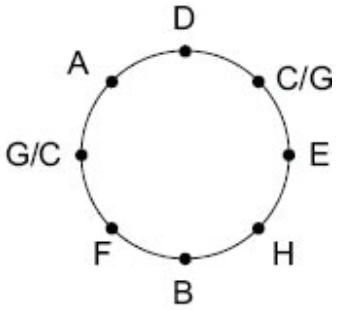


Case II (a) Case II (b)

Now, from clue (ii), we come to know that Dennis is not the neighbour of Herbert. Hence, reject Case lI(a). From clue (ii) we get the following two possibilities:

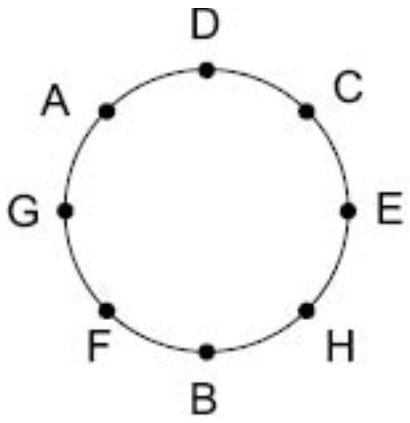


Case II (c)



Case II (d)

Now, from clue (v), Chloe can't be the neighbour of Giles. Therefore, reject Case II (c). Again, since Chloe can't be the neighbour of Alex, the final seating arrangement will be as follows:



The answers then become pretty straight forward

1. (c) 2. (c) 3. (b) 4. (d) 5. (d) 6. (d)

Example 3

Directions: These questions are based on the information that follows.

In a row of soldiers facing North, (i) Lambert is 8th to the right of Khurusheva; (ii) Mickey is 16th from the left end; (iii) Lambert is 16th to the right of Jackson, who is 27th from the right end of the row; (iv) Khurusheva is nearer than Mickey to the right end of the row; (v) there are 5 boys between Mickey and Khurusheva.

1. How many soldiers are there between Jackson and Mickey?

   (a) One (b) Two

   (c) Three (d) Data inadequate

2. How far away is Khurusheva from the right end of the row?

   (a) 30th (b) 10th

(c) 19^{th} (d) 18^{th}

3. How many soldiers are there in the row?

(a) 50 (b) 40

(c) 36 (d) Data inadequate

4. How far away is Jackson from the right end of the row?

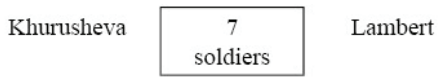
(a) Data inadequate (b) 24^{th}

(c) 25^{th} (d) 27^{th}

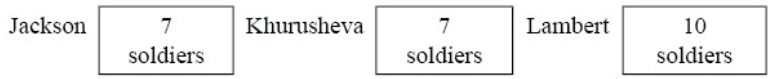
REACTION TRACKER

Let us arrange the whole information.

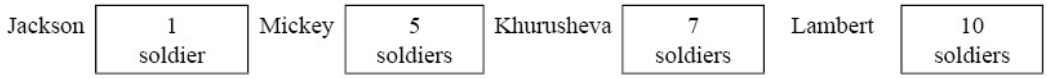
From clue (i), we get



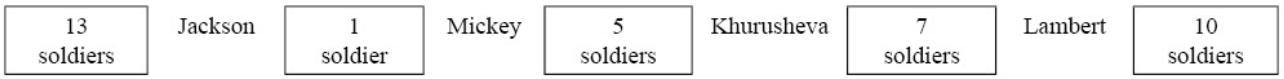
Now, using clue (iii), we get



Now, using clue (iv) and clue (v), we get



Now, from clue (ii), we get the complete information as following:



Hence the answers are:

1. (a)
2. (c) From the above information it is obvious that occupies 19^{th} position from the right end of the row.
3. (b) Total numbers of soldiers = 13 + 3 + 5 + 1 + 7 + 1 +10 = 40
4. (d)

EXERCISE ON ARRANGEMENTS

Directions for Questions 1–5: (Question Category: Matching Puzzle) Study the following information and answer the questions that follow:

i. Six picture cards P, Q, R, S, T and U are framed in six different colours – blue, red green, grey yellow and brown and are arranged from left to right (not

necessarily in the same order).

ii. The pictures are of king, princess, queen, palace, joker and prince.

iii. The picture of the palace is in the blue colour frame but is not on card S and card P which is of the queen, is in the brown frame and is placed at the extreme right.

iv. The picture of the princess is neither on card S nor on card T and is not in either the green or the yellow frame. Card R has a picture of the king in a grey frame and it is fifth from right and next to card Q having the picture of the prince.

1. If the princess's card is immediately between the cards of the palace and the prince, then at what number is the joker's card placed from left?

   (a) Fifth (b) Second

   (c) First (d) Data inadequate

2. Which is the correct combination of card and frame colours?

   (a) T-Yellow (b) U-Red

   (c) Q-Green (d) Data inadequate

3. The picture of the joker is in which colour frame?

   (a) Yellow (b) Green

   (c) Blue (d) Data inadequate

4. The picture of the palace is printed on which card?

   (a) S (b) T

   (c) U (d) None of these

5. If the photo frame of the prince and joker is interchanged, then the colour of frame of the prince is:

   (a) Green (b) Yellow

   (c) Blue (d) Data inadequate

Directions for Questions 6 to 8: Study the following information and answer the questions that follow:

A company is planning to organise 8 lectures—A, B, C, D, E, F, G and H for 3 subjects —Quants, D.I. and English.

The lectures are spread over three days.

Quants is to be covered first in 3 lectures followed by English and then D.I. in 2 lectures. Lectures A, C and D have to be different days. (Lectures B and F have to be on

the same day), but lecture B cannot be clubbed with A or G or D. Lecture G and H should come on the same day. Lecture A is a lecture on Quants and Lecture C cannot be on the last day. It is also known that there are at least 3 lectures on day 1.

6. Which of the following pairs of lectures can go along with lecture 'A' on Quants?

   (a) B, C (b) G, H

   (c) D, E (d) Data inadequate

7. Which combination of lectures was arranged on the second day of the series?

   (a) D, E, F (b) B, C, E

   (c) C, G, H (d) Data inadequate

8. Which of the following lectures were for D.I.?

   (a) D, F (b) B, C

   (c) G, H (d) Data inadequate

Directions for Questions 9 to 11: Five courses — A, B, C, D and E, each of one month duration are to be taught from January to May one after the other though not necessarily in the same order by lecturers P, Q, R, S and T. P teaches course 'B' but not in the month of April or May. Q teaches course 'A' in the month of March. R teaches in the month of January but does not teach course 'C' or 'D'.

9. Which course is taught by S?

   (a) C (b) E

   (c) Either C or D (d) D

10. Which lecturer's course immediately follows course B?

    (a) Q (b) P

    (c) S (d) T

11. Which course is taught in the month of January?

    (a) C (b) D

    (c) E (d) Data inadequate

Directions for Questions 12 to 15: The annual gathering of a college was organised on a day. Six different programmes—drama, singing, mimicry, speech, story-telling and dance are to be performed by six students A, B, C, D, E and F, not necessarily in the same order. The programme begins with a song not sung by B and ends with a dance. C

performs mimicry immediately after the speech. E performs drama just before the dance. D or F are not available for the last performance. The speech is not given by A. An interval of 30 minutes is given immediately after mimicry with three more items remaining to be performed. D performs immediately after the interval.

12. Which item is performed by F?

    (a) Song (b) Dance

    (c) Speech (d) Data inadequate

13. Who performed the dance?

    (a) A (b) B

    (c) Either A or B (d) F

14. Who was the first performer?

    (a) D (b) E

    (c) A (d) Data inadequate

15. Who was the last performer?

    (a) A (b) B

    (c) F (d) Data inadequate

Directions for Questions 16 to 18: Six persons—Akshay, Bobby, Celina, Dimple, Esha and Faisal took up a job with XYZ Consultants in a week from Monday to Saturday. Each of them joined for different posts on different days. The posts were of Clerk, Officer, Technician, Manager, Supervisor and Sales Executive, though not in the same order.

Faisal joined as a Manager on the first day. Bobby joined as a Supervisor but neither on Wednesday nor Friday. Dimple joined as a Technician on Thursday. The officer joined the firm on Wednesday. Esha joined as a clerk on Tuesday. Akshay joined as a Sales Executive.

16. Who joined the firm on Wednesday?

    (a) Bobby (b) Celina

    (c) Esha (d) Data inadequate

17. Who was the last to join the firm?

    (a) Esha (b) Faisal

    (c) Bobby (d) Akshay

18. On which of the following days did the Sales Executive join?

(a) Thursday (b) Friday

(c) Saturday (d) None of these

Directions for Questions 19 to 21:

i. Six friends A, B, C, D, E and F are sitting along the sides of a hexagonal table for playing a game, though not necessarily in the same order.

ii. F, who is sitting exactly opposite A, is to the immediate right of B.

iii. D is between A and B and is exactly opposite to C.

19. Who are the people sitting next to A?

(a) D & E (b) D & F

(c) C & E (d) B & D

20. Who is sitting opposite B?

(a) E (b) F

(c) A (d) C

21. Three of the following are alike in a certain way on the basis of sitting positions and so form a group. Which is the one that does not belong to the group?

(a) B, C (b) A, D

(c) B, F (d) E, A

Directions for Questions 22 to 25: A group of five boys—Abdul, Bony, Chandan, Devdas and Eram, and a group of five girls—Paro, Queen, Reena, Saifali and Tulika are standing in rows facing each other (not in the same order). The group of girls is facing north.

Eram is not at any of the ends. Chandan is to the immediate right of Bony and Devdas is to the immediate left of Abdul, who is facing Paro. There are as many girls between Paro and Queen as between Reena and Saifali. Abdul is second to the left of Bony. Saifali and Reena are not facing either Bony or Devdas.

22. Which pair of boys is standing at the ends of the row?

(a) Chandan & Devdas

(b) Chandan & Bony

(c) Devdas & Bony

(d) Data inadequate