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Index

Linear Arrangement – Unique Possibility

Analytical Reasoning is a topic that is best mastered through practice. Questions in this area appear in the form of sets i.e. data is provided which can run upto ten to twelve lines and then there are three or four questions that have to be answered with the help of the data given.

No two sets of Analytical Reasoning are identical. Further there is practically no theory or prior knowledge that can help you. The only advantage that a theory can provide is how to 'model' the numerous clues given.

This chapter here provides practice sets of Linear Arrangements. In questions on Linear Arrangement, one has to arrange few people or objects in a straight line. The clues given will be about the relative placement of two or more objects, their placement with respect to the ends, etc. We will take an example to help you 'model' the clues given.

Example 1

A, B, C, D, E, F, G and H are sitting in a row facing north.

i. A is fourth to the right of E.

ii. H is fourth to the left of D.

iii. C and F, which are not at the ends, are neighbours of B and E respectively.

iv. H is next to the left of A and A is the neighbour of B.

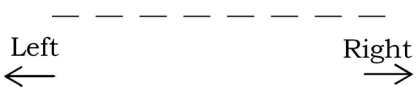
Who are sitting at the extreme ends?

Solution:

In such a question one should quickly skim through the clues. Do not memorize the clues int he first instance. Just go through them, really quick, to get an idea. E.g. In the above data, in the first reading, one should have just understood that clues talk about 'to the right', 'to the left', 'not at the ends', 'neighbours', etc.

Thus one should look at the arrangement as follows: _ _ _ _ _ _ _ _

More importantly, one should decide the right and left. So let's consider right and left as follows:



Now, one should read through all the clues again and try to 'model' the data given.

Clue i: E _ _ _ A

Clue ii: H _ _ _ D

Clue iii: C B or B C . Similarly, F E or E F

Clue iv: H A B

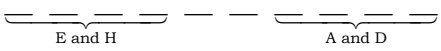
The above is the most common way that a student would read the clues.

One way to gain mastery in Analytical Reasoning is to 'extract' maximum information from each clue. Thus, while the above is true, one could also have 'extracted' more information from each of the above clues. Look at all the clues again and see how one could have got more insights...

Clue i: E _ _ _ A . And because of this, E has to be at a position amongst the first 4 seats from left end (likewise A has to be in the last 4 from left end)

Clue ii: H _ _ _ D . By the same logic as above H has to be at a position amongst the first 4 seats from left end (likewise D has to be in the last 4 from left end)

Before moving ahead, one should also always be on the look-out of 'tying-up' all the previously seen clues. E.g. Based on the two clues seen so far and form the insights gathered, the following arrangement should have been formed in the student's mind:



Clue iii: C B or B C . Similarly, F E or E F . Because of the earlier picture in mind, since E is in the left side of the arrangement, so would F also be. Also do not miss out the fact that F is not at the end. If you fear you will forget this fact, make a note in the picture:

Clue iv: H A B .

Again since A and B have been used in earlier clues, 'tie-up' the respective clues to get an arrangement as follows: E _ _ H A B C D (from clue i. E _ _ _ A , ii. H _ _ _ D)

One can now arrive at the final arrangement as:

E F G H A B C D

The above was an easy arrangement. But one should not miss the point of "extracting the maximum" and of "tying up with the previous clues". The idea should be that through one detailed reading of the clues, one should be able to arrive at the arrangement. And that one should not be need to go through the clues all over again.

Example 2:

Six friends A, B, C, D, E and F went to a picnic for a hill station. They have to be accommodated in a row of nine tents, each to a tent.

i. A, B and C do not want to live in a tent at the end of the row.

ii. D and A must not have anybody adjacent to their tents.

iii. There is only an empty tent between A and C.

iv. E is adjacent to both F and C.

v. B is in a cottage next to an end.

Who is in the fifth tent?

Who has empty tents on both sides?

Solution:

Information gathered on first skimming:

There are nine tents and only six friends. So three places will be vacant.

Data is primarily about vacant tents and about neighbours.

Detailed reading:

Clue i: This clue can just be kept in mind. A, B and C have to be in the 7 cottages in the middle and not at end.

Clue ii: D and A must not have anybody adjacent to their tents would under normal circumstances be thought of as follows: × D × and × A × .

But 'not having anyone on sides' could also mean that the person stays at one end. Tying up with the earlier clue, A cannot be at any end. Thus both cottages to A's side have to be vacant cottages.

Clue iii: One empty tent between A and C and also knowing that neither can C be at any end, we can get the following: × A × C or C × A ×

Clue iv: Tying it up with the earlier formed arrangement, × A × C E F or F E C × A ×

Clue v: We have B or B

The earlier formed block of 6 places have to be placed and also D has to be placed such that D does not have anybody on his sides. This can be done in just one way in each of these two options for B.....

B F E C × A × D or D × A × C E F B

In both the arrangements, the fifth tent (from either side) is occupied by C and the person having two empty tent's to his side is A.

This example also tells us that the final arrangement need not necessarily be a unique one for one to get a specific answer.

Error-Prone Area

Many times one will come across a data of the type "A is to the right of B". This DOES NOT mean B A . The sentence is often mistaken as "A is to the immediate right of B". Thus "A is to the right of B" implies that A could be anyplace to the right of B and need not be adjacent.

Exercise 1

Independent questions

1. There are five different houses, *A* to *E*, in a row. *A* is to the right of *B*; *E* is to the left of *C* and right of *A*; *B* is to the right of *D*. Which of the houses is in the middle?

   (1) *A* (2) *B* (3) *D* (4) *E*

2. In a march past, seven persons are standing in a row. *Q* is standing to the left of *R* and to the right of *P*. *O* is standing to the right of *N* and to the left of *P*. Similarly, *S* is standing to the right of *R* and to the left of *T*. Who is standing in the middle?

   (1) *P* (2) *Q* (3) *R* (4) *O*

3. Five children are sitting in a row. *S* is sitting next to *P* but not next to *T*. *K* is sitting next to *R* who is sitting to the extreme left, and *T* is not sitting next to *K*. Who are sitting adjacent to *S*?

   (1) *K* and *P* (2) *R* and *P* (3) Only *P* (4) *P* and *T*

4. Five girls are sitting in a row. Rashi is not adjacent to Sulekha or Abha. Anuradha is not adjacent to Sulekha. Rashi is adjacent to Monika. Monika is seated in the middle of the row. Then, amongst the following choices, to whom is Anuradha adjacent?

   (1) Rashi (2) Sulekha (3) Abha (4) Monika

5. On a seven member panel sitting in a row, *A* is in between *D* and *F*, *C* is between *F* and *G*. *G* is between *C* and *E* and *D* is between *B* and *A*. Find the person sitting right in the middle.

   (1) *D* (2) *C* (3) *A* (4) *F*

6. Five boys are standing in a row facing east. Mohan is standing between Umesh and Suresh. Prakash is standing to the immediate right of Umesh. Anand is standing at the one of the ends of the row. Who is standing at the other end of the row?

   (1) Prakash (2) Suresh (3) Mohan (4) Suresh or Prakash

7. Four girls are sitting on a bench to be photographed. Shikha is to the left of Reena. Manju is to the right of Reena. Rita is between Reena and Manju. Who would be the second from the left when the photographed is viewed?

   (1) Reena (2) Shikha (3) Manju (4) Rita

Set 1:

Six girls *A*, *B*, *K*, *D*, *E* and *P* are standing in arrow. *B* is between *D* and *P*. *A* does not stand next to either *P* or *D*. *K* does not stand next to *D*. *E* stands between *A* and *K*.

8. *P* stands between:

   (1) *B* and *K* (2) *E* and *A* (3) *D* and *B* (4) *A* and *K*

9. Who occupies the extreme ends of the row?

   (1) *D* and *E* (2) *D* and *A* (3) *A* and *P* (4) *B* and *E*

10. *K* stands between:

    (1) *P* and *B* (2) *P* and *D* (3) *P* and *E* (4) *E* and *A*

Set 2:

Five books are kept in a row, one besides the other. Among the books, one is a science fiction, one is a mystery, one is a romantic novel, one is an autobiography and one is on business management. The romantic novel is to the right of science fiction and the mystery book is to the left of the book on business management. The books on the ends are autobiography and the book on business management. The science fiction has the autobiography and the mystery novel as it's neighbour.

11. Counting from the left-end of the row, the romantic novel is at which place?

    (1) Second (2) Third (3) Fourth (4) Data Insufficient

12. Which book is in the middle of the arrangement?

    (1) Mystery novel (2) Science fiction (3) Romantic novel (4) Data Insufficient

13. If the position of the mystery novel and the book on business management are switched, also the position of romantic novel and the science fiction is switched, then which book will be to the left of science fiction?

    (1) Romantic novel (2) Business Mgmt (3) Mystery novel (4) Data Insufficient

14. Of the clues given below, which of them is/are redundant i.e. one can arrive at a unique arrangement even if the clue was not given?

    I The mystery book is to the left of the book on business management

    II The romantic novel is to the right of science fiction

    (1) I (2) II (3) I or II (4) I and II

Set 3:

Six swimmers A, B, C, D, E and F compete in a race. Each of the six finished the race with a different timing and the swimmers were then ranked with the fastest of them being ranked 1st, next fastest being ranked 2nd and do on. The following is known about their ranking or timings.

i. B does not win the race but has a better timing than E, though only one swimmer has a timing worse than B and better than E.

ii. F has a better timing than D. But A has a timing that is worse than D's and E's.

iii. There are two swimmers with their timings being between that of E and D

A better timing means completing the race in lesser time and a worse timing means completing the race in more time.

15. Who stood fifth in the race?

    (1) A (2) E (3) C (4) D

16. How many swimmers have their timings between that of A and F?

    (1) 1 (2) 2 (3) 3 (4) 4

17. The swimmer with a rank between that of C & E is

    (1) None (2) F (3) D (4) B

18. If the end of the race, swimmer D is disqualified by the Judges then swimmer B finishes with what rank?

    (1) 1 (2) 2 (3) 3 (4) 4

Set 4:

Six children *B*, *D*, *C*, *M*, *J* and *K* are split in two groups of three each and are made to stand in two rows in such a way that a child in one row is exactly facing a child in the other row.

M is not at the end of any row and is to the right of *J*, who is facing *C*.

K is to the left of *D*, who is facing *M*.

19. Which of the following group of children is in the same row?

(1) *BMD* (2) *MJK* (3) *BDC* (4) None of These

20. Who is to the immediate left of *B*?

(1) *M* (2) *D* (3) *J* (4) Data Inadequate

Set 5:

Six persons A, B, C, D, E and F are sitting in two rows, three people in each row.

E is not at the end of any row.

D is second to the left of F.

C, the neighbor of E, is sitting diagonally opposite to D.

B is the neighbor of F.

21. Which of the following are sitting diagonally opposite to each other?

(1) F and C (2) D and A (3) A and C (4) A and F

22. Who is facing B?

(1) A (2) C (3) D (4) E

23. Which of the following are in the same row?

(1) A and E (2) E and D (3) C and B (4) A and B

24. Which of the following are in one of the two rows?

(1) FBC (2) CEB (3) DBF (4) AEF

25. After interchanging seats with E, who will be the neighbors of D in the new position?

(1) C and A (2) F and B (3) Only B (4) Only A

Set 6:

The sports week of an institute was organized from 19th to 26th of a month, 19th being a Wednesday. During that period six games – Cricket (C), Badminton (B), Table-Tennis (T), Kho-Kho (K), Hockey (H) and Football (F) were played, one game on each day. Further information is:

Hockey was not played on the closing day i.e., on 26th.

Table-Tennis was played on the previous day of Cricket.

Football was not played either on Wednesday or Saturday.

No game was played on Thursday and Sunday.

Kho-Kho was played on Monday.

There was a gap of two days between Cricket and Football.

26. The sports week started with which game?

(1) Table-Tennis (2) Cricket (3) Kho-Kho (4) Hockey

27. How many days gap is there between Hockey and Football?

(1) 3 (2) 4 (3) 5 (4) 2

28. Which pair of games was played on Wednesday?

(1) Hockey and Badminton (2) Hockey and Cricket

(3) Cricket and Tennis (4) None of these

29. Which game exactly precedes Kho-Kho?

(1) Hockey (2) Football (3) Cricket (4) Table-Tennis

30. Table-tennis follows which game?

(1) Hockey (2) Cricket (3) Tennis (4) None of These

Set 7:

A training college has to conduct a refresher course for teachers of seven different subjects – Mechanics, Psychology, Philosophy, Sociology, Economics, Science and Engineering from 22nd July to 29th July.

1. Course should start with Psychology.

2. 23rd July, being Sunday, should be a holiday.

3. Science subject should be on the previous day of the Engineering Subject.

4. Course should end with Mechanics.

5. Philosophy should be immediately after holiday.

6. There should be a gap of one day between Economics and Engg.

7.There should be a gap of two days between Sociology and Economics.

31. Of the seven subjects, which is the subject taught in the middle of the course?

(1) Science (2) Sociology (3) Engineering (4) Economics

32. Which subject will be on Tuesday?

(1) Mechanics (2) Engineering (3) Economics (4) Psychology

33. Which subject is preceded by Science?

(1) Psychology (2) Philosophy (3) Economics (4) Engineering

34. Which subject precedes Mechanics?

(1) Economics (2) Engineering (3) Philosophy (4) None of these

35. How many days gap is there between Science and Philosophy?

(1) 1 (2) 2 (3) 3 (4) No gap

Set 8:

Six plays *A*, *B*, *C*, *D*, *E* and *F* are to be staged, one on each day from Monday to Saturday. The schedule of plays is to be in accordance with the following information.

1. *A* must be staged a day before *E*.
2. *C* must not be staged on Tuesday.
3. *B* must be staged on the day following the day on which *F* is staged.
4. *D* must be staged on Friday only and should not be immediately preceded by *B*.
5. *E* must not be staged on the last day of the schedule.

36. Which of the following plays is staged immediately after *E*?

(1) *B* (2) *D* (3) *E* (4) *F*

37. Which of the following plays is played on Monday?

(1) *E* (2) *F* (3) *C* (4) *B*

38. Play *D* is between which of the following pair of plays?

(1) *B* and *E* (2) *E* and *F* (3) *A* and *E* (4) *C* and *E*

Linear Arrangements (Non Deterministic)

In this chapter we will consider more difficult Linear Assignment questions. Also the later sets would be non-deterministic i.e. there would be no unique solution based on the data give. Further each question would also be providing you with a clue. An important aspect that you have to keep in mind is: Data provided in a question is meant for that question only. It cannot be used or carried-forward in any other question.

Sets of these types can easily be identified by looking at the questions. Each of the questions will provide additional data or else the questions will be of the type "Which of the following is false?"

In sets of this type, using the main set of data given, arrive at an 'incomplete arrangement'. Do not spend time trying to arrive at a unique solution based on the data.

In front of each question, re-draw the incomplete arrangement and then use the data given in the question to complete the arrangement.

For the next question, again draw the incomplete arrangement, based on the main set of data, in front of the question. In this way you would avoid the most common error of carrying forward a data given in a particular question.

Exercise 2

Set 1:

A, *B*, *C* and *D* are to be seated in a row but *C* and *D* cannot be together also *B* cannot be at the third place.

1. Which of the following must be false ?

   (1) *A* is at the first place (2) *A* is at the second place

   (3) *A* is at the third place (4) *A* is at the fourth place

2. If *A* is not at the third place , then *C* has which of the following positions

   (1) The first place only (2) The third place only

   (3) The first and the third place only (4) Any of the places

3. If *A* and *B* are together , then which of the following must be necessarily true ?

   (1) *C* is not at the first place (2) *A* is at the third place

   (3) *D* is at the first place (4) *C* is at the first place

Set 2:

A building having 6 floors houses only one house per floor. There are only 5 families residing in the building, one family to each floor. The floors are numbered 1 to 6 from bottommost floor to uppermost floor.

Mr & Mrs. Agarwal live two floors below Mr. and Mrs. Chaterjee. And Mr. and Mrs. Bhandari and Mr & Mrs. Deodhar are in neighbouring floors.

4. If the Agarwals live on floor 1, which of the following is true?

   (1) The Bhandaris stay on floor 2 (2) The Bhandaris stay on floor 5

   (3) The house on floor 2 is vacant (4) None of these

5. If Mr. & Mrs. Ahluwalia stay on floor 3 and the Bhandaris were on a floor higher than the Ahluwalias, which floor must be vacant

   (1) Floor 1 (2) Floor 2 (3) Floor 4 (4) Floor 5

6. If the Bhandaris were on floor 1, on which floor could the Agarwals be?

   (1) 2 or 4 (2) 3 or 5 (3) 3 or 4 (4) 4 or 5

7. If there were two floors between the Agarwals and Bhandaris, and the Agarwals were on a higher floor than the Deodhars, then the Agarwals must be staying on:

   (1) Floor 2 (2) Floor 3 (3) Floor 4 (4) Floor 5

8. Which of the following is false

   I. Both the Bhandaris and Deodhars can be on odd-numbered floor in the same configuration

   II. In any configuration, both the Agarwals and the Chaterjees must either be on an odd numbered floor or both on an even-numbered floor.

   III. The fifth family (other than the families mentioned in the clues) can be on a floor adjacent to the vacant floor.

   (1) I only (2) II only (3) III only (4) Both I and III

Set 3:

Five educational films A, B, C, D, & E are to be shown to a group of students. The films are to be shown in a particular order, which conforms to the following conditions:

A must be shown earlier than C.

B must be shown earlier than D.

E should NOT be the fifth film shown.

9. Which among the following is an acceptable order for showing the educational films ?

   (1) A, C, B, D, E (2) A, C, D, E, B (3) B, D, C, A, E (4) B, D, E, A, C

10. In case C is shown earlier than E, which among the following will hold true ?

    (1) A is the first film shown. (2) B is the second film shown.

    (3) C is the third film shown. (4) D is the fifth film shown.

11. In case D is to be shown earlier than A, then for which among the following films is there exactly one position from first through fifth in which it can be scheduled to be shown ?

(1) A (2) B (3) C (4) D

12. Which among the following is a pair of films that CANNOT both be shown earlier than E?

(1) A and B (2) A and D (3) C and D (4) B and D

13. In case D and E are shown as far apart from each other as possible, which among the following would be true?

(1) E is shown earlier than B. (2) B is shown earlier than C.

(3) C is shown earlier than E. (4) D is shown earlier than A.

14. In case B, D and E are to be shown one after the other in the given order, the two positions from first to fifth in which A could possibly be shown are

(1) 1^{st} & 2^{nd} (2) 1^{st} & 4^{th} (3) 2^{nd} & 3^{rd} (4) 3^{rd} & 5^{th}

15. In case exactly one film is shown between A and C, and exactly one film is shown between B and D, which among the following will hold true?

(1) B is the film shown between A and C. (2) E is the first film shown.

(3) E is the film shown between A and C. (4) D is the last film shown.

Set 4:

At the New India School, six subjects viz. Mathematics, Physics, Chemistry, Biology, English and Moral Science are taught, 3 in the morning session and 3 in the noon session with the two sessions being separated by a lunch break. The sequence of conducting the lectures, from 1, 2, ..., to 6, has to be decided based on the following conditions:

I. Mathematics should be immediately before Physics and the two subjects should not be separated by any break.

II. Moral Science must be the first lecture or the last lecture.

16. How many of the subjects can never be third in the sequence of lectures?

(1) One (2) Two (3) Three (4) Four

17. If Physics can never be the n^{th} in the sequence of lectures, how many values can n assume?

(1) 0 (2) 1 (3) 2 (4) 3

18. Mathematics could be any of the following in the sequence of lectures EXCEPT

(1) First (2) Second (3) Third (4) Fourth

19. In case English is immediately after Moral Science, Physics could be which of the following in the sequence?

(1) Fifth (2) Fourth (3) Third (4) Second

20. In case English and Biology are the fifth and sixth lectures respectively, then which of the following must be true?

(1) Chemistry is first in the sequence (2) Chemistry is third in the sequence

(3) Chemistry is fourth in the sequence (4) Mathematics is first in the sequence

Set 5:

The owner of a house hires the services of a plumber, a carpenter, a painter, an electrician, and an interior decorator to renovate his cottage. The renovation is to be completed in a period of one working week i.e. Monday to Friday. Every worker will be taking one complete day to do his job and only one person can work per day.

The painter can do his work only after the plumber and the carpenter have completed their jobs.

The interior decorator has to complete his job before that of the electrician.

The carpenter cannot work on Monday or Tuesday.

21. In case the painter works on Thursday, which among the following alternatives is possible?

    (1) The electrician works on Tuesday.

    (2) The electrician works on Friday.

    (3) The interior decorator does his work after the painter.

    (4) The plumber and the painter work on consecutive days.

22. In case the painter works on Friday, which among the following statements must be untrue?

    (1) The carpenter may work on Wednesday.

    (2) The carpenter and the electrician may work on consecutive days.

    (3) In case the carpenter works on Thursday, the electrician has to work on the previous day i.e. Wednesday.

    (4) The plumber may work before the electrician does.

23. Which arrangement among the following is possible?

    (1) The electrician will work on Tuesday and the interior decorator on Friday.

    (2) The painter will work on Wednesday and the plumber on Thursday.

    (3) The carpenter will work on Tuesday and the painter on Friday.

    (4) The carpenter will work on Wednesday and the plumber on Thursday.

Set 6:

Exactly seven persons- P, Q, R, S, T, U and V participate in a series of swimming races. There are no ties for any position at the finish of any of the races:

V always finishes somewhere ahead of P.

P always finishes somewhere ahead of Q.

Either R finishes first and T finishes last, or S finishes first and U or Q finishes last.

24. If in a race V finishes fifth, which of the following must be true?

    (1) S finishes first (2) R finishes second

    (3) T finishes third (4) Q finishes fourth

25. If in a race R finishes first, V finishes no lower than :

    (1) second (2) third (3) Fourth (4) Fifth

26. If in a race S finishes second, which of the following can be true ?

(1) P finishes before R (2) V finishes before S

(3) P finishes before V (4) U finishes before V

27. If in a race S finishes sixth and Q finishes fifth, which of the following can be true ?

(1) V finishes first or fourth (2) T finishes second or third

(3) P finishes second or fifth (4) U finishes third or fourth

28. If in a race R finishes second and Q finishes fifth, which of the following must be true ?

(1) S finishes third (2) P finishes third

(3) V finishes fourth (4) T finishes sixth

Set 7:

Seven airline flights- 101, 102, 103, 104, 105, 106 and 107-are to be scheduled for departure, one at a time on the hour, from 9:00 a.m. until 3:00 p.m. The schedule must conform to the following requirements:

Flight 101 must depart at 9:00 a.m.

Flight 105 must depart later than flight 103, and also later than flight 102.

Flights 104, 106 and 107 must depart on consecutive hours in that order.

29. If Flight 107 is scheduled to depart at noon, Flight 105 must be scheduled to depart at:

(1) 10:00 a.m. (2) 11:00 a.m. (3) 1:00 p.m. (4) 3:00 p.m.

30. If Flights 103 and 104 are scheduled to depart at 11:00 a.m. and 12 noon, respectively, Flight 102 must be scheduled to depart at:

(1) 9:00 a.m. (2) 10:00 a.m. (3) 1:00 p.m. (4) 2:00 p.m.

31. If Flight 106 is scheduled to depart at 2:00 p.m., Flight 105 must be scheduled to depart at:

(1) 10:00 a.m. (2) 11:00 a.m. (3) 12 noon (4) 1:00 p.m.

32. What is the latest hour at which Flight 102 can be scheduled to depart ?

1. 10:00 a.m. (2) 11:00 a.m. (3) 12 noon (4) 2:00 p.m.

Set 8:

The top four seeded players, Radal, Regor, Yurram and Kovan were being honoured at a dinner function. Each were expected to arrive with their coaches and share their experiences, but one of the player's coach could not make it. The three coaches that could make to the event are Blake, Albert and Victor. Each of the coaches spoke immediately after the player they coached. The first two players to speak in order were Radal and Regor.

33. Among the following which is not an appropriate order of speaking?

(1) Radal, Blake, Regor, Albert, Kovan, Yurram, Victor

(2) Radal, Victor, Regor, Albert, Yurram, Kovan, Blake

(3) Radal, Regor, Albert, Victor, Kovan, Yurram, Blake

(4) Radal, Regor, Blake, Kovan, Victor, Yurram, Albert

34. In case Yurram speaks after Blake, and Blake is the third of the coaches to speak, then among the following statements which would be false?

    (1) Kovan spoke immediately after Albert.

    (2 The order of the first four speakers was Radal, Albert, Regor, Victor.

    (3) Kovan's coach was present at the dinner.

    (4) Blake was the fourth speaker after Radal.

35. Among the following statements, which statement must be true?

    (1) In case the second speaker was a player, the seventh speaker was a coach.

    (2) In case the second speaker was a coach, the seventh speaker was a player.

    (3) In case the third speaker was a coach, the seventh speaker was a player.

    (4) In case the third speaker was a player, the seventh speaker was a coach.

36. In case Blake spoke immediately after Yurram and immediately before Kovan, and Kovan was not the last speaker, then Yurram spoke

    (1) Second (2) Third (3) Fourth (4) Fifth

37. In case Albert is Radal's coach, Victor could be the person who spoke immediately

    (1) prior to Regor (2) prior to Albert (3) prior to Blake (4) after Kovan

38. In case Blake is the third of the coaches to speak, and Yurram is the player whose coach is not present, which among the following statements must be true?

    (1) Blake spoke sometime before Yurram (2) Victor spoke sometime before Kovan

    (3) Yuram spoke sometime before Kovan (4) Kovan spoke sometime before Yurram

Set 9:

A bus has exactly six stops on its route. The bus first stops at stop one and then at stops two, three, four, five, and six respectively. The stops, in alphabetical order, are L, M, N, O, P, and Q.

P is the third stop.
M is the sixth stop.
The stop O is the stop immediately before Q.
N is the stop immediately before L.

39. In case N is the fourth stop, which among the following must be the stop immediately before P?

    (1) O (2) Q (3) N (4) L

40. In case L is the second stop, which among the following must be the stop immediately before M?

    (1) N (2) L (3) P (4) Q

41. In case a passenger gets on the bus at O, rides past one of the stops, and gets off at P, which of the following must be true?

    (1) O is stop one. (2) Q is stop three. (3) P is stop four. (4) N is stop five.

Circular Arrangements

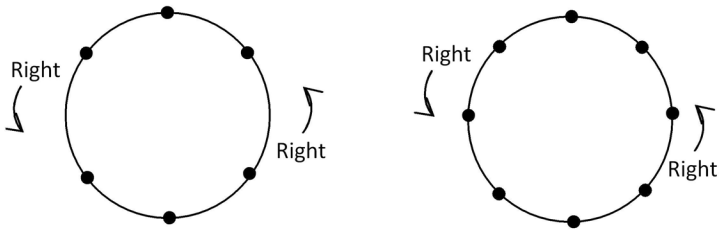
In the previous chapters we have seen linear arrangements. In this assignment we will have a look at Circular Arrangements. The following are the salient differences...

1. There is no start and end to a Circular Arrangement. Thus, the first person can be seated at any position in a circular arrangement, to begin with.

2. The right and left of a person, becomes anti-clockwise and clockwise directions.

3. There are seats that are diametrically opposite

Usually you would have to seat people ranging from 5 to 8 in a circular arrangement. For 6 and 8 people in a circular arrangement, you could use the following figures:



Exercise 3

1. Six persons are sitting around a circular table. Ajay is facing Hemant who is sitting to left of Arvind and right of Sanjay. Suman is to the right of Arvind. If Hemant and Manoj, Arvind and Sanjay mutually exchange their positions, who is now sitting to the right of Manoj?

   (1) Arvind (2) Ajay (3) Suman (4) Sanjay

2. Five persons are sitting facing centre of a circle. Pramod is sitting to the right of Rajan. Raju is sitting between Brijesh and Naveen. Raju is to the left of Brijesh. Who is sitting to the left of Naveen?

   (1) Pramod (2) Raju (3) Brijesh (4) Rajan

Set 1:

Six girls are sitting in a circle. Sonia is sitting opposite to Radhika. Poonam is sitting right of Radhika but left of Deepti. Monika is sitting left of Radhika. Kamini is sitting right of Sonia and left of Monika. Now Deepti and Kamini, Monika and Radhika mutually exchange their positions.

3. Who will be sitting opposite to Sonia?

   (1) Radhika (2) Monika (3) Kamini (4) Sonia

4. Who will be sitting left of Kamini?

   (1) Poonam (2) Deepti (3) Radhika (4) Sonia

5. Who will be sitting left of Deepti?

   (1) Sonia (2) Monika (3) Radhika (4) Poonam

Set 2:

Six friends are sitting around a circular table at equal distance from each other. Sita is sitting two places right of Gita who is exactly opposite to Nita. Nita is on immediate left of Lata, who is exactly opposite to Rita. Mita is also sitting at the table.

6. Who is the only person sitting between Gita and Sita?

   (1) Rita (2) Mita (3) Lata (4) Nita

7. Sita is not sitting at equal distance from:

   (1) Rita and Nita (2) Lata and Gita (3) Mita and Lata (4) All of these.

8. Gita is sitting to the

   (1) left of Mita (2) right of Rita (3) left of Rita (4) right of Nita.

9. The angle subtended by Mita and Nita at the ceneter of the table is:

   (1) 60 degrees (2) 120 degrees (3) 90 degrees (4) 180 degrees

10. Which of the following statements is not correct?

    (1) Mita and Sita are exactly opposite to each other.

    (2) Rita and Mita are at equal distance from Gita.

    (3) Angle subtended by Rita and Mita is same as the angle subtended by Sita and Lata at the centre of the table.

    (4) Mita is on the immediate left of Lata.

Set 3:

Read the following information carefully and answer the questions given below it:

A, *B*, *C*, *D*, *E*, *F*, *G* are playing cards sitting across a circular table and facing inwards.

i) *F* is second to the right of *G*.

ii) *B* is neighbour of *F* but not of *E*.

iii) *E*, the neighbour of *C*, is fourth to the right of *G*.

iv) *D* is immediately between *E* and *A*.

11. Who is fourth to the left of *G*?

    (1) *D* (2) *E* (3) *C* (4) Cannot be determined

12. Who is to the left of *G*?

    (1) *A* (2) *C* (3) *B* (4) Cannot be determined

13. Who are neighbours of *F*?

    (1) *E* and *C* (2) *F* and *B* (3) *A* and *B* (4) *C* and *B*

14. If the turn moves anticlockwise, who would play after B?

    (1) G (2) F (3) D (4) G or F

Tabular Arrangements (more than 2 variables)

So far we had only two variables, a position and a person. Now there would be one more variable. Say, names of four people, say A, B, C and D, the cities they live in, say Mumbai, Delhi, Kolkatta, Chennai and also their professions, say Accountant, Engineer, Lawyer and Doctor.

In questions of these types, read through the data first, specially paying attention to which of the three variables appears the most often in the data given. Use this variable then to form the first row while 'modelling' the given data. If the names of the persons appear most in the data given, write the four given names in the first row and make two more rows below this, one for the cities they live in and one for the professions.

Names: A B C D

Cities:

Professions:

Now read through each of the clue and try to populate the lower two rows.

Do not forgot to 'tie-up' the previously read clues with any new information read in successive clues.

In few of the sets, one of the variables could be the positions in a row or the days of a week. Needless to say, in this case, the first row would be this variable, because they are already fixed relative to each other.

Exercise 4

Set 1:

Six scientists *A*, *B*, *C*, *D*, *E* and *F* have to demonstrate their subjects namely Chemistry, Zoology, Botany, Physics, Geology and Maths. One scientist will demonstrate only one day. Demonstration will start from Monday and will end on Sunday. There will be a day of rest.

Chemistry will immediately follow Geology.

A, who is a mathematician, will demonstrate either on second or last day.

C will demonstrate on third day. Physics will be on the fifth day.

E, who is a zoologist, demonstrates on second day.

B has demonstrated on Monday and the rest day will be immediately after *F*'s demonstration day.

1. On which of the following days no demonstration will take place?
   (1) Friday (2) Wednesday (3) Saturday (4) Sunday
2. On which day Botany will be demonstrated?
   (1) Monday (2) Saturday (3) Wednesday (4) Cannot be determined
3. Geology is immediately preceded by which of the following subjects?
   (1) Zoology (2) Maths (3) Botany (4) Physics
4. Who demonstrates Physics?
   (1) *B* (2) *D* (3) *F* (4) *C*
5. Who among the following demonstrates just after B and just before C?
   (1) *E* (2) *A* (3) *D* (4) Cannot be determined

Set 2:

6 professors *A*, *B*, *C*, *D*, *E* and *F* teach at exactly one of 6 different institutes – XLRI, MDI, IIM A, FMS, IIM B, and IIM L, not necessarily in the same order. They teach exactly one of 6 different subjects – HRM, Business Strategy, Accounts, Financial management, Marketing and Taxation. They have graduated from one of the 6 B-schools – Wharton, Harvard, Stanford, Sloan, Kellogg, AIM. Following information is given:

i) None of the IIM professors are from Sloan.

ii) One, who teaches Accounts graduated from Wharton & he is not A

iii) *B* and *C* teach Business Strategy and HRM respectively.

iv) *D* and *E* teach at XLRI and FMS respectively, but do not teach Accounts.

v) The graduates from Kellogg and Stanford teach Marketing and Financial Management respectively.

vi) Marketing is taught by *D*.

vii) Taxation is taught at MDI and Accounts at IIMA

6. The professor teaching at IIMA is

(1) B (2) C (3) F (4) Cannot be determined

7. Financial management is taught at

(1) XLRI (2) FMS (3) MDI (4) IIM A

8. *B* can teach at which of the following institutions

(1) IIM B (2) IIM L (3) IIM A (4) (1) or (2)

9. *E* has graduated from

(1) Stanford (2) Harvard (3) Wharton (4) AIM

10. Taxation faculty has graduated from

(1) Wharton (2) Harvard (3) Sloan (4) AIM

Set 3:

John is undecided about which movie to watch. He is considering among four movies that were released this week. Each movie belonged to one of the following genres: Romance, Period, Action and Horror. Each of Salman, Hrithik, Aamir and Shah Rukh starred in exactly one of the movies. And the production houses that produced the movies were, Adlabs, Yash-Raj Movies, Red-Chillies and Ramsay Brothers, each production house producing one movie. Further,

I. The movie starring Shah Rukh is produced by Ramsay Brothers.

II. The romantic movie is produced by Red-Chillies.

III. Hrithik stars in the action movie and the movie is not produced by Yash-Raj Movies

IV. The period movie stars Salman

11. The movie produced by Adlabs falls in which genre?

(1) Romance (2) Horror (3) Period (4) Action

12. The movie that stars Shah Rukh is a

(1) Romance (2) Horror (3) Period (4) Action

13. Aamir stars in movie of which production house?

(1) Ramsay Brothers (2) Red-Chillies (3) Adlabs (4) Yash-Raj Movies

14. The romantic movie stars

(1) Shah Rukh (2) Salman (3) Hrithik (4) Aamir

Set 4:

Out of four persons Arun, Bharat, Chandu and Dharma, two are interested in Hockey, two in Cricket, two are painters, one is a singer and one is a dancer. Each young man has one outdoor interest and one hobby concerned with fine arts.

Arun is not a painter nor does he play Hockey.

Bharat does not dance.

The dancer plays Hockey.

Bharat and Dharma do not play Cricket.

15. Who among the following plays Cricket and is a painter?

(1) Arun (2) Bharat (3) Chandu (4) Arun & Chandu

16. Who among the following is a singer?

(1) Dharma (2) Arun (3) Chandu (4) Bharat

17. Which pair shows the correct relationship of the game and hobby of Dharma?

(1) Hockey, Singing (2) Cricket, Dancing (3) Cricket, Painting (4) Hockey, Dancing

Set 5:

There are 6 male players who play 6 different sports- Cricket, Football, Hockey, Tennis, Badminton and Athletics. They are married to 2 Engineers, Doctor, CA, Professor and Housewife, not necessarily in the same order. Each of the 6 couples stay in one of the 6 different cities- Ahmedabad, Bangalore, Kolkata, Delhi, Ernakulam and Indore.

i. The football player is married to an Engineer, but does not belong to either Kolkata or Delhi.

ii. The Doctor and Athlete do not stay in Indore and Ernakulam respectively.

iii. The Hockey player is not married to either Doctor or CA, and his wife is not a housewife either.

iv. One of the Engineers stays in Delhi.

v. The Hockey player, the Tennis player and the Cricketer stay in Kolkata, Indore and Bangalore respectively.

vi. The lady, who stays in Ernakulam, is a housewife.

18. Who is married to the Hockey player?

(1) Engineer (2) CA (3) Doctor (4) Professor

19. In which city does the Doctor stay?

(1) Kolkata (2) Indore (3) Delhi (4) Bangalore

20. Who is married to the Athlete?

(1) Engineer (2) CA (3) Doctor (4) Cannot be determined

21. The CA stays in which city?

(1) Bangalore (2) Ahmedabad (3) Indore (4) Kolkatta

Set 6:

Six families Sharma, Dubey, Joshi, Verma, Agarwal and Mishra plan to go to six different hill stations- Mahabaleshwar, Kullu, Mussorie, Kodaikanal, Simla and Nainital, one family to each hill station. They wish to go in 6 different months- Jan, Feb, Mar, Apr, May and June, one in each month. Two of them travel by bus, two by rail, and one each by car and flight. Following information is given.

i. Mr. Agarwal goes to Mahabaleshwar but not by flight or bus.

ii. Mr. Sharma travels by bus but does not travel in Feb or May.

iii. Neither Mishra nor Dubey family go to Shimla or Mussorie.

iv. Kodaikanal was visited in April.

v. Families going to Kullu and Shimla go by bus and rail respectively.

vi. Mr. Joshi goes to Nainital in Mar by air and Mishra does not travel in April.

22. Who of the following visit Shimla?

(1) Dubey (2) Sharma (3) Mishra (4) Verma

23. Kodaikanal was visited by

(1) Sharma (2) Mishra (3) Dubey (4) Verma

24. Mr. Verma visited

(1) Shimla (2) Mussorie (3) Mahabaleshwar (4) Kodaikanal

25. If Mr. Agarwal traveled in June, Mr. Sharma must have traveled in

(1) January (2) April (3) May (4) February

26. Mr. Sharma visited

(1) Nainital (2) Mussorie (3) Kullu (4) Mahabaleshwar

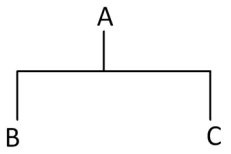
Blood Relations & Family Trees

Generally speaking a family tree is the totality of one's ancestors represented as a tree structure, or more specifically, a chart used in genealogy. For our purpose, i.e. analytical reasoning questions that are asked ion entrance tests and that are based on family tree, representing two or three generations would suffice.

The advised set of notation is the following:

Gender of A unknown	A
A and B are married	A === B
A and B are siblings	A ----- B

B and C are children of A:



Example

A, B, C, D, E and F are six members of a family.

Out of six members, three are male members.

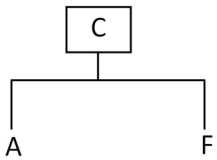
There are two married couples among them.

C is the father of A and F and E is the mother of C.

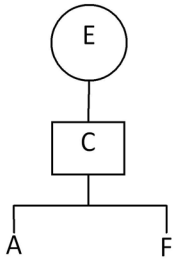
A is the granddaughter of B.

According to the above given information, let's try and make the family tree.

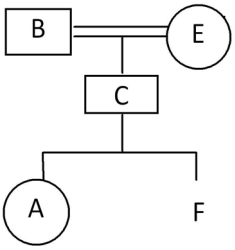
It's given that C is the father of A and F. Hence we know that C is a male. We get,



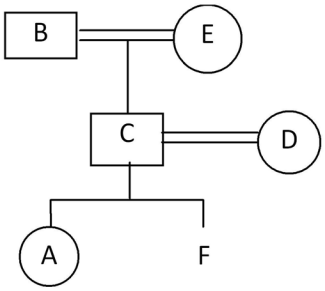
Also E is the mother of C, hence



Also, since A is the granddaughter of B, hence E and B must be a couple. So,



Now the only member left is D and since A and F are siblings, C and D must be the second couple. Since there are 3 male members, so F must be a male too. So we get



Now we have the complete family tree. Let us now try some questions based on this.

1. Which of the following pairs is one of the married couples?

   (1) EF (2) BD (3) EB (4) AF

   From the diagram, we see that married couples are BE and CD. So answer is (3).

2. Who is the husband of E?

   (1) A (2) B (3) C (4) D

   Again, from the diagram its apparent that husband of E is B.

3. How is B related to F?

   (1) Brother (2) Grandfather (3) Husband (4) Data inadequate

   B is the grandfather of F

Exercise 5

1. Pointing towards a person, a man said to a woman, "His mother is the only daughter of your father." How is the woman related to that person?

   (1) Daughter (2) Sister (3) Mother (4) Aunt

2. Pointing to a photograph, a woman says, "This man's son's sister is my mother-in-law". How is the woman's husband related to the man in the photograph?

   (1) Grandson (2) Son (3) Son-in-law (4) Nephew

3. If Neena, a female, says, "Rani's father Ram is the only son of my father-in-law Mohan", then how is Bina, who is the sister of Rani related to Mohan?

   (1) Niece (2) Daughter (3) Wife (4) Grand-daughter

4. Showing the man receiving the prize, Sally said, "He is the brother of my uncle's daughter." How is the man related to Sally?

   (1) Son (2) Nephew (3) Uncle (4) Cousin

5. Introducing a man, a woman said, "His wife is the only daughter of my father." How is that man related to the woman?

   (1) Brother (2) Husband (3) Maternal Uncle (4) Father-in-law

6. Raj told Adwait, "Yesterday I defeated the only brother of the daughter of my paternal grandmother." Whom did Raj defeat?

   (1) Son (2) Father (3) Uncle (4) Father or Uncle

Set 1:

Few of the members of a big family are M, N, O and P.

M is the daughter of N.

N is the son of O

O is the father of P.

7. Among the following statements, which is true?

   (1) O is the uncle of M.

   (2) P and N are brothers

   (3) M is the daughter of P.

   (4) If B is the daughter of N, then M and B are sisters.

8. Which among the following statements is contradictory to the above premises?

   (1) P is the father of M. (2) O has three children.

   (3) M has one brother. (4) M is the granddaughter of O.

9. If B is the son of N and B has one brother, D, then

   I. M is the sister of D. II. D and N are brothers.

   III. O is the grandfather of D.

   (1) I only (2) II only (3) III only (4) I and III only

Set 2:

In a family of exactly six persons M, N, O, P, Q and R, there are two married couples and the following relations exists among the six people. There is no other member in the family other than the above.

P is the grandmother of M and mother of N.

R is the granddaughter of Q.

O is the wife of N and mother of R.

10. How is O related to M?

(1) Daughter (2) Grandmother (3) Mother (4) Cannot be determined

11. How many male members are there in the family?

(1) Two (2) Three (3) Four (4) Cannot be determined

12. Which of the following is true?

(1) M is brother of R (2) M is sister of R

(3) P has two grandsons (4) None of these

13. Who among the following is one of the couples?

(1) OP (2) PQ (3) QN (4) Cannot be determined

Set 3:

All the six members of a family M, N, O, P, Q and R are travelling together. N is the son of O but O is not the mother of N. M and O are a married couple. Q is the brother of O. P is the daughter of M. R is the brother of N.

14. How many male members are there in the family?

(1) one (2) two (3) three (4) four

15. Who is the mother of N?

(1) P (2) R (3) Q (4) M

16. How many children does M have?

(1) one (2) two (3) three (4) four

17. Who is the wife of Q?

(1) M (2) R (3) N (4) Cannot be determined

18. Which of the following is a pair of females?

(1) MQ (2) NP (3) PR (4) MP

19. How is Q related to P?

(1) Father (2) Brother (3) Uncle (4) Cannot be determined

Set 4:

A family consists of 5 members P, Q, R, S and T. T has two sons, an unmarried daughter and a daughter-in-law. P is the brother-in-law of the above mentioned daughter-in-law. Q's sister is not happy with Q's wife. But P and his father support Q's wife, S.

20. Who is the daughter of T?

(1) P (2) Q (3) R (4) S

21. What is the relation of P with S?

(1) Brother (2) Brother-in-law (3) Sister-in-law (4) Sister

22. How is T related to Q?

(1) Father (2) Mother (3) Father-in-law (4) Cannot be determined

23. Who is the wife of Q?

(1) P (2) R (3) S (4) Cannot be determined

24. How is P related to T?

(1) Father (2) Brother (3) Sister (4) None of these

Set 5:

U, V, W, X, Y and Z are members of a family in which there are three generations and two married couples. The different professions in the family are professor, doctor, manager, banker, housewife and lawyer.

(i) Y is married to U who is a professor.

(ii) X, who is a housewife, is the mother of U.

(iii) V is the grandfather of W who is a doctor.

(iv) Y, who is the father of the doctor, is not a banker.

(v) Z is the granddaughter of X and is a manager.

25. Which of the family members is the banker?

(1) Y (2) V (3) W (4) None of these

26. What is the profession of Y?

(1) Manager (2) Doctor (3) Lawyer (4) None of these

27. How many female members are there in the family?

(1) Two (2) Three (3) Four (4) Cannot be determined

28. Who is the husband of the housewife?

(1) W (2) V (3) Z (4) None of these

29. How is W related to Z?

(1) Sister (2) Brother (3) Father (4) Cannot be determined

Set 6:

Five people A, B, C, D, E are related to each other.

Four of them make one true statement each as follows.

Statement 1: B is my father's brother.

Statement 2: E is my mother-in-law.

Statement 3: C is my son-in-law's brother

Statement 4: A is my brother's wife.

30. Who made statement 1?

(1) A (2) B (3) C (4) D

31. Who made statement 2?

(1) B (2) C (3) D (4) E

32. Who made statement 3?

(1) A (2) C (3) D (4) E

33. Who made statement 4?

(1) A (2) B (3) C (4) E

34. Who did not make any statement?

(1) A (2) B (3) D (4) E

Grouping

Grouping questions require you to analyze the variables in terms of which ones can or cannot be together.

Consider an example:

A six person research group is selected from seven candidates – A, B, C, D, E, F and G. The group is selected according to the following restrictions:

If A is selected, then C is selected.

If D is selected, then F is not selected.

In this arrangement, the concept of order or linearity (order of arranging) does not appear; instead, the focus is on placing the variables into a workable group.

Unified Grouping Theory

In analyzing Grouping questions we use a system similar to the one for linear arrangements.

The first step in classifying Grouping questions is to identify whether the set is Defined, Undefined or Partially Defined:

Defined:

In these questions, the exact number of variables to be selected is fixed in the rules. For example, "Exactly six people will be selected to attend a dinner party."

Undefined:

The number of variables to be selected for the set is not fixed, and is only limited by the total number of variables. E.g. A video parlor has ten types of DVDs. It is having a sale on some of these DVDs.

Partially Defined:

There is a minimum and/or maximum number of variables to be selected, but the exact number of variables selected in the game cannot be determined. E.g. Ten candidates applied for a job. Atleast three have to be selected.

In addition, all defined sets can be broken down into following sub-classifications:

Balanced:

The number of variables to be selected is equal to the overall number of available spaces. E.g. Eight students are divided into two four-person study groups.

Unbalanced:

The number of variables to be selected is not equal to the overall number of available spaces. Unbalanced questions are either Overloaded or Underfunded.

Overloaded:

There are extra candidates for the available spaces. For example, nine candidates for a five person research panel.

Underfunded:

There are not enough candidates for the available spaces. This lack is solved by reusing one or more of the candidates. E.g. Seven television advertisements must be aired during two weeks, five advertisements per week.

Thus, a game of 9 candidates for 5 spaces will be classified as Defined (exactly 5 spaces are available), Unbalanced (there are 9 candidates for the 5 spaces) and Overloaded (there are a greater number of candidates than selection spaces).

Diagramming the Groups:

In a diagram, the number of groups being created affects how the groups are shown. E.g. If there is only one group to be diagrammed, as in "There are nine candidates for a five person group, " the group will be displayed horizontally as follows:

___ ___ ___ ___ ___

5 person group

Please note that the spaces are not numbered because being "first" or "second" in the group has no meaning.

In contrast, when there are two or more groups, the diagram will contain both horizontal and vertical elements. If the question states, there are two groups, group 1 and group 2 of four children each, " the two groups will be displayed as follows:

___	___
___	___
___	___
___	___
Grp 1	Grp 1

Representing Conditional Rules:

Conditional reasoning involves sufficient and necessary conditions. A sufficient condition can be defined as an event or circumstance whose occurrence indicates that another event occurred. A necessary condition can be defined as an event or circumstance whose occurrence is required in order for another event to occur.

Sufficient Condition:

If A is selected, then B is selected. Representation: $A \Rightarrow B$

If C is selected, D is not selected. Representation: $C \Rightarrow \not D$

If this is the case then via the contrapositive, it is the case that when D is selected, C is not selected. So it also implies $D \Rightarrow \not C$

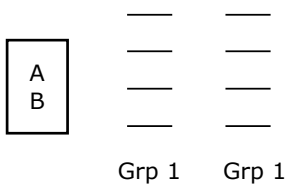
Necessary Condition:

Only if A is selected, can B be selected. Representation: $B \Rightarrow A$

In Grouping representations, we use blocks in three specific situations:

1. When working with diagrams that have vertical components.

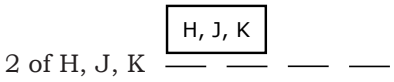
Blocks represent the relationship between the variables in a visually powerful way, and are therefore the best diagramming choice. E.g. In a question involving two groups – group 1 and group 2 – of four children each, A must be in the same group as B, " the diagram is as follows:



2. When diagramming rules that contain three or more variables in a positive or negative grouping relationship, such as "D, F and G cannot all be selected together."

This is diagrammed as: 

3. To represent groups that must occupy a specified number of spaces, such as "In a game where four horses are selected, exactly two horses from H, J and K must be selected." The diagram is:



Let's look at an example now.

E.g. A group of three objects must be selected according to the following conditions:

I. Either K or S or both must be selected.

II. Either O or V must be selected, but neither V nor S can be selected with O.

Following is a diagram for the question: 

According to the conditions, K or S can occupy the third place if it hasn't already been selected. Some other object can also occupy the third place.

1. Which of the following is an acceptable selection of objects?

(1) K, O and S (2) K, S and T (3) K, S and V (4) O, S and V

We know O and S cannot be selected together so option (1) and (4) are not acceptable selection of objects. One of O and V is a must but option ((2) has neither.

Option (3) is acceptable since it satisfies all conditions.

2. Which of the following pairs of objects cannot be both among the objects selected?

(1) K and O (2) K and T (3) O and W (4) T and W

T and W cannot be both among the objects selected because only one place is available. The other two places must be occupied by one of K and S and one of O and V.

3. If S is selected, which of the following must also be among the objects selected?

(1) K (2) O (3) T (4) V

If S is selected, then O cannot be selected. But according to the conditions, one of O and V must be selected hence V must be selected.

4. If V is not selected, which pair of objects must be among those selected?

(1) K and O (2) K and T (3) K and W (4) O and T

If V is not selected, O must be selected. If O is selected, S cannot be selected so K must be selected. Hence K and O must be selected.

> Tip
>
> A smart way to handle questions on grouping is to eliminate options. Thus, rather than actually form all possible groups, one should look at each option turn by turn and check if the group in the option violates any condition. Thus, one can eliminate quite a few options and then focus on the possibility of the remaining ones.

Exercise 6

Set 1:

At a benefit dinner, a community theater's seven sponsors - K, L, M, P, Q, V and Z - will be seated at three tables - 1, 2 and 3. Of the sponsors, only K, L and M will receive honors, and only M, P and Q will give a speech. The sponsors' seating assignments must conform to the following conditions:

I. Each table has at least two sponsors seated at it, and each sponsor is seated at exactly one table.

II. Any sponsor receiving honors is seated at table 1 or table 2.

III. L is seated at the same table as V.

1. Which one of the following is an acceptable assignment of sponsors to tables?

(1) Table 1: K, P; Table 2: M, Q; Table 3: L, V, Z

(2) Table 1: K, Q, Z; Table 2: L, V; Table 3: M, P

(3) Table 1: L, P; Table 2: K, M; Table 3: Q, V, Z

(4) Table 1: L, Q, V; Table 2: K, M; Table 3: P, Z

2. Which one of the following is a list of all and only those sponsors who could be among the sponsors assigned to table 3 ?

(1) P, Q (2) Q, Z (3) P, Q, Z (4) Q, V, Z

3. If K is assigned to a different table than M, which one of the following must be true?

(1) K is seated at the same table as L. (2) L is seated at the same table as Q.

(3) Exactly 2 sponsors are seated at table 1. (4) Exactly 2 sponsors are seated at table 3.

4. If Q is assigned to table 1 along with two other sponsors, which one of the following could be true of the seating assignment?

(1) K is seated at the same table as L. (2) K is seated at the same table as Q.

(3) M is seated at the same table as V. (4) M is seated at the same table as Z.

5. If the sponsors assigned to table 3 include exactly one of the sponsors who will give a speech, then the sponsors assigned to table 1 could include any of the following EXCEPT:

   (1) K (2) M (3) P (4) Z

6. If three sponsors, exactly two of whom are receiving honors, are assigned to table 2, which one of the following could be the list of sponsors assigned to table 1?

   (1) K, M (2) K, Z (3) P, V (4) P, Z

Set 2:

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

I. If both G and S are reduced, W is also reduced.

II. If N is reduced, neither R nor S is reduced.

III. If P is reduced, L is not reduced.

IV. Of the three areas L, M, and R, exactly two are reduced.

7. Which one of the following could be a complete and accurate list of the areas of expenditure reduced by the committee?

   (1) G, L, M, N, W (2) G, L, M, P, W (3) G, M, N, R, W (4) G, M, P, R, S

8. If W is reduced, which one of the following could be a complete and accurate list of the four other areas of expenditure to be reduced?

   (1) G, M, P, S (2) L, M, N, R (3) L, M, P, S (4) M, P, R, S

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

   (1) G, M (2) M, R (3) N, R (4) R, S

10. If both L and S are reduced, which one of the following could be a pair of areas of expenditure both of which are reduced?

    (1) G, M (2) G, P (3) N, R (4) N, W

11. If R is not reduced, which one of the following must be true?

    (1) G is reduced. (2) N is not reduced.

    (3) P is reduced. (4) S is reduced.

12. If both M and R are reduced, which one of the following is a pair of areas of expenditure, neither of which could be reduced?

    (1) G, L (2) G, N (3) L, N (4) L, P

13. Which one of the following areas must be reduced?

    (1) G (2) L (3) P (4) W

Set 3:

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

I. If N is selected, then J is also selected.

II. If M is selected, then neither J nor O can be selected.

III. If X is selected, then neither Z nor P can be selected.

IV. If both J and O are selected, then J is played at some time before O.

V. X cannot be played on the fifth Sunday unless one of Rodrigo's concertos is played on the first Sunday.

14. Which one of the following is an acceptable selection of concertos that the soloist could play on the first through the sixth Sunday in the given order?

(1) H Z M N Y K (2) K J Y O Z N (3) K Y P J Z M (4) P Y J H X O

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

(1) J (2) K (3) O (4) Y

16. If J, O, and Y are the first three concertos to be played, not necessarily in the order given, which one of the following is a concerto that CANNOT be played on the fifth Sunday?

(1) X (2) K (3) N (4) P

17. If O is selected for the first Sunday, which one of the following is a concerto that must also be selected?

(1) J (2) K (3) M (4) N

18. Which one of the following is a concerto that must be selected?

(1) J (2) K (3) O (4) Y

19. Which one of the following is a concerto that CANNOT be selected together with N?

(1) M (2) O (3) P (4) X

Set 4:

An art teacher will schedule exactly six of eight lectures - Fresco, History, Lithography, Naturalism, Oils, Pastels, Sculpture, and Watercolors - for three days - 1, 2, and 3. There will be exactly two lectures each day - morning and afternoon. Scheduling is governed by the following conditions:

I. Day 2 is the only day for which Oils can be scheduled.

II. Neither Sculpture nor Watercolors can be scheduled for the afternoon.

III. Neither Oils nor Pastels can be scheduled for the same day as Lithography.

IV. If Pastels is scheduled for day 1 or day 2, then the lectures scheduled for the day immediately following Pastels must be Fresco and History, not necessarily in that order.

20. Which one of the following is an acceptable schedule of lectures for days 1, 2, and 3, respectively?

(1) Morning: Lithography, History, Sculpture Afternoon: Pastels, Fresco, Naturalism

(2) Morning: Naturalism, Oils, Fresco Afternoon: Lithography, Pastels, History

(3) Morning: Oils, History, Naturalism Afternoon: Pastels, Fresco, Lithography

(4) Morning: Sculpture, Lithography, Naturalism Afternoon: Watercolors, Fresco, Pastels

21. If Lithography and Fresco are scheduled for the afternoons of day 2 and day 3, respectively, which one of the following is a lecture that could be scheduled for the afternoon of day 1?

(1) History (2) Oils (3) Pastels (4) Sculpture

22. If Lithography and History are scheduled for the mornings of day 2 and day 3, respectively, which one of the following lectures could be scheduled for the morning of day 1?

(1) Fresco (2) Sculpture (3) Oils (4) Pastels

23. If Oils and Lithography are scheduled for the mornings of day 2 and day 3, respectively, which one of the following CANNOT be scheduled for any day?

(1) Fresco (2) History (3) Naturalism (4) Pastels

24. If neither Fresco nor Naturalism is scheduled for any day, which one of the following must be scheduled for day1?

(1) History (2) Lithography (3) Oils (4) Pastels

25. If the lectures scheduled for the mornings are Fresco, History, and Lithography, not necessarily in that order, which one of the following could be true?

(1) Lithography is scheduled for day 3. (2) Naturalism is scheduled for day 2.

(3) Fresco is scheduled the same day as Naturalism.

(4) History is scheduled the same day as Oils

Set 5:

The office staff of XYZ corporation presently consists of three book-keepers–A, B, C and 5 secretaries D, E, F, G, H. The management is planning to open a new office in another city using 2 book-keepers and 3 secretaries of the present staff. To do so they plan to separate certain individuals who don't function well together. The following guidelines were established to set up the new office.

I. Book-keepers A and C are constantly finding fault with one another and should not be sent together to the new office as a team

II. C and E function well alone but not as a team, they HAVE to be separated

III. D and G have not been on speaking terms and should not be sent to the new place together.

IV. Since D and F have been competing for a promotion, both of them should not be sent together.

26. If A is to be moved as one of the book-keepers, which of the following cannot be a possible working unit.

(1) A, B, D, E, H (2) A, B, D, G, H (3) A, B, E, F, H (4) A, B, E, G, H

27. If C and F are moved to the new office, how many combinations are possible

(1) 1 (2) 2 (3) 3 (4) 4

28. If C is sent to the new office, which member of the staff cannot go with C

(1) B (2) D (3) F (4) G

29. Under the guidelines developed, which of the following must go to the new office

(1) B (2) D (3) E (4) G

30. If D goes to the new office, which of the following is/are true?

I. C cannot go II. A cannot go III. H must also go

(1) I only (2) II only (3) I and II only (4) I and III only

Set 6:

A group of three or four has to be selected from seven persons. Among the seven are two women: Fiza and Kavita, and five men: Ram, Shyam, David, Peter and Rahim.

i. Ram would not like to be in the group if Shyam is also selected.

ii. Shyam and Rahim want to be selected together in the group.

iii. Kavita would like to be in the group only if David is also there.

iv. David, if selected, would not like Peter in the group.

v. Ram would like to be in the group only if Peter is also there.

vi. David insists that Fiza be selected in case he is there in the group.

31. Which of the following is a feasible group of three ?

(1) David, Ram, Rahim (2) Peter, Shyam, Rahim

(3) Kavita, David, Shyam (4) Fiza, David, Ram

32. Which of the following is a feasible group of four ?

(1) Ram, Peter, Fiza, Rahim (2) Shyam, Rahim, Kavita, David

(3) Shyam, Rahim, Fiza, David (4) Fiza, David, Ram, Peter

33. Which of the following statements is true ?

(1) Kavita and Ram can be part of a group of four

(2) A group of four can have two women

(3) A group of four can have all four men

(4) None of these

Set 7:

Seven friends T, N, P, M, R, F and K have to travel by car. Two cars are available.

I. T must travel in the same car as R.

II. F cannot be in the same car as P unless M is also in the car.

III. Not more than 4 people can travel in a car.

IV. Neither N nor P can be assigned to the same car as K.

34. If N travels in the same car as R and T, then who can be the fourth person in the car?

(1) P only (2) M only (3) either F or M (4) P or F or M

35. If F and P travel in the same car, then who else of the following could be in the same car?

(1) T (2) R (3) K (4) N

36. Which of the following can be the combination of passengers in any one car?

(1) T-K-R-M (2) F-P-M-K (3) T-F-P-M (4) None of these

37. If car containing only 3 people has to include K, which of the following persons cannot be present in that car?

(1) T (2) F (3) M (4) All these can be present

38. If F and P are in the same car, how many passengers can be present in that car?

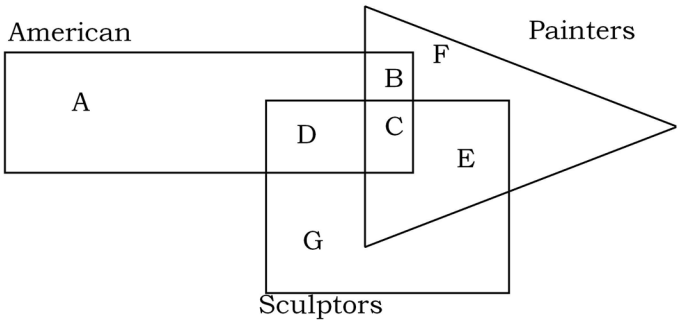
(1) 3 only (2) 4 only

(3) either 3 or 4 (4) F & P cannot be in same car.

Miscellaneous - Exercise 7

Set 1:

The rectangle, square and triangle refers to Americans, Sculptors and Painters respectively. Different regions of the diagram, representing different combinations of the above three characteristics are lettered from 'A' through 'G'. Read the statements of the questions given below the diagram and write down the letter of the region which represents the given statement.



1. Americans who are painters but not sculptors

   (1) B (2) C (3) D (4) A

2. Painters who are neither Americans nor sculptors

   (1) B (2) C (3) E (4) F

3. Non-American painters and sculptors

   (1) C (2) E (3) F (4) G

4. Americans who are sculptors but not painters

   (1) A (2) D (3) C (4) G

5. Americans who are sculptors as well as painters

   (1) A (2) C (3) D (4) E

6. Non American sculptors who are not painters

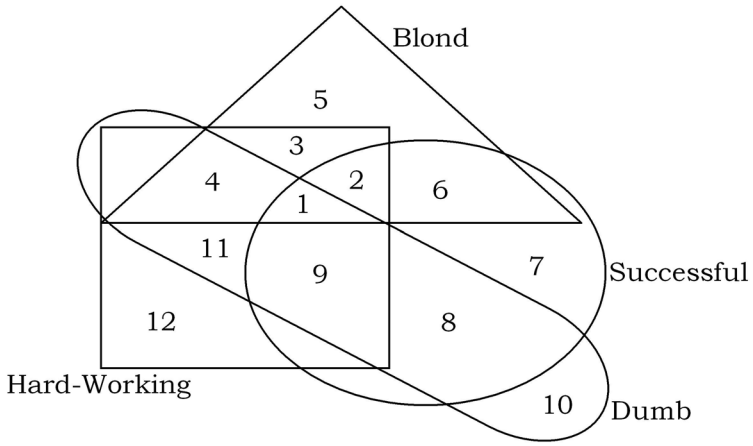
   (1) D (2) C (3) E (4) G

7. Americans who are neither painters nor sculptors

   (1) A (2) D (3) B (4) C

Set 2:

Study the diagram given below and answer the following questions.



8. Blond, hard-working, successful but dumb people are indicated in the diagram by

(1) 1 (2) 2 (3) 3 (4) 9

9. Hard working but dumb people who are neither blond nor successful are indicated by

(1) 9 (2) 4 (3) 10 (4) 11

10. Blond and successful people who are neither dumb nor hard working are indicated by

(1) 5 (2) 6 (3) 7 (4) 3

11. Unsuccessful blond people who are dumb and hard working are indicated by

(1) 3 (2) 4 (3) 11 (4) 1

12. Hard working people who are neither blond nor successful and are not dumb too are indicated by

(1) 4 (2) 11 (3) 9 (4) 12

13. Successful, hard working and dumb people but not blond are indicated by

(1) 8 (2) 9 (3) 11 (4) 12

14. Successful people who are neither dumb nor hard working and neither blond are indicated by

(1) 6 (2) 7 (3) 8 (4) 10

15. Successful and hard-working blond people who are not dumb are indicated by

(1) 2 (2) 3 (3) 6 (4) 1

16. Blond and hard-working people who are neither successful nor dumb are indicated by

(1) 5 (2) 3 (3) 4 (4) 11

Set 3:

Two or more essences out of a stock of five essences – L, M, N, O, and P are used in making all perfumes by a manufacturer. He has learned that for a blend of essences to be agreeable it should comply with all the rules listed below.

i. A perfume containing L, should also contain the essence N, and the quantity of N should be twice as that of L.

ii. A perfume containing M, must also have O as one of its components and they should be in equal proportion.

iii. A single perfume should never contain N as well as O.

iv. O and P should not be used together.

v. A perfume containing the essence P should contain P in such a proportion that the total amount of P present should be greater than the total amount of the other essence or essences used.

17. Among the following which is an agreeable formula for a perfume?

(1) One part L, one part P (2) Two parts M, two parts L

(3) Three parts N, three parts L (4) Four parts O, four parts M

18. Adding more amount of essence N will make which of the following perfumes agreeable?

(1) One part L, one part N, five parts P (2) Two parts M, two parts N, two parts P

(3) One part M, one part N, one part P (4) Two parts M, one part N, four parts P

19. Among the following, the addition of which combination would make an unagreeable perfume containing two parts N and one part P agreeable?

(1) One part L (2) One part M

(3) Two parts N (4) Two parts P

20. Among the following which combination cannot be used together in an agreeable perfume containing two or more essences?

(1) L and M (2) L and N (3) L and P (4) M and O

21. Among the below mentioned formulas, which can be made agreeable by the eliminating some or all of one essence ?

(1) One part L, one part M, one part N, four parts P

(2) One part L, two parts N, one part O, four parts P

(3) One part L, one part M, one part O, one part P

(4) Two parts L, two parts N, one part O, two parts P

Set 4:

There are three on-off switches on a control panel A, B, and C. They have to be changed from an initial setting to a second setting according to the following conditions:

i. In case only switch A is the switch on in the initial setting , then turn on switch B.

ii. In case switches A and B are the only switches on in the initial setting, then turn on switch C.

iii. In case all the three switches are on initially setting, then turn off the switch C.

iv. For any other initial setting, turn on all switches that are off and turn off all switches, if any, that are on.

22. In case in the initial setting the switches A and B are on and the switch C is off, then what could be the second setting?

    (1) A on, B on, C on. (2) A on, B off, C on. (3) A on, B off, C off. (4) A off, B on, C off.

23. In case switch B is the only switch on in the initial setting, what must be the second setting?

    (1) A on, B on, C on. (2) A on, B on, C off. (3) A on, B off, C on. (4) A off, B off, C on.

24. In case all the three switches are on in the second setting, which among the following could have been the initial setting?

    (1) A on, B on, C on. (2) A on, B on, C off. (3) A on, B off, C on. (4) A on, B off, C off.

25. In case switch A is off in the second setting, which among the following could have been the initial setting ?

    (1) A on, B on, C on. (2) A on, B on, C off. (3) A on, B off, C on. (4) A on, B off, C off.

26. In case only switch B is on in the second setting, which among the following could have been the initial setting ?

    (1) A on, B on, C on. (2) A on, B off, C on. (3) A off, B on, C off. (4) A off, B off, C on.

27. Which among the following initial settings leads to a second setting, where only one switch is off?

    (1) A on, B on, C off. (2) A on, B off, C on. (3) A off, B on, C on. (4) A off, B on, C off.

Set 5:

Read the following statements carefully and answer the questions that follow.

i. Mohan and Ram play hockey and football. ii. Edward and Ram play football and cricket.

iii. Mohan and Rafiq play tennis and hockey. iv. Rafiq and Edward play cricket and tennis.

28. Name the boy who plays hockey, football and tennis.

    (1) Edward (2) Ram (3) Mohan (4) Rafiq

29. Name the boy who plays hockey, football and cricket.

    (1) Ram (2) Mohan (3) Rafiq (4) Edward

30. Name the boy who plays hockey, cricket and tennis.

    (1) Mohan (2) Ram (3) Rafiq (4) Edward

Mathematical & Logical Reasoning - Exercise 8

Set 1:

All the faces of a solid cube of side 3 inches are painted red. Then each edge of the cube is cut into three equal segments of 1 inch each resulting in cubes of side 1 inch being formed.

1. How many small cubes of 1 inch sides are formed?

   (1) 3 (2) 8 (3) 9 (4) 27

2. How many of these small 1 inch cubes have three of their faces painted?

   (1) 3 (2) 8 (3) 9 (4) 27

3. How many of these small 1 inch cubes have two of their faces painted?

   (1) 36 (2) 12 (3) 24 (4) 8

4. How many of these small 1 inch cubes have one of their faces painted?

   (1) 6 (2) 8 (3) 12 (4) 9

5. How many of these small 1 inch cubes have none of their faces painted?

   (1) None (2) 1 (3) 3 (4) 6

Set Theory

The following two sets are based on Set Theory. This is covered in the maths book and we would strongly urge you to have finished studying that chapter before attempting the following two sets. Just to recap …

If we are talking of two sets, set of people who drink coffee, say C, and set of people who drink tea, say T, then …

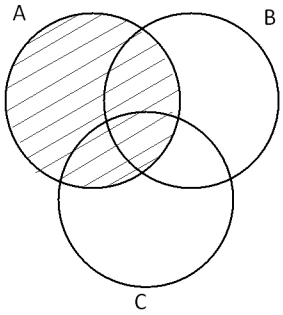
Intersection of the two sets, denoted by $C \cap T$, is set of people belonging to both the above sets i.e. people who drink coffee **AND** tea

Union of the two sets, denoted by $C \cup T$, is set of people belonging to either (atleast one) of the two sets i.e. people who drink tea **OR** coffee. In counting the number of members of this set a person who drinks both coffee and tea is counted only once and not twice.

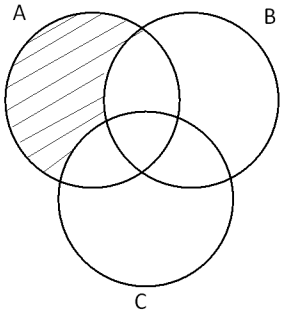
And the relation we have is $n(C \cup T) = n(C) + n(T) - n(C \cap T)$

For the case of three sets, use of venn diagram is preferred.

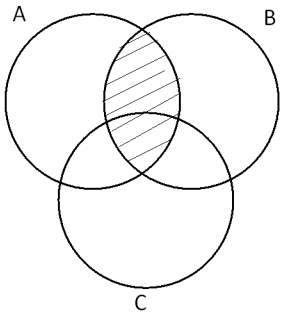
Set of people preferring A is the entire circle A.



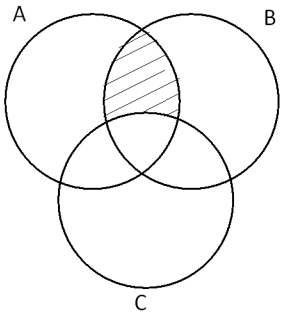
If we want to refer to the shaded area, we use 'set of people preferring *only* A'



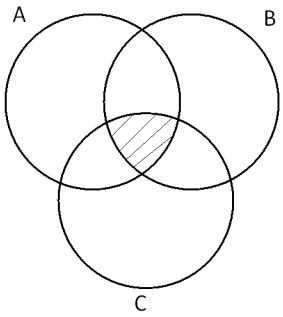
Set of people preferring A and B is the entire shaded area shown below, $A \cap B$



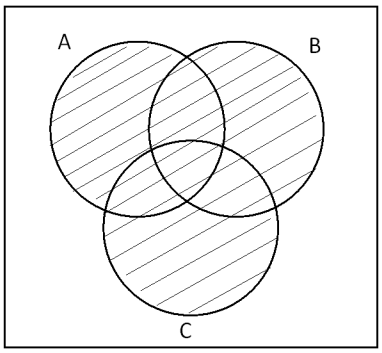
If we want to refer to the shaded area, we use ''set of people preferring *only* A and B'



Set of people preferring all three, A, B and C is the entire shaded area shown below, $A \cap B \cap C$



The 'union $A \cup B \cup C$ 'or 'people preferring A or B or C' or 'those preferring atleast one' is the entire shaded area



The rectangle represents all the people i.e. the sample space. The area outside the shaded portion i.e. outside the union represents people who play none of the three sports.

But if you are adept with the equation, it will help you solve questions faster. And the equation is

$$n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(A \cap C) + n(A \cap B \cap C)$$

Set 2:

In a class of 200 students, the following data is noticed about the sports that the students play:

100 play Cricket, 80 play Hockey and 120 play Football

60 play Cricket and Hockey, 40 play Hockey and Football and 50 play Cricket and Football

20 play all three sports

6. The number of students who play none of the three sports is:

   (1) 10 (2) 20 (3) 30 (4) Cannot be determined

7. The number of students who play only Cricket is:

   (1) 10 (2) 20 (3) 30 (4) Cannot be determined

8. The number of students who play exactly two out of the three sports is:

   (1) 150 (2) 130 (3) 110 (4) 90

Set 3:

Out of 160 respondents, all of whom subscribe to atleast one of Outlook, Filmfare and Femina, 80 subscribe Outlook, 100 subscribe Filmfare, 60 subscribe Femina. Further 30 subscribe Outlook and Filmfare, 40 subscribe Filmfare and Femina and 20 subscribe Outlook and Femina.

9. The number of respondents who subscribe all three magazines are:

   (1) 5 (2) 10 (3) 15 (4) 20

10. The number of respondents who subscribe exactly two magazines are:

    (1) 90 (2) 80 (3) 70 (4) 60

11. The number of respondents who subscribe exactly one magazine are:

    (1) 90 (2) 80 (3) 70 (4) 60

Directions for questions 12 to 20: Answer each question independently

12. The flowers in a basket become double every minute. In one hour, the basket becomes full. After how many minutes, the basket would be half filled?

    (1) 30 (2) 45 (3) 58 (4) 59

13. I am proceeding towards North. I take a turn to my right. After some time I take a turn to my left and again to my left. Then I go to my right. After some distance I again turn towards my right. The direction in which I am moving now is

    (1) East (2) West (3) North (4) South

14. If A runs faster than E but not as fast as D and D runs faster than C but not as fast as B, then the person who runs the fastest is

    (1) A (2) B (3) D (4) E

15. A person is to go up a tree 60 ft high. In every second, he climbs 5 ft but slips 4 ft. After how many seconds will he be able to touch the top of the tree?

    (1) 60 (2) 59 (3) 56 (4) 58

16. At 6′o clock, a clock ticks 6 times. The time between first and last ticks is 30 seconds. How long does it tick at 12′o clock?

    (1) 55 sec (2) 60 sec (3) 1 min 5 sec (4) 1 min 6 sec

17. Vipul was studying for his examinations and the lights went off. It was around 1:00 AM. He lighted two uniform candles of equal length but one thicker than the other. The thick candle is supposed to last six hours and the thin one two hours less. When he finally went to sleep, the thick candle was twice as long as the thin one. For how long did Vipul study in candle light?

    (1) 1 hr (2) 2 hrs (3) 3 hrs (4) 3.5 hrs

18. In a group of 30 people, all of whom are mad or sad, 20 are mad and 15 are sad. How many people are sad but not mad?

    (1) 5 (2) 10 (3) 15 (4) 20

19. While we were on vacation, either it rained in the morning or in the evening, but on no day did it rain both the times and no day was clear in both morning and evening. If in all there were 15 clear mornings and 20 clear evenings, how long was our vacation?

    (1) 35 (2) 30 (3) 25 (4) 20

20. As a part of our exercise regime that lasted just for 15 days, we either did yoga or aerobics. On a day we would engage in just one of these activities and on some days when we were lazy, we did neither. If in all there were 8 days we did not do yoga and 12 days we did not do aerobics, how many days did we do neither?

    (1) 5 (2) 3 (3) 7 (4) 10

Set 4:

The following is a partially completed result table of a football tournament played between three teams A, B and C. Each team has played one match against the other team:

Team	Matches Played	Matches Won	Matches Lost	Matches Drawn	Goals For	Goals Against
A	2	2				1
B	2			1	2	4
C	2				3	7

'Goals For' is the number of goals the team has scored and 'Goals Against' is the number of goals scored by opponents against the team.

21. The number of matches that team C has drawn is:

    (1) 0 (2) 1 (3) 2 (4) Cannot be determined

22. If each team receives 2 points for a win, 1 point for a draw and 0 points for a loss, the team which finished lowest in the ranking is:

    (1) A (2) B (3) C (4) Both B and C

23. How many goals were scored by team A?

    (1) 5 (2) 7 (3) 9 (4) Cannot be determined

Set 5:

Three criminals were arrested for shop lifting. One of them took the goods out of the shop while one of them created a diversion. The third criminal drove the car. When interrogated, each of them made two statements. However, only one of them told the truth in both his statements, while each of the other two told one true statement and one lie.

The statements were:

ALBERT: Clive drove the car. Bruce created the diversion.

BRUCE: Albert drove the car. I created the diversion.

CLIVE: I took the goods out of the shop. Bruce drove the car.

24. Who spoke both the true statements?

(1) Albert (2) Bruce (3) Clive (4) Cannot be determined

25. Who took the goods out of the shop?

(1) Albert (2) Bruce (3) Clive (4) Cannot be determined

Set 6:

Shahrukh speaks truth only in the morning and lies in the afternoon, whereas Salman speaks truth only in the afternoon and lies in the morning. One out of A and B is Shahrukh and other is Salman. A says that B is Shahrukh.

26. What time of the day is the statement made?

(1) Morning (2) Afternoon (3) Cannot be determined

27. Who is A?

(1) Shahrukh (2) Salman (3) Cannot be determined

Set 7:

Three friends A, B and C play a series of three betting games among them, such that the loser of the game has to double the money of the other two friends i.e. pay each of the other two friends as much money as they already have. Each of them starts with a different amount and in total they had Rs. 72 between themselves at the start. A lost the first game, B lost the second game and C lost the third game. After the three games it was found that all of them had the same amount.

28. What amount did A start with?

(1) Rs. 12 (2) Rs. 27 (3) Rs. 39 (4) Rs. 48

29. What amount did B start with?

(1) Rs. 21 (2) Rs. 27 (3) Rs. 39 (4) Rs. 48

30. What amount did C start with?

(1) Rs. 12 (2) Rs. 27 (3) Rs. 39 (4) Rs. 48

31. At any point in the series of the three games, what is the maximum amount that any player had?

(1) Rs. 42 (2) Rs. 48 (3) Rs. 39 (4) Cannot be determined

Set 8:

A shopkeeper has kept the minimum number of weights that are required so as to measure every integral weight from 1 kg to 120 kgs. He uses a pan balance and can keep the weights in one of the pans only.

32. What is the number of weights that he has?

(1) 6 (2) 7 (3) 8 (4) 9

33. If he has to measure 100 kgs, how many weights does he have to use?

(1) 3 (2) 4 (3) 5 (4) 6

Set 9:

A shopkeeper has kept the minimum number of weights that are required so as to measure every integral weight from 1 kg to 120 kgs. He uses a pan balance and while measuring he can keep the weights in both of the pans if required.

34. What is the number of weights that he has?

(1) 3 (2) 4 (3) 5 (4) 6

35. If he has to measure 100 kgs, how many weights does he have to use?

(1) 3 (2) 4 (3) 5 (4) 6

Set 10:

I have one ninety-six 1 Re coins with me. I need to divide the coins into bags such that if needed I can tender any amount from Re 1 to Rs. 96 by just handing over certain number of bags i.e. I do not want to open any bags.

36. What is the least number of bags that will be needed?

(1) 7 (2) 8 (3) 11 (4) 13

37. If I have to tender Rs. 80, how many bags would I have to give?

(1) 3 (2) 4 (3) 5 (4) 6

Directions for 38 to 40: Answer each question independently.

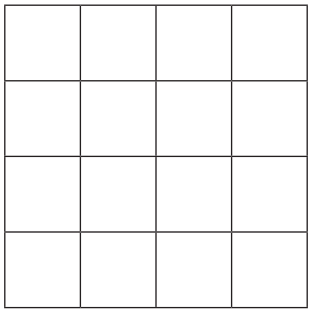
38. I have 64 identical looking coins. But then one of them is a counterfeit coin and weighs more than the others. I also have a pan balance with me. What is the minimum number of weighing needed to identify the faulty coin?

(1) 3 (2) 4 (3) 5 (4) 6

39. I have 64 identical looking coins. But then one of them is a counterfeit coin and weighs 11 gms whereas all other are authentic and weigh 10 gms. I also have a spring balance with me. What is the minimum number of weighing needed to identify the faulty coin?

(1) 3 (2) 4 (3) 5 (4) 6

40. The number of squares in the following figure is:



(1) 16 (2) 25 (3) 30 (4) 36

Coding-Decoding

In this a certain word is coded based on a certain code. The coding is broadly in two ways:

– alphabets could be coded with another alphabet, number or symbol

– position of alphabets could be changed within themselves

Quite often both the above are techniques are used.

The first aspect to check is if the same alphabets are used. If yes, then mostly, only the positions are changed. These types are easier to decode.

E.g.: If ACROPOLIS is coded as RACOOPSLI, what would ACROBATIC be coded as?

Since the alphabets in ACROPOLIS and the code RACOOPSLI are the same, we can deduce that the code is in re-arranging the alphabets.

Common themes in re-arranging alphabets

There are numerous way, the following lists a few of them. And the above example is a tough one in re-arrangements

1. Writing the word backwards.

This is the most easiest way. Thus, ACROPOLIS will be coded as SILOPORCA.

2. Maintaining the order of words but having a cyclic arrangement among them

ACROPOLIS is coded as SACROPOLI, where each letter is moved 1 place to the right and the rightmost letter is moved to the start.

If the letters were moved two places to the right, we would get ISACROPOL

3. Changing the order among pairs of alphabets.

The way the pairing of the alphabets is done, can be innovative. See the following examples for few ideas.

AC RO P OL IS is coded as CA OR P LO SI

A *C R* O P O *L I* S is coded as ORCA P SILO (here the underlined pairs are interchanged and the italics pair are interchanged.

Instead of inter-changing pairs of words, groups of three alphabets could also be re-arranged.

And this is the case in our question i.e. ACROPOLIS is coded as RACOOPSLI

The way to identify this is by observations only and the realisation that the first three alphabets of both the word and code are A, C & R and similar is the case with the last three letter i.e. L, I & S.

Thus, the word is first divided into sets of three alphabets, A C R O P O L I S, and then a cyclic movement among each set where alphabets are moved one place to the right within each group, to result in R A C O O P S L I.

Thus, the way ACROBATIC would be coded is RAC AOB CTI

Common themes in substituting alphabets

Usually alphabets are substituted by other alphabets

If symbols are used, then since there is no order of symbols, multiple logics of coding can be framed and hence these types are not popular in exams.

Similarly if numbers are used, then it is difficult to identify if the code 1234 is to be read as a four digit code i.e. 1 2 3 4 or a three digit code as 12 3 4 or 1 23 4. Thus, this method is also avoided in exams. However one approach here is very common i.e. a word is coded as a mathematical operation among the numbers that denote the position of the alphabet in the alphabetical listing. E.g. If NAME is coded as 33, what will GIRL be coded as?

N, A, M and E occupy the 14^{th}, 1^{st}, 5^{th} and 13^{th} position in the alphabetical listing. A little thought of linking 33 with 14, 1, 5 and 13 will immediately lead to the fact that 33 = 14 + 1 + 5 + 13.

Thus, GIRL will be coded as 7 + 9 + 18 + 12 = 46.

Alphabets substituted by other alphabets

This is most common in exams.

1. Substituted by succeeding or preceding neighbours

Alphabets could be replaced with their neighbours in the alphabetical listing, either following or preceding or a mix.

This can be identified if once realises that the original word has B, H and P and the coded word has C, I and Q in it. Thus, you would have to observe the code carefully. Please note that the code need not come in the same place as the original alphabet. One could also be using the above techniques of changing the order, in addition to substituting the alphabets.

2. A pair of alphabets substituted for each other.

In this case, all the alphabets may be formed into 13 pairs and within a pair, one alphabet is substituted with the other one.

Simple case of pairing is AB CD EF GH .... WX YZ. Now A is substituted by B and B by A. So on in the other pairs.

Another common way of pairing is pairing of alphabets that occupy the same numeric position counted from start and counted from end e.g. A and Z are substituted for each other, B and Y are substituted for each other, C and X and so on. The best way to identify this case is to be a little familiar with the following pairing:

A	B	C	D	E	F	G	H	I	J	K	L	M
Z	Y	X	W	V	U	T	S	R	Q	P	O	N

Exercise 9

1. If ANIMAL is written as LAMINA, then HUMAN is written as
   (1) MANUH (2) NAMUH (3) NUMAH (4) MUHAN
2. If NOTEBOOK is written as LPPCFUPO, then LAPTOP is coded as
   (1) MBQUPQ (2) MBQPQU (3) QPUQBM (4) PUQBQM
3. If ORANGE is coded as RONAEG, then BANANA is coded as
   (1) ANANAB (2) ABANAN (3) NANABA (4) NABANA
4. If ALGEBRA is coded as BNJIGXH, then GEOMETRY is coded as
   (1) HFRQIAZG (2) GGRQIAZG (3) GFQPIXYE (4) HGRQJZYG
5. If ORDINARY is coded as BEQVANEL, then SPECIAL is coded as
   (1) HKVHUIO (2) FCPRNVZ (3) HKRPNVZ (4) FCRPVNY
6. If CODING is coded as XLWRMT, then DECODING is coded as
   (1) VWXLWRMT (2) WUXLWRMT (3) WVXLWRMT (4) WVWRXLMT
7. If MAGAZINES is coded as GAMIZASEN, then NEWSPAPER is coded as
   (1) ENSWAPEPR (2) WENAPSREP (3) WENPASPER (4) ESNPAWPER
8. If TOMATO is coded as WRPDWR, then POTATO is coded as
   (1) SRPDPE (2) RSDWRW (3) SRWDWR (4) RSWDWR
9. In a certain code, YELLOW is coded as 956612, then LOWLY will be coded as
   (1) 62196 (2) 61269 (3) 92196 (4) 91296
10. In a certain code, BUTTER is coded as 123345 and FLY is coded as 678, then FLYER will be coded as
    (1) 45678 (2) 56784 (3) 34567 (4) 67845
11. In a certain code, QUEUE is coded as 46161 and BARON is coded as 23759, then BAROQUE is coded as
    (1) 2357641 (2) 2375461 (3) 2754361 (4) 2754163
12. If 18514 stands for AHEAD, what does 31385 stand for?
    (1) CATCH (2) CASSET (3) CONQUER (4) CACHE
13. In a certain language if 'nso ptr kli chn' stands for 'Sharma gets marriage gift', 'ptr lnm wop chn' stands for 'wife gives marriage gift', 'tti wop nhi' stands for 'he gives nothing', what word in that language would mean 'gives'?
    (1) chn (2) nhi (3) ptr (4) wop
14. In a certain language if 'tee see pee' means 'drink fruit juice'; 'see kee lee' means 'juice is sweet' and 'lee ree mee' means 'he is intelligent', which word in the language means 'sweet'?
    (1) see (2) kee (3) lee (4) pee
15. If in a certain language 'sti nro kti' means 'clouds pour down'; 'nro bsi mit' means 'down he goes' and 'bsi nro zpi' means 'died down he', what word of the language would mean 'goes'?
    (1) nro (2) mit (3) bsi (4) kti

Number Series

Starting with a simple example to familiarise you with the type of questions of number series …

Which number would replace the ? in the following series: 5, 6, 8, 11, 15, 20, ?

To solve questions of this type, one standard way of approaching is to observe the following two aspects:

1. Check if the numbers are increasing or decreasing slowly or by a large magnitude?

E.g. in the series, 50, 52, 55, 60, 67, 78, ? or in the series 50, 46, 38, 26, 10, ?, the numbers of the series are increasing/decreasing relatively more slowly than the series, 2, 6, 30, 260, ? or in the series 2, 5, 10, 50, 500, ?. In the latter two series, towards the end of the series, the numbers suddenly increase by a large magnitude.

If numbers are increasing/decreasing more slowly, then the mathematical operation used would usually be addition or subtraction.

If numbers are increasing very rapidly, then the mathematical operation used would usually be multiplication or powers of numbers (2^2, 3^2, 4^2 or 2^3, 3^3, 4^3 …).

2. Check the differences between consecutive numbers.

The differences between consecutive numbers would usually play a part in series where the numbers are increasing/decreasing at a slower pace.

E.g. The first series with which the chapter was introduced: 5, 6, 8, 11, 15, 20, ?

Observe the pattern in the differences of consecutive terms:

5	6	8	11	15	20	?
	1	2	3	4	5	?

Needless to add, the differences are consecutive natural numbers and hence the next difference will be 6 and the required answer will be 20 + 6 = 26.

E.g. : The next series with numbers increasing slowly was: 50, 52, 55, 60, 67, 78, 91

Again looking at the differences,

50	52	55	60	67	78	91	?
	2	3	5	7	11	13	?

Please note that the differences are not successive odd numbers – the presence of 2 and the absence of 9 should suggest this. In fact the differences are consecutive prime numbers. Thus, the next difference will be 17 and the required number will be 91 + 17 = 108.

E.g. : Looking at the other series with slowly decreasing numbers, 50, 46, 38, 28, 16, ?

The difference between consecutive terms are:

50	46	38	26	10	?	
	4	8	12	16	?	

The differences are multiples of 4. And thus the next difference will be 20 and the required answer will be 10 – 20 = –10

Notice how, the moment multiples have come into picture, the magnitude of decrease (or increase) in the numbers of the series starts becoming larger and larger.

Now, let us look at the series where the numbers increase more rapidly.

E.g. : 2, 6, 30, 260, ?

The increase from 30 to 260 should strike you as an increase that will not be accounted for by differences between terms. Hence one should think of powers of natural numbers.

It would be very good if one is familiar with consecutive powers of 2 and 3:

2, 4, 8, 16, 32, 64, 128, 256, 512, 1024 and 3, 9, 27, 81, 243, 729.

The above series is a difficult one and would take some hit and trial to arrive at the solution. One would have to be acquainted that near 260, we have 256 as a power and not only is it 28 but also 44. Couple this with the fact that 33 is 27, very close to the term 30, one can identify the series as:

$1^1 + 1$, $2^2 + 2$, $3^3 + 3$, $4^4 + 4$, $5^5 + 5$, ...

E.g. : 2, 5, 10, 50, 500, ?

After one tries and realises that the powers of natural numbers close to 10 (32 = 9) or close to 50 (72 =) or there is not power close to 500 and hence the series is not based on powers, the numbers 5, 10, 50, 500 should suggest multiplication. And in the series, the next term is obtained by multiplying the previous two terms: 2, 5, 2 × 5 = 10, 5 × 10 = 50, 10 × 50 = 500, 50 × 500 = 25000,

3. Long series of 8 or more terms

Occasionally the series given will be a very long series and would have a seemingly error in them i.e. the series will not move smoothly (sometimes increase, sometimes decrease, or random behaviour). The fact that the series is unusually long, atleast 8 terms, should alert you to the fact that the series could also be made up of two or more intervening series.

E.g. 3, 10, 7, 8, 11, 6, 15, 4, ?

This series is made up of two series, each being formed by alternate terms: 3, 7, 11, 15, ? and 10, 8, 6, 4.

Since the ? belongs to the first of these two series, the answer would be 19.

Thus, the series could be a mixture of two or even three different/independent series.

Exercise 10

Directions: Find the number that should replace the ? in the following series.

1. 21, 25, 33, 49, 81 ?

   (1) 145 (2) 129 (3) 113 (4) 97

2. 12, 32, 72, 152, ?

   (1) 312 (2) 325 (3) 515 (4) 613

3. 3, 6, 5, 20, 7, 42, 9, ?

   (1) 54 (2) 60 (3) 66 (4) 72

4. 1, 3, 4, 8, 15, 27, ?

   (1) 37 (2) 44 (3) 50 (4) 55

5. 2, 15, 41, 80, ?

   (1) 111 (2) 120 (3) 121 (4) 132

6. 1, 2, 5, 12, 27, 58, 121, ?

   (1) 246 (2) 247 (3) 248 (4) 249

7. 0.5, 0.55, 0.65, 0.8, ?

   (1) 0.9 (2) 0.82 (3) 1 (4) 0.95

8. $11\frac{1}{9}, 12\frac{1}{2}, 14\frac{2}{7}, 16\frac{2}{3}, ?$

   (1) $8\frac{1}{3}$ (2) $9\frac{1}{11}$ (3) 10 (4) 20

9. 11, 10, ?, 100, 1001, 1000, 10001

   (1) 101 (2) 110 (3) 111 (4) None of these

10. 8, 9, 8, 7, 10, 9, 6, 11, 10, ?, 12

    (1) 5 (2) 7 (3) 8 (4) 11

11. 3, 4, 7, 7, 13, 13, 21, 22, 31, 44, ?

    (1) 42 (2) 43 (3) 51 (4) 52

12. 4, 23, 60, 121, ?

    (1) 212 (2) 221 (3) 241 (4) 242

13. 2, 1, 2, 4, 4, 5, 6, 7, 8, 8, 10, 11, ?

    (1) 9 (2) 10 (3) 11 (4) 12

14. 4, 8, 28, 80, 244, ?

    (1) 278 (2) 728 (3) 428 (4) 628

15. 563, 647, 479, 815, ?

    (1) 672 (2) 386 (3) 279 (4) 143

Data Interpretation

Concept 1: Growth Rates

One of the most common themes of questions in Data Interpretation is that of finding the growth rate. Growth rate is just a percentage increase (or a percentage decrease).

E.g. Sales of a company increased from Rs. 150,000 to Rs. 200,000. Find the growth rate of sales.

Think of the two values on a time frame – initially the sales was 150,000 and then it increased to 200,000 .....

$$150,000 \longrightarrow 200,000$$

In this case there is an increase in sales. The percentage by which 200,000 is more **than** 150,000 is the growth rate in this case. As learnt in percentages, the required growth rate will be $\frac{200000-150000}{150000}\times 100$

$= \frac{50,000}{150,000}\times 100$ i.e. 33.33%

E.g.: It was also quite possible that the sales of a company could have decreased from 200,000 to 150,000.

Would the growth rate in this case be the negative of the earlier answer i.e. –33.33%?

No, it would not be so. Hence it is important to think of the two values on a time frame .....

$$200,000 \longrightarrow 150,000$$

In this case there is a decrease in sales. Even this is called a growth rate, the difference being that in this case the growth rate will be negative. But in this case it will be the percentage by which 150,000 is less **than** 200,000 i.e. $= \frac{150,000-200,000}{200,000}\times 100 = \frac{-50,000}{200,000}\times 100$ i.e. –25%.

With Multiple Years

In the above examples, there were only two sales values given. However in Data Interpretation usually a plethora of values would be present. One of the simplest data is regarding sales in a number of consecutive years, as given in the following table .....

Sales of Maruti Cars in India over 2002 – 06					
Year	2002	2003	2004	2005	2006
Sales ('000)	150	170	210	250	270

With such a data, different growth rates could be defined .....

A. Growth rate for a particular year:

What was the growth rate of sales of cars in the year 2006?

In such cases, when only one year is mentioned, it is assumed that the required growth rate is compared to the previous year.

Thus, in the year 2006, the sales grew from 250 (sales in the previous year) to 270. And the required growth rate will be $\frac{270-250}{250}\times 100 = \frac{20}{250}\times 100 = 8\%$

B. Growth rate over a particular time period:

However if the question itself specifies a particular time-period, then appropriate initial and final values have to be taken to calculate the growth rate .....

By what percentage did sales grow over the years 2002 – 2005?

Please read the years carefully, because in such questions, many students just assume the question would be about the first value and the last value. In this case the question asks for the year 2005 and not 2006.

In the year 2002, the sales were 150 and it grew to 250 in the year 2005.

Thus, the required growth rate will be $\frac{100}{150} \times 100 = 66.66\%$

C. Average Annual Growth Rate

Compare the following question with the one just solved: "By what average annual rate did sales grow over the years 2002 – 2005?"

This question is different because of the words: "average annual". It is very liable that one misses these two words altogether and finds the total growth rate as found earlier. So read the question very carefully.

To find the average annual growth rate, we find the total growth rate of the sales over the entire time period given. Next we 'average' out this total growth rate over the number of years elapsed in the given time period to find the 'annual' rate

The total growth rate over the period 2002 – 2005, as found above is $\frac{250-150}{150} \times 100 = \frac{100}{150} \times 100$

= 66.66%

Since this growth of 66.66% is achieved over 3 annual period elapsed, the average annual growth rate of sales over the years 2002-2005 is $\frac{66.66\%}{3} = 22.22\%$

Consider the census population data given in the box above, reproduced here again:

Census:	1981	1991	2001
Population (in mn):	750	900	1100

What was the average annual growth rate of population over the years 1991-2001?

Since the question requires the "average annual" growth rate of the population, the answer will be the total growth rate over the years 1991-2001 divided by the number of years elapsed from 1991-2001.

The total growth rate is already found as $\frac{200}{900} \times 100 = 22.22\%$. The number of years elapsed from 1991 to 2001 is 10 (91-92; 92-93; .....; 2000-01 are 10 annual time periods).

Thus the required average annual growth rate is 2.22%

In reality, a data interpretation set would have a plethora of data involved, even more than the data of sales values over the years 2002-06. In such cases, one just has to be careful about the two underlying values between which the growth rate is asked. So WHILE reading the question itself, one should highlight the two values between which the growth rate is asked. The following example requires you to find the growth rate in a relatively simpler data structure.

Example:

Export of Services across 4 sectors (all values in billion $)

	Travel	Transportation	Labour	Insurance
Jan	0.9	1.1	0.6	2.0
Feb	1.4	0.9	0.9	1.2
Mar	2.2	1.1	1.4	2.4
Apr	2.5	1.1	2.1	2.8
May	2.0	1.6	1.8	2.6

1. Over the period Jan to May, which of the four service sectors – travel, transportation, labour and insurance, has shown the least percentage growth in their exports?

   1. Travel 2. Transportation 3. Labour

   4. Insurance 5. Both Transportation & Insurance

2. What is the growth rate of total exports of the four sectors considered together in the time period Feb to Apr?

   1. 83.33% 2. 87.5% 3. 88.88% 4. 93.18% 5. 99.99%

3. Over the entire five months, Jan to May, by what percentage is the total export of labour services lesser than the total export of travel services?

   1. 16.66% 2. 18.88% 3. 20% 4. 22.22% 5. 24.44%

Solutions:

For Q 1: Growth rate of exports of travel = 1.1/0.9 = 122.22%

Growth rate of exports of transportation = 0.5/1.1 = 45.45%

Growth rate of exports of labour = 1.2/0.6 = 200%

Growth rate of exports of insurance = 0.6/2 = 3/10 = 30%

Thus, least percentage growth has been shown by the sector of insurance.

Before calculating check if there is an obvious answer

For each sector, just looking at the value in the first row and that in the last row should have made it evident that exports of travel services more than doubled and exports of labour services have tripled. Thus, they have grown by a very large percentage and would never be the answers. Thus, we would have to do just two calculations that for transportation and insurance.

Even this could have been avoided by noticing that growth in transportation is 0.5 and that in insurance is 0.6. But transportation grew from a very less base, 1.1, whereas insurance had a much larger base, 2.0. Thus, growth *rate* would obviously be less for Insurance.

For Q. 2 and 3: For such questions involving total across sectors or across time period, you just need to be think, if you have to add across the columns or across the rows.

In Q. 2 we would need to add all values in the row of Feb and that in row of Apr.

Thus, total exports of all 4 sectors in Feb = 1.4 + 0.9 + 0.9 + 1.2 = 4.4

And total exports of all 4 sectors in Apr = 2.5 + 1.1 + 2.1 + 2.8 = 8.5

The required growth rate = 4.1/4.4. Approximating it to 4/4.4 i.e. 10/11 = 90.90%, we know the correct answer has to be greater 90.90%. Thus correct choice is (4)

In Q. 3 we would need to add all values in the column of labour services and that in the column of travel services.

Total exports of labour services for entire period Jan – May = 0.6 + 0.9 + 1.4 + 2.1 + 1.8 = 6.8

Total exports of travel services for entire period Jan – May = 0.9 + 1.4 + 2.2 + 2.5 + 2 = 9

Thus, percentage by which labour services is less *than* travel services = 2.2/9 = 24.44%

Concept 2: Market Share, Basic Pie Charts, Value & Volume

Market Share is another term that one will come across very often in DI. Though the name itself is very self explanatory, for those who are not clear about its meaning a very basic primer on the associated terms follows.

Market

'Market' refers to the aggregation (sum) of all sellers of a particular product. For e.g. the market for automobiles would refer to the total of all automobile manufactures like Maruti, Hyundai, Honda, Ford, Tata, Bajaj, Hero, Volvo, etc. Usually there will be some restriction like 'Indian Car Market'. So here we are talking of only car manufacturers and that too only in India. So this 'market' would refer to the total of all the relevant players in the sector/geographical area.

Market Share of an Individual Player

Share as the meaning suggests is that part of the total market that is made up by the individual player. And it is usually expressed in percentage terms, e.g. 10% of the market. E.g. If total sales of all the cars in India was 20,000 and of these 20,000, sales of Maruti was 8,000, then Maruti's share of the market would have been $\frac{8,000}{20,000} \times 100 = 40\%$

Thus, market share of individual player = $\frac{\text{Sales of that individual player}}{\text{Total sales of all the players}} \times 100$

Needless to add, the sum of market shares of all the individual players has to be 100%, because all of them together account for the entire market i.e. for 100% of the market. Thus, if there are only three players in a particular market and the market share of two of them is 20% and 30%, the rest of the market, 100% – 20% – 30% = 50% has to be the market share of the third player.

The above understanding should be enough to fill in the following table:

Example:

Fill in all the six blank cells in the following table.

Sales of CTVs in India in 2005		
Manufacturer	Sales (Rs. Mn)	Market Share
LG		16.50%
Samsung	180	15%
Videocon	150	
Others		
Total Market		

Solution:

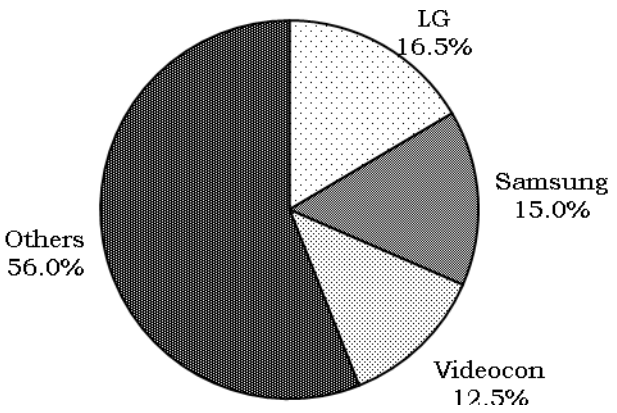
Since Samsung has 15% of the market and this is equal to a sales of Rs. 180 mn, thus market = 180/15 × 100 = 1200. Sales of LG will be 16.5% of 1200 i.e. 198 Rs. mn. Market share of Videocon will be 150/1200 × 100 = 12.5%. Sales of Others can be found by subtracting the sales of all the comanies from the total market i.e. 1200 – 198 – 180 – 150 = 672. And in market share also, we would have 100 – 16.5 – 15 – 12.5 = 56%.

Market & Share could be in Value or Volume terms

The total market could be expressed in different terms. E.g. in the example of the car market, we could have said that altogether 20,000 cars were sold. Here we are talking of number of cars and this is called Volume sales. Alternately we could also have said that the total value of all cars sold is Rs. 1,500 crores. In this case, we are talking of the market in Value terms. Accordingly, based on whether we are talking about volume or value, the market share could also be Volume share or Value Share.

Pie Charts

Pie Charts are the most convenient form to represent any 'Share'. The name, pie, itself suggests an entire pie that is shared among many players. Again most of you would be familiar, that the entire pie, denoted by a circle, refers to the entire market. And this circle is then divided into sectors, each sector representing the individual share of the players. The depiction of market share for the above CTV market and sales values is:



Larger the market share of an individual player, larger will be his sector. Infact, the size of the sector is directly proportional to the market share. Since 'Others' have more than half the market, more than 50%, their sector is also more than half the circle. Thus, the pie chart is a nice visual comparison between all players.

Concept 4: Value, Volume & Price per unit

Earlier in the chapter, it was briefly mentioned that the market (and sales of individual companies) can be expressed in two terms - in the example of the car market, we could have said that altogether 20,000 cars were sold. Here we are talking of number of cars and this is called Volume sales. Alternately we could also have said that the total value of all cars sold is Rs. 1,500 lacs. In this case, we are talking of the market in Value terms. Accordingly market share would also specifically mean share of the value of the market or share of the volume of the market.

The linking factor between sales in value terms (in Rs.) and sales in volume terms (in number of products) is the Price per product. Consider that Maruti sold 20,000 cars and this was equivalent to a sales of Rs. 1,500 crores. It would be obvious that .....

Number of cars × Price per car = Value of cars sold.

Thus, in this case, price per car = $\frac{1500 \times 10^7}{20,000}$ = Rs. 750,000

Needless to say, in reality, this will be the average price per car, since there are many different models being sold at different prices.

Now that we know market shares could be in value terms as well as in volume terms, and we also know the relation between Values Sales and Volume sales as price per unit, we can go ahead with a simple exercise that captures all of this.

Example:

The following table refers to preparatory classes for ACT entrance exam in the city of Poona. The entire preparatory class market in Poona is a fragmented sector with Acumen Classes, Scholar Classes, Topper's Academy, Achiever's Academy and Takshzila being a few players and then there are numerous other players that are all clubbed in as 'Others'. The table gives the data about the number of students at the classes, the revenue (in Rs. millions) and the price per student of their courses. Some cells are intentionally left blank. Your task is to fill in all the blank cells in the table.

	Number of students		Revenue		Product Price
	#	Market Share	Rs. Mn	Market Share	
Acumen Classes					18000
Scholar Classes	2400			30%	
Topper's Academy		9.375%	9		
Achiever's Academy	3200	40.00%			
Takshzila			6	5%	24000
Others	400		3		
Total Market					

Solution:

Volume Share: From Achiever's Academy we know that 40% of number of students = 3200 i.e. $2/5^{th}$ of market = 3200. So the entire market (number of students) = 1600 × 5 = 8000

Number of students with Topper's Academy = 9.375% × 8000 i.e. $9\frac{3}{8}\%$ of 8000 i.e. 75 × 10 = 750.

Volume Market Share of Scholar Classes = 2400/8000 = 30%. And volume market share of Others = 400/8000 = 5%.

In the volume column, only Takshzila and Acumen are left. Knowing any one, we can find the other (by subtracting from the total). Hence here we should have taken help of the product price and value sales. We know both of these for Takshzila. So number of students at Takshzila = $(6 \times 10^6)/24000$ = 250. And its market share will be 250/8000 = 3.125%.

Thus students at Acumen = 8000 – (2400 + 750 + 3200 + 250 + 400) = 8000 – 7000 = 1000. And it's market share = 1000/8000 = 12.5%.

Value Share: From Taskhzila, we know that 5% of the market is Rs. 6 mn. Hence total market is 20 × 6 = Rs. 120 mn.

Sales (in Rs. mn) of Scholar will be 30% × 120 mn = 36.

Market share of Topper's will be 9/120 = 7.5%. Market share of Others = 3/120 = 2.5%.

Since the product price of Acumen is Rs. 18000 and it has 1000 students, its sales (in Rs. mn) will be 18. And it's market share will be 18/120 = 15%

Now the only cells left are that for Others which can be found by subtracting from the total.

Product price can be found by dividing sales (in Rs. mn) by the number of students.

The final table will look like:

	Number of students		Revenue		Product Price
	#	Market Share	Rs. Mn	Market Share	
Acumen	1000	12.5%	18	15%	18000
Scholar	2400	30%	36	30%	15000
Topper's	750	9.375%	9	7.5%	12000
Achiever's	3200	40.00%	48	40%	15000
Takshzila	250	3.125%	6	5%	24000
Others	400	5%	3	2.5%	7500
Total Market	8000	100%	120	100%	15000

Comcept 4: Measures using Ratio: Yield, Productivity, Density, etc.

Ratios are another very useful measure in Data Interpretation. There are a lot of ratios that are used and you would be familiar with most of them. E.g. ratios of the type $\frac{\text{Number of commercial vehicles sold}}{\text{Total number of vehicles sold}}$ or $\frac{\text{Exports to a country}}{\text{Imports from the country}}$ and many more. You would all have worked with these ratios without paying any importance to them. These ratios usually boil down to a percentage (or a percent more/less than) and hence these ratios do not pose any difficulty.

Another type of ratio is a measure of efficiency, and this ratio for beginners may seem to be different from the above ratios. Some of the most common such measures are 'yield', 'productivity', 'capacity utilisation', 'density', etc.

A few of these would be exactly similar to the earlier ratios i.e. would be a percentage value e.g. capacity utilisation = $\frac{\text{Total Production}}{\text{Total Capacity}}$. In this case both production and capacity will be measured in the same units and hence the ratio will boil down to a percentage value. (Please take note that in this case, capacity utilisation can also be more than 100% because the entire 'capacity' available may be being worked on for more time (using overtime) or with more speed than prescribed one)

However there are other ratios that may not be a percent value and will also have some unit to them.

E.g. yield of any crop grown is defined as $\frac{\text{Total Production (in kgs, tons)}}{\text{Area under cultivation (in acre, hectare)}}$. Thus, here yield will be measured in tons/hectare or kgs/acre or similar units.

Similarly 'population density' may be defined as $\frac{\text{Total Population (in numbers)}}{\text{Area (in acre, hectare)}}$. Or as used in Science, density can also be $\frac{\text{Weight (in kgs)}}{\text{Volume (in m}^3\text{)}}$.

Now, all these ratios have basically just three quantities, viz. the numerator, the denominator and the efficiency measure. So we can have three such situations:

1. Both the numerator and denominator values are given in the table/graph/data. And questions are about the yields

2. The numerator and efficiency is given e.g. the production values and capacity utilisation is given and one needs to find the capacity.

In such cases, it is better to re-arrange the relation such that we get a 'formula' of what we need to find, e.g. $\text{Capacity Utilisation (\%)} = \frac{\text{Production}}{\text{Capacity}} \Rightarrow \text{Capacity} = \frac{\text{Production}}{\text{Utilisation (\%)}}$

3. The denominator and efficiency measure is given e.g. Yield and area under cultivation of crop is given. And questions are on production. Again re-arrange the relation so that one can find the production directly e.g. Production = Yield × Area

These are the only three types of situations. So theoretically there is not much to discuss. However, the difficulty again lies when you have to do the above calculation for four or more times in a single question and then compare the results. The way out is to master the calculation techniques. And remember that you do not need to find the exact values to compare. We will take up two solved sets and then you can practice these types of questions in the 5 sets given for practice.

For the following solved example, try out the above questions and then read the solutions that follow. See if you have approached the question in the most efficient manner.

Example:

The following table gives the data about production and area under cultivation for 4 crops across 6 different countries for the year 2006. Production figures are in millions of tonnes and Area under cultivation is expressed in millions of hectares.

Yield for a crop is defined as the ratio of the production value to the area under cultivation for that crop and is expressed in tons/hectare.

Read the table carefully and answer the questions that follow:

	Paddy		Wheat		Maize		Groundnut	
	Production	Area	Production	Area	Production	Area	Production	Area
India	137	43.7	69	26	14.7	7.6	4.9	5.8
China	184	29.4	104	23.4	146	27.1	14.7	4.7
USA	8.8	1.1	57.3	20.3	3.7	1.01	1.5	0.5
Brazil	11.5	2.9	29.5	11.3	42.6	12.6	0.24	0.106
Pakistan	8.1	2.6	21.2	8.4	2.9	1.02	2.2	1.3
World	635	155	606	216	695	144	47.7	22.2

1. In 2006, what was the yield of Maize in Brazil?

   a. 3. 18 b. 3.28 c. 3.38 d. 3.48

2. Which country, among the ones given, had the highest yield of Wheat in the year 2006?

   a. India b. USA c. Brazil d. Pakistan

3. In Brazil, which of the four crops require the least area to produce 1 ton of the crop?

   a. Paddy b. Wheat c. Maize d. Groundnut

4. The yield of Paddy in India was how much percent more or less than the yield of Paddy world-wide?

   a. 32% more b. 32% less c. 24% less d. 24% more

5. If in 2007, the area under cultivation of Groundnut in all the countries remains the same as in 2006, but the yield increases by 10%, what will be the difference in the production of groundnuts in Pakistan and those in USA?

   a. 0.63 b. 0.7 c. 0.77 d. 1.4

6. If in 2007, the production of Wheat world-wide increases by 12.5% and the area under cultivation of Wheat increases only by 10%, what will be the percentage increase in world-wide yield of Wheat?

   a. 2.5% b. 22.375% c. 1.25% d. 2.27%

Solutions:

1. c

Required yield = $\frac{42.6}{12.6}$. One glance at the options will suggest that this will be in the vicinity of 3 and 3.5. A good way to calculate is to express it as mixed fraction and then to approximate the proper fraction involved. Since 126 × 3 = 300 + 78 = 378, we will have $\frac{42.6}{12.6} = 3\frac{48}{126}$. Next, 48/120 is exactly 0.4, thus, the required ratio will be just less than 3.4. This is enough to identify the option choice.

2. b

In this question we have to compare the yields.

One should not immediately start writing all the yields as a fraction. This involves lot of unnecessary writing. One should just glance at the reading and then make some rough approximation. However rough the approximations are, atleast one or two options will be ruled out.

India: Finding orally what multiple of 26 is nearer to 69.

We can orally think that 26 × 2 = 52 and 69 is yet 17 more than 52. Thus, 69 will be more than 2.5 times 26. It will be around 2.68 since 17/26 is just less than 17/25 i.e. 0.68. Now we have a bench-mark, 2.5, to compare other yields with. Remember we want to find the highest yield.

USA: First check to do is to find if the yield is more than the earlier bench-mark, 2.5.

20.3 × 2.5 will be 40.6 + 10.1 i.e. 50.7. But the production of USA is far more than 50.7. In fact the production is 6.6 more, which is considerable. Thus, yield of USA is closer to 3. One can leave it at this level of accuracy or one can also guess that 6.6/20.3 is roughly 1/3 i.e. 0.33 and thus the yield is 2.5 + 0.33 i.e. 2.83.

Brazil: Checking 2.5 times 11.3, we get 22.6 + 5.6 i.e. 28.2. The production is more than this but just slightly. So the yield will not be as much as that of USA.

Pakistan: Checking 2.5 times 8.4, we get 16.8 + 4.2 i.e. 21. The production is almost 21 itself, thus, the yield will be very very marginally more than 2.5, but not as much as that of USA.

Thus, one can identify the answer as USA without the need to write all the four ratios and do detailed conventional calculations.

3. a

The least area to produce 1 ton will be for that crop which has the highest yield. Thus, again yields have to be compared and the highest has to be found.

As learnt in above question, don't write all four yields, just make an estimate first.

Paddy: 11.5 is how many times of 3? Almost 4 times, but lesser than 4.

Wheat: 29.5 is how many times 11.3? Between 2 and 3 times, closer to 3. So this option is ruled out.

Maize: 42.6 is how many times 12.6? This ratio has been found earlier in Q. 1. as 3.8. So this option is also not as great as Paddy and is eliminated.

Groundnut: 0.24 is just 2.4 times 0.1. So this option is also ruled out.

Thus, again without need of detailed calculation, the answer can be found.

4. c

Yield of Paddy in India is 137/43.7

First one should make a rough approximation, by taking round figures if necessary. 137 is more than thrice of 44. Now, one can do more precise calculations with the decimal values. 3 × 43.7 = 131.1. Thus, $\frac{137}{43.7} = 3\frac{5.9}{43.7}$. The fraction part can be approximated in multiple ways, work with whatever comes to your mind first e.g. 6/42 is 1/7 i.e. 0.14. So the fraction part in this case will be lesser than 0.14. Alternately 0.1 times 43.7 is 4.37. Thus the fractional part is little more than 0.1. In either ways the ratio can be found as 3.1 very easily.

World-wide yield is 635/155 i.e. 127/31

Since 31 × 4 = 124, the ratio is $4\frac{3}{31}$ i.e. almost 4.1

We need to find the percent by which 3.1 is more/less than 4.1. And the answer is it is less by 1/4.1 i.e. just less than 25%.

5. c

Since Production = Area × Yield, if the area remains the same and yield increases by 10%, then the production will also increase by 10%.

Rather than find the increased production values of Pakistan and USA, which will need two additions of 10%, and then find the difference, one should realise that the difference will also increase by 10% over the current difference. Thus, the current difference in the production is 0.7 and after a 10% increase it will be 0.77.

6. d

This is a question based more on funda of percentages rather than any data given in the table. Since Yield = $\frac{\text{Production}}{\text{Area}}$. Thus, the new yield will be $\frac{9/8 \times \text{Production}}{11/10 \times \text{Area}}$ i.e. $\frac{9}{8} \times \frac{10}{11} \times \text{Old Yield}$ i.e. 45/44 times old yield. Thus, the yield increases by 1/44 i.e. 9.0909/4% i.e. 2.272%.

Exercise 11

Set 1:

The following table gives the data about India's imports from and exports to the 5 largest trading partners of India for the period 2004-05 to 2008-09. Read the table carefully and answer the questions that follow. All values are in Rs. bn.

Country	2004-05		2005-06		2006-07		2007-08		2008-09	
	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import
UAE	330.15	208.53	380.38	192.77	544.45	391.75	629.15	542.33	1102.3	1059.2
China	252.3	319	299.2	481.2	375.3	790.1	436	1091.1	426.6	1476.1
USA	618.5	314.6	768.2	418.6	853.6	531.1	833.9	846.3	954.6	848.2
Saudi Arabia	63.4	58.5	80.1	72.3	117.1	605.6	149.2	781.1	229.4	897.5
Germany	127	180.4	158.8	266.7	180.1	341.5	206	397.4	291.9	549.2

1. In which year did the exports to China show the largest percentage growth?

   a. 2005-06 b. 2006-07 c. 2007-08 d. 2008-09

2. In which year did the imports from Germany show the largest percentage increase?

   a. 2005-06 b. 2006-07 c. 2007-08 d. 2008-09

3. Exports to UAE in the year 2007-08 was how much percent more than the imports from UAE in the same year?

   a. 12% b. 14% c. 16% d. 18%

4. By what approximate average annual percentage did imports from Germany grow over the period 2004-05 to 2008-09?

   a. 50% b. 32% c. 40% d. 200%

5. In the year 2004-05, which country had the highest ratio of exports to imports?

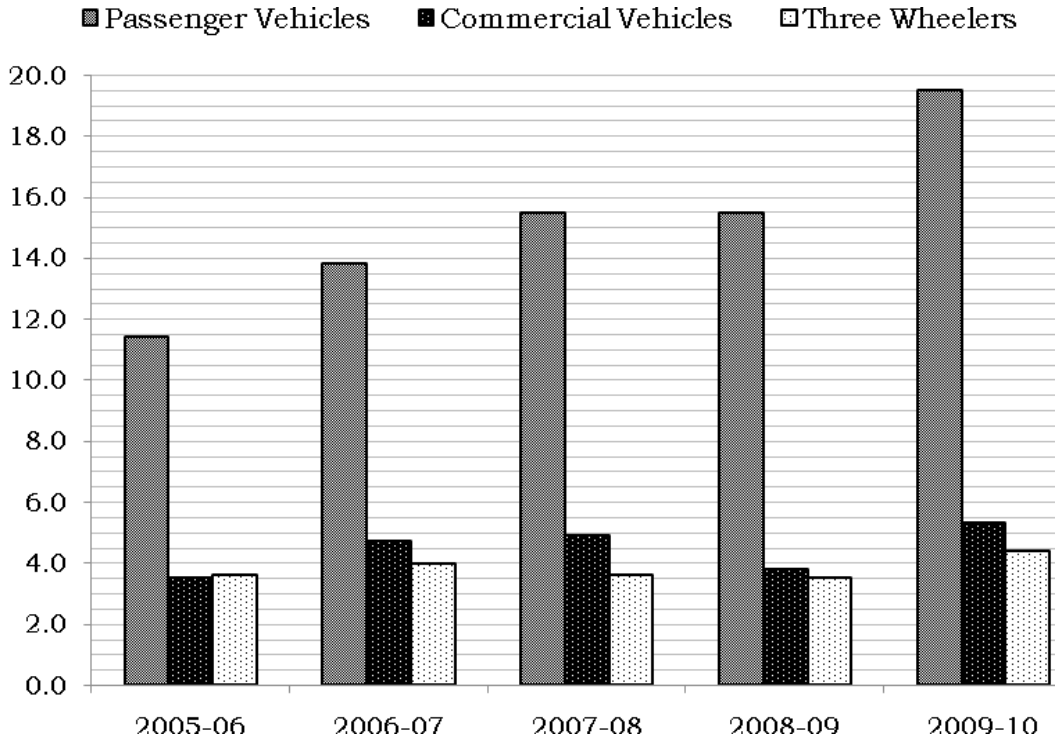
   a. UAE b. China c. USA d. Saudi Arabia

6. Which country showed the least average annual growth rate in imports over the period 2004-05 to 2008-09?

   a. Germany b. Saudi Arabia c. USA d. China

Set 2:

The following bar graph gives the number of vehicles sold in India for three categories of vehicles – passenger vehicles, commercial vehicles and three wheelers, over the years 2005-06 to 2009-10. Read the graph carefully and then answer the questions that follow. All values in the graph are in lacs.



7. From 2005-06 to 2009-10, which category of vehicles showed the highest compounded annual growth rate?

   a. Passenger vehicles b. Commercial vehicles

   c. Three Wheelers d. Cannot be determined

8. In which year did commercial vehicles register the largest growth rate?

   a. 2006-07 b. 2007-08 c. 2008-09 d. 2009-10

9. In the year 2006-07, which category of vehicles registered the least growth rate?

   a. Passenger vehicles b. Commercial vehicles

   c. Three Wheelers d. Cannot be determined

10. What was the growth rate in the total number of vehicles, across all the three categories, sold in the year 2008-09 over those sold in the year 2006-07?

    a. 0.13% b. 1.3% c. 13.3% d. 0.013%

11. In 2006-07, commercial vehicles accounted for what percent of the total sales of the three categories of the vehicles?

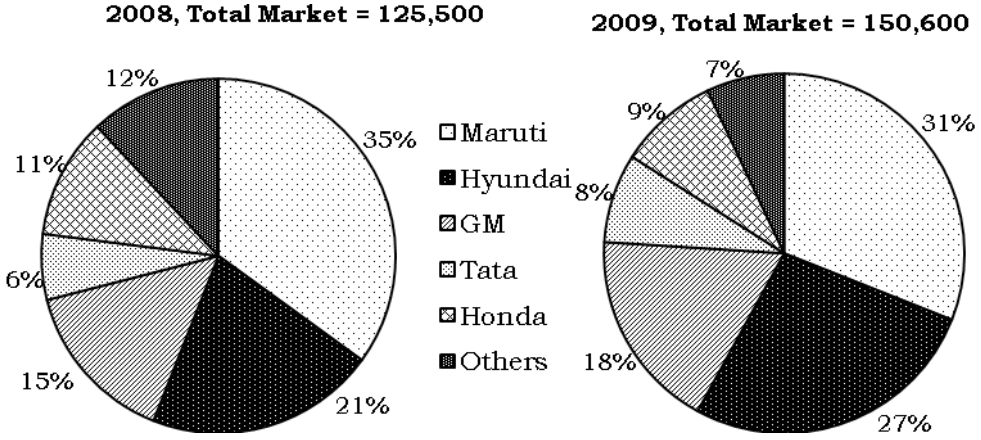
    a. 19.5% b. 20.5% c. 21.5% d. 22.5%

12. By what percent did the sales of the three categories of vehicles grow from 2007-08 to 2008-09?

    a. 7.5% increase b. 5% increase c. 7.5% decrease d. 5% decrease

Set 3:

The pie chart gives distribution of the total sales of cars (in numbers of cars) across the various players who produce cars in India for the years 2008 and 2009. Answer the questions that follow on the basis of only the information given in the graph.



13. How many more cars were sold by GM in 2009 as compared to 2008?

    a. 8,283 b. 8,755 c. 8,056 d. 8,575

14. In 2008, how many more cars were sold by Hyundai as compared to GM?

    a. 7,250 b. 7,380 c. 7,530 d. 7,680

15. What is the ratio of the number of cars sold by Tata in 2008 to the number of cars sold by Honda in 2009?

    a. 2 : 3 b. 5 : 9 c. 5 : 8 d. 4 : 7

16. What is the ratio of the number of cars sold by GM in the year 2008 to those sold in 2009?

    a. 25 : 36 b. 5 : 6 c. 5 : 8 d. 5 : 9

17. From 2008 to 2009, which company grew by the greatest growth rate? (Exclude Others)

    a. Maruti b. Hyundai c. GM d. Tata

18. From 2008 to 2009, which company showed the largest increase in the number of cars sold? (Exclude Others)

    a. Maruti b. Hyundai c. GM d. Tata

19. Which company showed a decrease in the number of cars sold in 2009 as compared to 2008? (Exclude Others)

    a. Maruti b. Honda c. Maruti & Honda d. None

20. By what degree is the angle subtended by the sector depicting sales of Tata in 2008 less than the angle subtended by sector depicting sales by Honda in 2009?

    a. 12 degrees b. 10.8 degrees c. 7.2 degrees d. 3 degrees.

21. If Toyota accounts for 25% of Others in 2009, find the market share of Toyota in 2009?

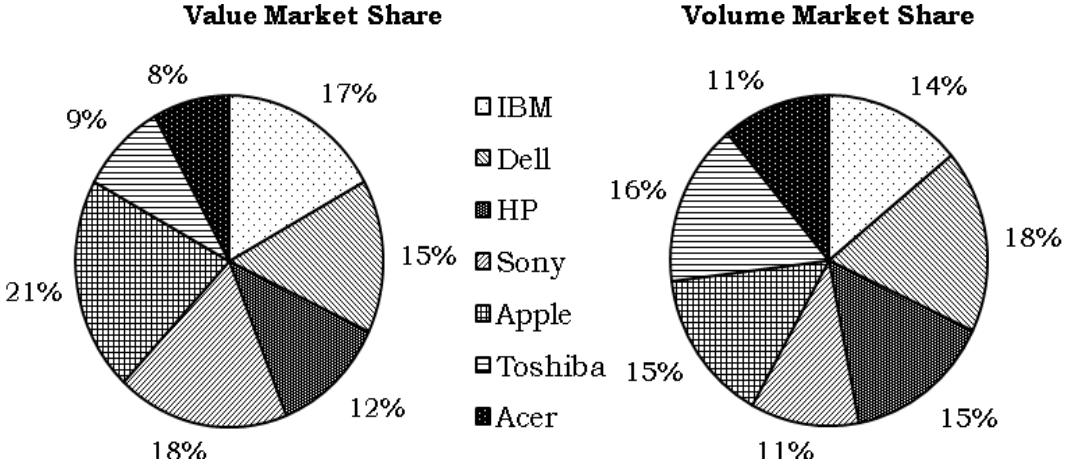
a. 1.75% b. 2% c. 2.5% d. 3%

22. If Audi accounts for 10% of Others in 2008 and 20% of Others in 2009, find the percentage increase in the number of cars sold by Audi in 2009.

a. 16.66% b. 20% c. 80% d. 40%

Set 4:

The laptop market in India is a very competitive market with seven laptop manufacturers being neck to neck in terms of market share. Assume that these are the only sellers of laptops in India. The pie chart to the left depicts the market share of these seven players in terms of the value of the laptops sold whereas the pie chart on the right depicts the market share in terms of the number of laptops sold. Average Market Price of a laptop is the total sales value of all the seven players divided by the total number of laptops sold by all the seven players.



23. If all the laptop sellers are arranged in increasing order of their average price per laptop sold, which model will occupy the middle position?

a. IBM b. Dell c. HP d. Acer

24. The average price at which Sony sells its laptops is how much percent more/less than the average price at which Apple sells its laptops?

a. 14.28% b. 15.55% c. 16.45 d. 17.5%

25. Which of the following is larger?

I. The difference between the average price of a Dell laptop and the average price of a HP laptop

II. The difference between the average price of a IBM laptop and the average price of a Toshiba laptop

a. I b. II c. Both are equal d. Cannot be determined

26. As compared to Acer, how many of the other six laptop sellers sell more number of laptops and at an average price that is higher than the average price of Acer?

a. 6 b. 5 c. 4 d. 3

27. If the Average Market Price of a laptop is Rs. 54,000, find the average price of HP laptop.

a. Rs. 56,500 b. Rs. 50,400 c. Rs. 48,000 d. Rs. 43,200

28. How many sellers have their average price of a laptop more than the Average Market Price of a laptop?

a. 2 b. 3 c. 4 d. 5

29. The average price of a Apple laptop is how much percent more/less than the Average Market Price of a laptop?

a. 40% b. 32.5% c. 14% d. 28.56%

30. The Average Market Price of a laptop is how much percent more/less than the average price of a Toshiba laptop?

a. 43.75% b. 56.25% c. 77.77% d. 83.33%

Set 5:

The following table gives the details of production of 4 crops in India in the years 2006 to 2009. Kharif and Rabi refer to two different seasons of sowing and harvesting in the year. All the 4 crops are produced in both the seasons and the break-up across the two seasons is also given in the table.

Further the table also gives the yield of the crops across the seasons and the years. Yield is defined as the production of the crop per hectare of area under cultivation.

		2006		2007		2008		2009	
	Season	Production	Yield	Production	Yield	Production	Yield	Production	Yield
Rice	Kharif	74.47	1.91	76.7	1.88	80.2	2.12	78.25	2.05
	Rabi	11.25	3.02	12.6	2.98	12	2.88	12.5	3.15
Jowar	Kharif	4.18	1.03	4.6	0.96	4.88	1.11	5.12	0.9
	Rabi	2.96	0.6	3.4	0.65	3.2	0.7	3.8	0.75
Maize	Kharif	11.44	1.74	10.4	1.76	9.1	1.8	12.5	1.85
	Rabi	2.58	3.22	1.9	2.87	3.5	3.08	3.96	3.2
Pulses	Kharif	4.94	0.45	4.7	0.45	5.11	0.55	4.98	0.55
	Rabi	8.41	0.72	7.9	0.74	7.5	0.75	8.2	0.78

Production figures are in million tonnes and the Yield is in tons/hectare.

31. In the year 2007, for how many of the four crops is the yield in Rabi season more than the yield in the kharif season?

a. 1 b. 2 c. 3 d. 4

32. In which year did the area under cultivation of Rice in the Kharif season increase by the greatest rate?

a. 2006 b. 2007 c. 2008 d. 2009

33. Arrange the following in increasing order of their magnitudes

I. the area under cultivation of Jowar in Rabi season in the year 2008

II. the area under cultivation of Maize in Kharif season in the year 2006

III. the area under cultivation of Pulses in Rabi season in the year 2009

a. I, II, III b. I, III, II c. II, III, I d. III, II, I

34. The area under cultivation of which crop was the highest in the Kharif season of 2007?

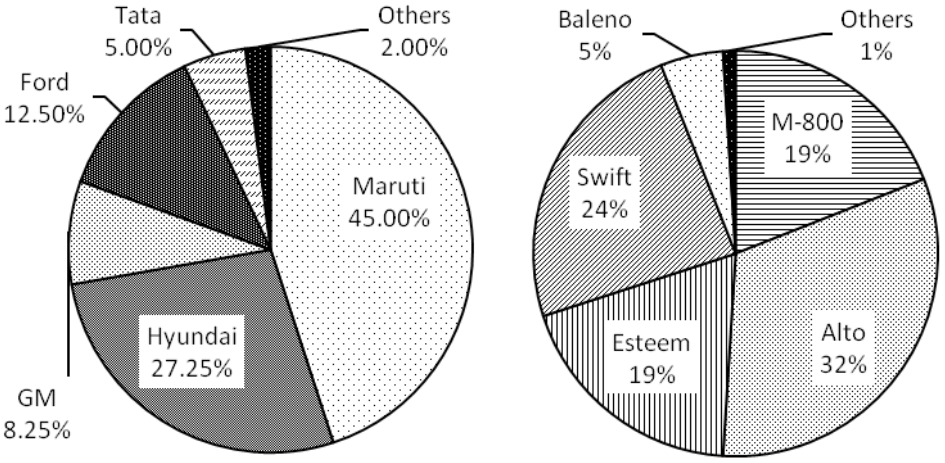
a. Rice b. Jowar c. Maize d. Pulses

35. The area under cultivation of Jowar in the Kharif season was the least for which year?

a. 2006 b. 2007 c. 2008 d. 2009

Set 6:

The pie chart on the left shows the breakup of the total sales of cars in 2004 across the various car manufacturers present in the market. The pie-chart on the right shows the break-up of the sales of cars of Maruti, a car manufacturer, across the various models that it sells.



Car market in 2004, total sales: 18,000 Break-up of Maruti across its models

36. How many M-800 were sold in the year 2004?

a. 1439 b. 1539 c. 1639 d. 1739

37. If Maruti-Omni accounted for 55.55...% of the 'Others' category of Maruti, find the number of Maruti-Omni sold in 2004.

a. 45 b. 36 c. 24 d. 18

38. Find the ratio of the number of Alto sold to the number of Ford sold in the year 2004.

a. 144 : 125 b. 160 : 3 c. 576 : 5 d. 80 : 3

39. If the number of Esteems sold increases by 900, find the market share of Maruti in the car market. (Assume sale of all other models remain the same)

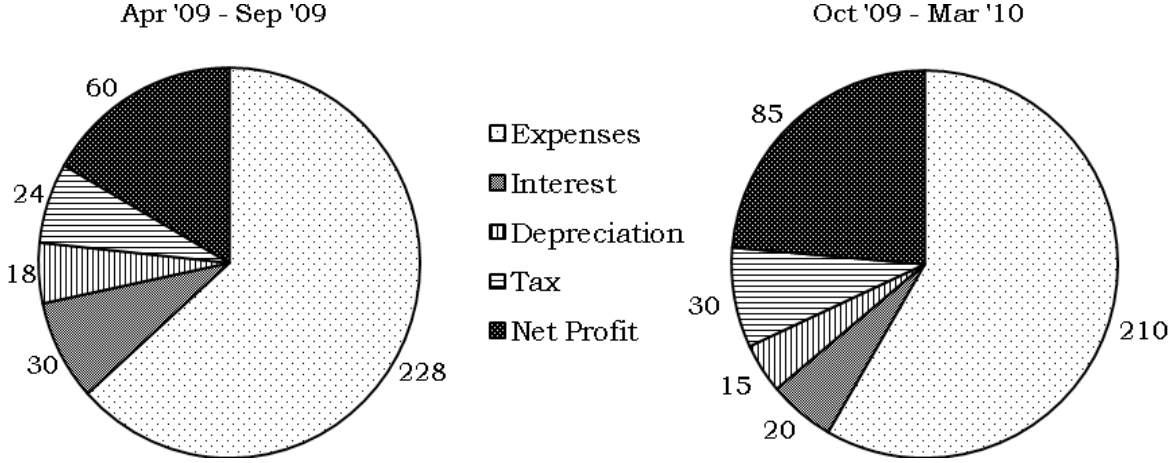
a. 45.5% b. 46.5% c. 47.6% d. 48.7%

40. If the number of Swifts sold increases, such that it now accounts for 30.909% of the sales of Maruti. Find the number of increase in the Swift sold.

a. 750 b. 800 c. 810 d. 850

Set 7:

The two pie charts show the break-up of Income across various heads for DISKI Ltd in the financial year Apr '09 to Mar '10. To analyse the performance of the company in the first half of the financial year vis-à-vis the second half of the financial year, the pie charts are prepared separately for the two half years. First half of a financial year is Apr to Sep and second half is Oct to Mar.



NOTE: The numbers given besides the sectors are the angle the sector makes at the center of the circle.

41. If the company pays equal amount of tax in the two half years, find the ratio of the income of the company in the first half year to that in the second half year.

    a. 1 : 1 b. 4 : 5 c. 5 : 4 d. Cannot be determined

42. If expenses in the first half year is 60% of the total expenses of the year, which of the following ratios most closely represent the ratio of the Interest paid by the company in the two half years.

    a. 1 : 1 b. 3 : 2 c. 2 : 1 d. 3 : 1

43. If Depreciation accounts for 4.66% of the total Income of the company over the entire financial year Apr '09 to Mar '10, Taxes account for what percent of the total Income of the company over the entire financial year

    a. 7% b. 7.33% c. 7.66% d. 8%

Additional directions for questions 44 to 45: Income of the company in the first half year i.e. Apr '09 – Sep '09 is Rs. 120 cr and the income in the second half year i.e. Oct '09 to Mar '10 is Rs. 144 cr.

44. If profit percentage is Net Profit as a percentage of Expenses, find the profit percentage of for the entire year Apr '09 – Mar '10.

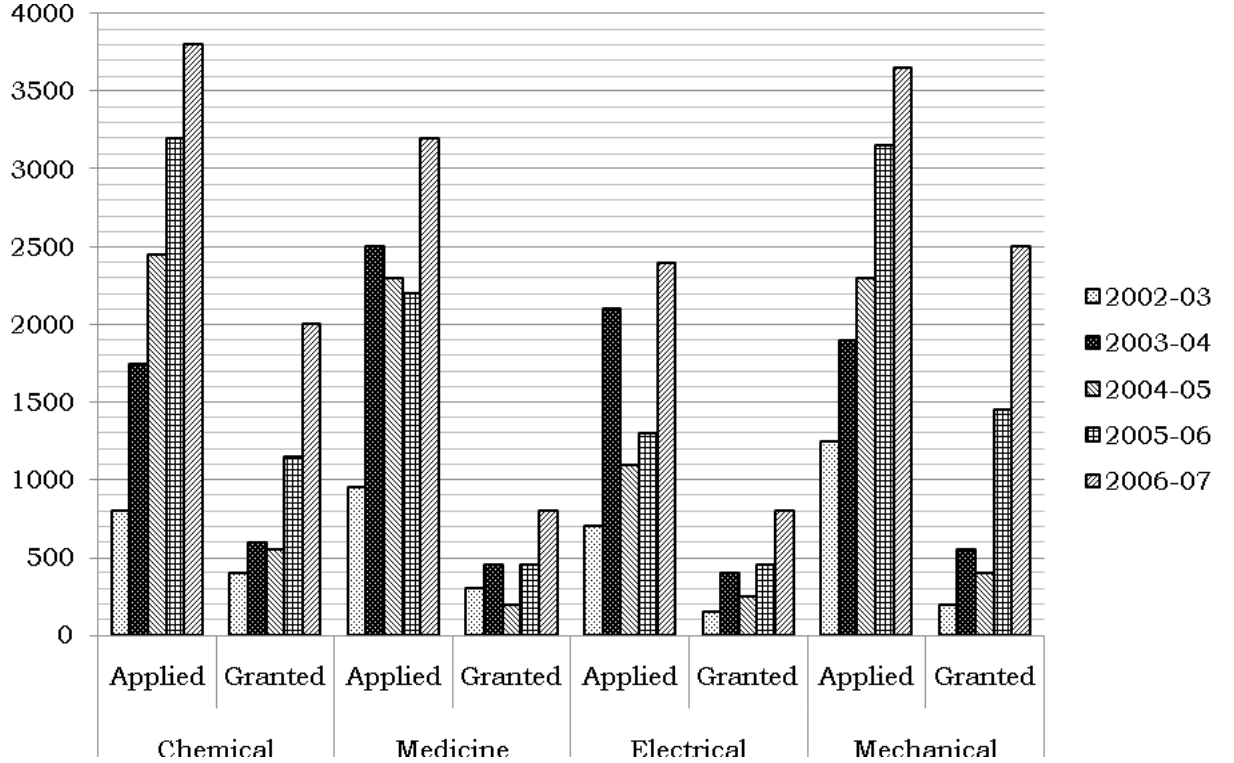
    a. 25% b. 27.5% c. 32.5% d. 33.75%

45. By what percentage is the Interest paid in the first half of the year more/less than the Interest paid in the second half of the year?

    a. 25% more b. 20% more c. 20% less d. 25% less

Set 8:

The following graph lists the number of patents applied for and the number of patents granted at the US Patent and Copyright Office over the years 2002-03 to 2006-07. Further the patents are always applied in any one of the four categories – Chemical, Medicine, Electrical and Mechanical.



46. In which year was the maximum percentage of patents applied in the field of Medicine granted?

a. 2002-03 b. 2003-04 c. 2005-06 d. 2006-07

47. In the year 2005-06, for which field was the percentage of applications of patents that were granted, the maximum?

a. Chemical b. Medicine c. Electrical d. Mechanical

48. In the field of Chemical, in which year did the number of application of patents grow by the least percentage?

a. 2003-04 b. 2004-05 c. 2005-06 d. 2006-07

49. For which year and field, was the number of granted patents the least percentage of the number of applied patents?

a. Medicine, 03-04 b. Electrical, 03-04
c. Mechanical, 02-03 d. Mechanical, 04-05

50. In the year 2003-04, for which field did the number of patents granted grew by the largest percentage, as compared to the previous year?

a. Chemical b. Medicine c. Electrical d. Mechanical

Deductive Logic - Syllogisms

What is Deductive Logic?

First of all it's not rocket science.

And it's made up of two words: Deductive and Logic.

Deductive is the adjective of Deduce which according to the Concise Oxford Dictionary means: arrive at (a fact or a conclusion) by reasoning.

Logic is defined as:

reasoning conducted or assessed according to strict principles of validity; the quality of being justifiable by reason; (the logic of) the course of action following as a necessary consequence of.

So Deductive Logic is the process by which we arrive at a conclusion with the help of reasoning.

This process comprises two parts:

Premises

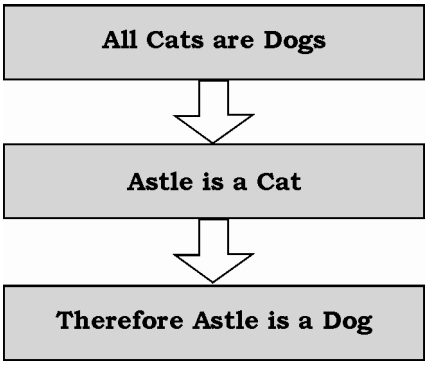
Conclusion

Premises are nothing but the given facts. Note that in Logic there is a difference between facts and truths. Facts may or may not be true. However, in logic questions, we have to take them to be true as there is no way to verify whether the given premises are true or not. So if it is given that "all cats are dogs", you have to take it to be true. You can't say that how is it possible; "I haven't seen any cat which is a dog". If it is given, then you have to accept it in the context of the given question.

> Tip:
> Logic is not about content. It is about form. We don't have to question the given premises. We have to say – If the premises were true, would the conclusion follow.

A conclusion is the deduction that you make based on the given premises. If the given premises are taken to be true, the conclusion has to follow.

For example:



Syllogisms

In deductive reasoning, an argument is made based on two facts, or premises. If the premises are true, then it should follow that the conclusion of the argument must also be true. You also call such arguments **syllogisms**.

YOU HEAR DEDUCTIVE arguments, both good and bad, made all the time. In magazines, you read, "If you use Brand X detergent your clothes will not get clean. But our detergent works much better. Use our detergent and your clothes will get clean."On television, you hear a politician saying, "High taxes are putting people out of work. Tax cuts are a better policy. Tax cuts will give people jobs."At home, most people can remember a parent telling them, "If you do not finish your supper, you will not get dessert."

Understanding how these arguments work, and do not work, will help you to do two things. One, you will learn how to use deductive reasoning to construct your own strong arguments. Getting your point across accurately and forcefully will be easier. And two, you will be able to tell when someone else's argument is weak. You can't be influenced or persuaded by faulty reasoning when you recognize it and see its flaws. On the other hand, you will also be able to determine when someone has a strong argument that you should be influenced by.

Qualities of a Deductive Argument

- It has two premises that provide a guarantee of the truth of the conclusion by providing support for it that is so strong that, if the premises are true, it would be impossible for the conclusion to be false.
- It is described by the terms valid and invalid; when the premises are correct, and the conclusion that follows is correct, the argument is said to be valid. If the conclusion does not follow from the given premises, the argument is invalid.
- It is based on rules, laws, principles, or generalizations, as opposed to inductive arguments, whose major premises are based on observations or experiences.

Practice: Which of the following is an example of a deductive argument?

a. There are 25 CDs on the top shelf of my bookcase and 14 on the lower shelf. There are no other CDs in my bookcase. Therefore, there are 39 CDs in my bookcase.

b. Topeka is either in Kansas or Honduras. If Topeka is in Kansas, then Topeka is in North America. If Topeka is in Honduras, then Topeka is in Central America. Therefore, Topeka is in Kansas.

c. No one got an A on yesterday's test. Jimmy wasn't in school yesterday. Jimmy will make up the test today, and get an A.

d. All human beings are in favour of world peace. Terrorists don't care about world peace. Terrorists bring about destruction.

Answer: The answer is a, because it has two premises which are stated as generalizations or facts and a conclusion that follows logically from them. Choice b has three premises and the conclusion does not follow from them. Choices c and d have conclusions that do not follow the premises.

It is not difficult to figure out a deductive argument when it is presented as straightforwardly as the examples above. But that is not how you will see them much of the time. In order for you to be able to detect a deductive argument, and then determine whether or not it is valid, you must be able to figure out what the premises and the conclusion are. Let's look more closely at both of these parts that make up a deductive argument.

In Logic the words or terminology that is used could be – in fact it is – different from the terminology of everyday spoken language. So, be careful and don't try to confuse the meaning. Let's have a look at some common words:

1. **Some** A are B

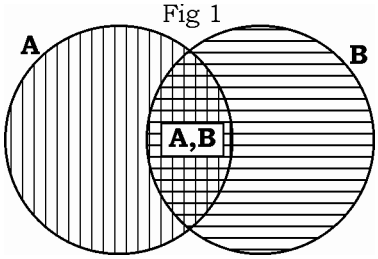
What do you think the phrase means?

Well, if we look at the way the word "some" is used in everyday English, it generally implies that some A are B and some A are not B. For example if I say that Some boys in my class are intelligent, I mean that some boys are and some are not, intelligent. However this is not what the word "some" means in Logic.

> Note on the diagrams used:
>
> Let's take the help of Venn diagrams to understand it better. In all the figures given below, the hatched area represents populated area i.e. atleast 1 one element is present in the hatched area. The vertical hatched area represents A and the horizontal hatched area represents B. Obviously the intersection i.e. vertical & horizontal hatched area represents those elements that are A as well as B.

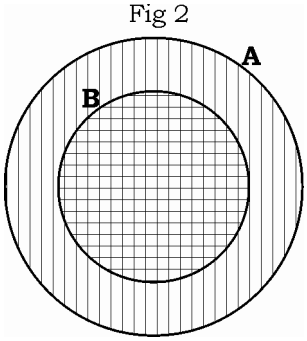
Some A are B is most commonly understood as:

Fig 1



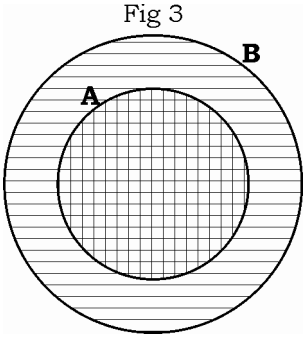
However, if you think about it, this is not the only way to represent it; what about:

Fig 2



And what about:

Fig 3

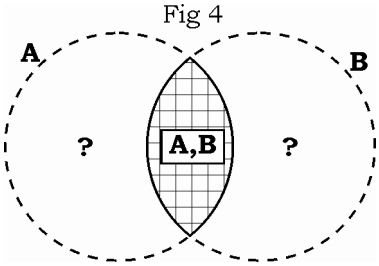


You might ask – how is this possible? The statement says "some", and not "all".

The answer to this will be – Does the statement say "some A are **not** B"; it only says "some A **are** B"; It could be "all". It might not be also – that's possible. The point is that all that the statement says is – Some A are B. Rest we don't know.

So the best inference that I can draw from the statement is this: At least one A is a B and vice-versa.

Fig 4



Tip:

A note on the above figure.

The fig 4 encompasses all the possible scenarios as explained above depending on if the region marked with the ? are populated or not.

If there are some A which are not B and some B which are not A, the figure becomes same as fig 1.

If there are some A which are not B but all B are A, the figure becomes same as fig 2.

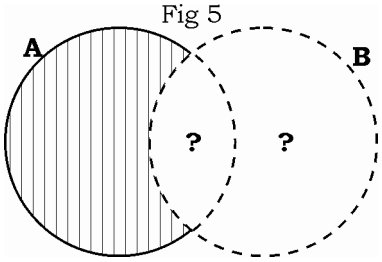
If there are some B which are not A but all A are B, the figure becomes same as fig 3.

One more scenario is when the set of A and B are identical i.e. the two circles overlap.

2. **Some** A are **not** B means:

If the meaning of the word 'some' as explained in 'Some A are B' is clear, you should immediately be able to realise that the most general situation for 'Some A are not B' is:

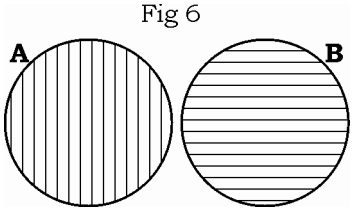
Fig 5



Which is to say that there is at least one A which is not a B. So just like above case, there are many possible scenarios, as seen below:

It is possible that no A are B:

Fig 6



The following scenarios are also possible:

Fig 2

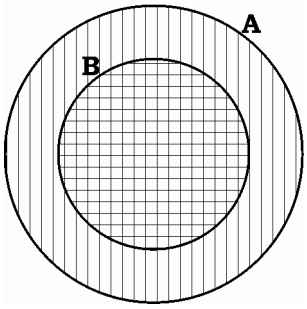
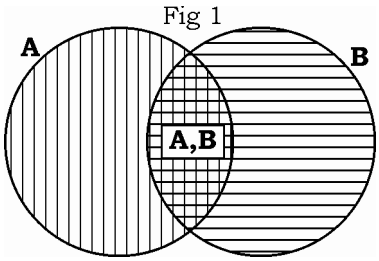
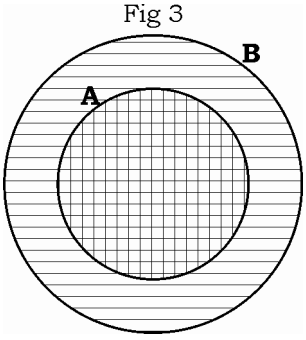


Fig 1



3. **All** A are B

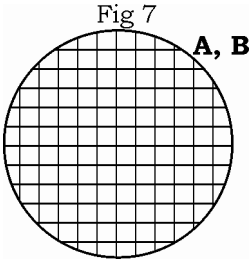
Fig 3



Does it also mean Some B are not A?

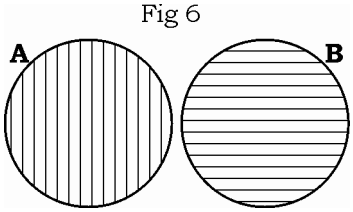
If your answer was – No, then you're right; cause A and B could be equal.

Fig 7



4. **No** A are B

Fig 6



There is **no** connection between A and B. It also means that 'No B are A'. Only one venn diagram is possible.

Exercise 12

Directions for questions 1 to 5: In the given questions, which of the following are valid arguments?

1. A. Some printers are fast. No fast is slow. No printer is slow.

   B. No poet is a thinker. Some thinkers are leaders. No leader is a poet.

   C. No poet is a thinker. Some thinkers are leaders. Some leaders are not poets.

   D. Only cats are dogs. No cat is a pig. No dog is a pig.

   a. A b. B and C c. C and D d. B

2. A. All music is good. All good is great. All music is great.

   B. All men are wise. All wise are leaders. All leaders are men.

   C. All men are wise. All wise are leaders. Some men are leaders.

   D. All boys are men. Some men are smart. Some boys are smart.

   a. A b. B c. D d. A & C

3. A. I go out only on Sundays. Today is a Sunday. I am out.

   B. I go out only on Sundays. Today is not a Sunday. I am not out.

   C. I go out only on Sundays. I am out. Today is a Sunday.

   D. I go out only on Sundays. I am not out. It is not a Sunday.

   a. B and C b. B c. A and D d. A

4. A. All princes have moles. Raj has a mole. Raj is a prince.

   B. All princes have moles. Raj is a prince. Raj has a mole.

   C. Only princes have moles. Raj is a prince. Raj has a mole.

   D. No princes have moles. Raj is not a prince. Raj does not have a mole.

   a. B b. C and D c. A and D d. C

5. A. Raj has a mole. Raj is a prince. All princes have moles.

   B. All kings are men. All men are weak. Some weak are kings.

   C. All kings are men. All men are weak. All king are weak.

   D. All kings are men. All men are weak. All weak are kings.

   a. A b. B and C c. C and D d. D

Directions for questions 6 to 10: In each question below, there are two statements followed by two conclusions numbered 1 and 2. You have to decide which of the given conclusions logically follows from the statements given. Answer options are

a. If only conclusion 1 follows
b. If only conclusion 2 follows
c. If neither 1 nor 2 follows
d. If both 1 and 2 follow

6. Statements: 1. All cars are cats. 2. All fans are cats.
   Conclusions: 1. All cars are fans. 2. Some fans are cars.
7. Statements: 1. Some scooters are trucks. 2. All trucks are trains.
   Conclusions: 1. Some scooters are trains. 2. No truck is a scooter.
8. Statements: 1. All pencils are pens. 2. No pen is a book.
   Conclusions: 1. No pencil is a book. 2. Some pencils are books.
9. Statements: 1. Some rats are rabbits. 2. All rats are mosquitoes.
   Conclusions: 1. Some mosquitoes are rabbits. 2. No rabbit is a mosquito.
10. Statements: 1. All fans are cups. 2. All cups are pillows.
    Conclusions: 1. All fans are pillows. 2. All pillows are fans.

Directions for questions 11 to 15: In each of the questions given below, a set of six statements is given followed by four answer choices. Each of the choices has a combination of three statements from the given statements. Identify the answer choice in which the third statement is a valid conclusion based on the first two.

11. A. All green is blue. B. All green is white.
    C. All green is black. D. All black is white.
    E. All blue is yellow. F. All blue is white.
    a. ABF b. AEF c. CDB d. CBE
12. A. All copper is metal. B. All bronze is non metal.
    C. Some metal is silver. D. Some metal is not silver.
    E. No copper is bronze. F. Some silver is not metal.
    a. ABF b. ACB c. ABE d. CDF
13. A. All beaters cheat. B. All teachers cheat.
    C. Some teachers teach. D. Some teachers beat.
    E. Some teachers beat and cheat. F. Some beaters cheat.
    a. AFC b. BDE c. CDE d. FAB
14. A. Some communists are socialists. B. All socialists are Leninists.
    C. Some socialists are Leninists. D. Marxists are not capitalists.
    E. All Leninists are communists. F. All communists are socialists.
    a. CEA b. CEF c. ABE d. BEF
15. A. All Sitas lie. B. Some Sitas are girls.
    C. All girls are Sitas. D. Some girls lie.
    E. All girls lie. F. All liars are girls.
    a. ABC b. BCD c. BCE d. CAE

Directions for questions 16 to 30: In the given questions, which of the following are valid arguments?

16. A. Some workers are stupid. Some stupid are great. Some workers are great.

    B. Some men are dancers. All dancers are poets. Some men are poets.

    C. Some boys are not studious. All studious are men. Some boys are men.

    D. Either Ram or Shyam attends college. Ram has gone to college. Shyam has gone for a movie.

    a. C and B b. D c. A d. B

17. A. All apples are oranges. Some oranges are mangoes. Some apples are mangoes.

    B. All sports persons are healthy. Some who are healthy are women. Some sports persons are women.

    C. All carrots are edible. All edible contain vitamin. Vitamin is present in carrot.

    D. No car is a cart. No cart is a cycle. No cycle is a car.

    a. A and B b. D c. C d. B

18. A. All big stars are yellow. Sun is a star. Sun is yellow.

    B. All men are educated. All Educated are wise. All men are wise.

    C. All frocks are tubs. Some tubs are beds. Some frocks are beds.

    D. All pranksters are funny. Clark is a prankster . Clark is funny.

    a. A and D b. B and C. c. A d. B and D

19. A. All locks are books. No book is green. No lock is green.

    B. All ghosts are scary. All scary are non funny. All non funny are ghosts.

    C. A is part of Z. B is part of Z. A is part of B.

    a. A b. B c. A and B d. C

20. A. Verma is a coward. All models are coward. Verma is a model.

    B. Some nets are monkeys. Rudolph is a monkey. Rudolph is a net.

    C. Some snakes are poisonous. Some poisonous are secrets. Some secrets are snakes.

    D. All guns are wrenches. All wrenches are wicked. All guns are wicked.

    a. A and B b. B and C c. A and C d. D

21. A. All teas are coffee. This is coffee. This is tea.

    B. Some pets are peons. No peon is handsome. Some pets are handsome.

    C. Some ponds are deep. Some lakes are deep. Some ponds are lakes.

    D. All roads are poles. All poles are lamps. Some lamps are roads.

    a. A b. B and C c. C d. D

22. A. All poets are wrestlers. Some wrestlers are mad. Some poets are mad.

    B. All practice is theory. All surgery is practice. All surgery is theory.

    C. All men are tall. All tall are boors. All men are boors.

    D. Either he or she drinks mineral water. He did not drink mineral water. She drank mineral water.

    a. A b. B, C and D c. C d. C and D

23. A. Some cars are blue. Some apples are blue. All blue are either cars or apples.

    B. Some As are Bs. All Cs are As. Most Cs are Bs.

    C. All birds lay eggs. Mammal is a bird. Mammal lays eggs.

    D. All A need B. All C are A. All C need B.

    a. A and C b. B and D c. C and D. d. C

24. A. No M is P. All R is M. All R is P.

    B. All A are wrong. No A is C. No C is wrong.

    C. Some C are A. Most C are right. Most A are right.

    D. No M is P. All R is M. No R is P.

    a. A b. B c. C and D d. D

25. A. Some S is not P. Some X is S. Some X is not P.

    B. Some S is not P. All X is P. No X is P.

    C. No A is C. All C are B. No B is A.

    a. C b. A c. A and B d. None of These

26. A. All roses are red. Some roses are pink. Some pink are red.

    B. Some roses are red. All Pink are red. Some roses are pink.

    C. Some zens are not cars. All cars are marutis. Some zen are not marutis

    D. All zens are marutis. Some cars are not marutis. Some marutis are not cars.

    a. A b. D c. C d. B and C

27. A. There can be no photograph without a camera. There is a camera. There must be a photograph.

    B. There can be no photograph without a camera. There is no photograph. There is no camera.

    C. There can be no photograph without a camera. There is a photograph. There must be a camera.

    D. There can be no photograph without a camera. There is a camera. There is no photograph.

    a. A b. B c. C and D d. C

28. A. Only soldiers carry guns. Sam is a soldier. Sam is carrying a gun.

    B. Only soldiers carry guns. Sam is carrying a gun. Sam is a soldier.

    C. All soldiers carry guns. Sam is carrying a gun. Sam is a soldier.

    D. All soldiers carry guns. Sam is a soldier. Sam is carrying a gun.

    a. A b. B and D c. B and C d. A and B

29. A. Some toys are mad. Some mad are crazy. No toys are crazy.

    B. Some clubs are hip. Some hip are cool. Some clubs are cool.

    C. Some men are wise. Some wise are radioactive. Some men are radioactive.

    D. All women are pretty. Some pretty are cool. Some women are cool.

    a. B b. A and B c. C and D d. None of these

30. A. No pig is a dog. Only dogs are cats. Some cats are pigs.

    B. Some Apples are bad. All apples are handsome. Some handsome are bad.

    C. Only daughters wear gloves. Hema is Malini's daughter. Hema wears gloves

    D. All officers are corrupt. All corrupt are smart. All smart are officers.

    a. A b. B c. C d. D

Directions for questions 31 to 40: In each question below, there are two statements followed by two conclusions numbered 1 and 2 . You have to decide which of the given conclusions logically follows from the statements given. Answer options are

a. If only conclusion 1 follows b. If only conclusion 2 follows

c. If neither 1 nor 2 follows d. If both 1 and 2 follow

31. Statements: 1. Some players are singers. 2. All singers are tall.
    Conclusions: 1. Some players are tall. 2. All players are tall.
32. Statements: 1. Some hats are caps. 2. Some caps are mats.
    Conclusions: 1. Some caps are hats. 2. Some mats are caps.
33. Statements: 1. Some vegetables are fruit. 2. No fruit is black.
    Conclusions: 1. Some blacks are vegetables. 2. No vegetable is black.
34. Statements: 1. Some fools are intelligent. 2. Some intelligent are great.
    Conclusions: 1. Some fools are great. 2. All great are intelligent.
35. Statements: 1. All stones are water. 2. Some waters are clean.
    Conclusions: 1. Some stones are clean. 2. No stone is clean.
36. Statements: 1. All keys are locks. 2. All locks are screws.
    Conclusions: 1. All screws are keys. 2. Some screws are not keys.
37. Statements: 1. Some books are pen. 2. No pen is pencil.
    Conclusions: 1. Some books are pencils. 2. No book is a pencil.
38. Statements: 1. All dogs are monkeys. 2. No monkey is a cat.
    Conclusions: 1. No dog is a cat. 2. No cat is a dog.
39. Statements: 1. Some phones are watches. 2. All watches are guns.
    Conclusions: 1. All guns are watches. 2. Some guns are phones.
40. Statements: 1. All umbrellas are airplanes. 2. Some airplanes are birds.
    Conclusions: 1. Some umbrellas are birds. 2. Some birds are umbrellas.

Answer Key

Exercise 1 (Linear – Unique arrangement)

1. 1	2. 2	3. 1	4. 1	5. 4	6. 2
7. 1	8. 1	9. 2	10. 3	11. 3	12. 1
13. 2	14. 3	15. 2	16. 4	17. 1	18. 2
19. 4	20. 1	21. 4	22. 4	23. 1	24. 3
25. 1	26. 4	27. 3	28. 1	29. 3	30. 1
31. 1	32. 3	33. 3	34. 4	35. 1	36. 2
37. 2	38. 4				

Exercise 2 (Linear – Non-deterministic)

1. 1	2. 3	3. 2	4. 4	5. 1	6. 3
7. 3	8. 4	9. 4	10. 4	11. 3	12. 3
13. 1	14. 2	15. 2	16. 2	17. 3	18. 3
19. 1	20. 3	21. 2	22. 3	23. 4	24. 1
25. 3	26. 4	27. 4	28. 4	29. 4	30. 2
31. 4	32. 2	33. 3	34. 4	35. 1	36. 3
37. 4	38. 2	39. 2	40. 4	41. 1	

Exercise 3 (Circular Arrangement)

1. 4	2. 1	3. 2	4. 1	5. 1	6. 1
7. 3	8. 3	9. 2	10. 4	11. 3	12. 1
13. 4	14. 1				

Exercise 4 (Tabular Arrangement)

1. 3	2. 1	3. 1	4. 3	5. 1	6. 3
7. 2	8. 4	9. 1	10. 3	11. 4	12. 2
13. 2	14. 4	15. 3	16. 2	17. 4	18. 4
19. 4	20. 1	21. 3	22. 4	23. 3	24. 1
25. 1	26. 2				

Exercise 5 (Blood relations and Family Trees)

1. 3	2. 1	3. 4	4. 4	5. 2	6. 2
7. 4	8. 1	9. 4	10. 3	11. 4	12. 4
13. 2	14. 4	15. 4	16. 3	17. 4	18. 4
19. 3	20. 3	21. 2	22. 1	23. 3	24. 4
25. 2	26. 3	27. 4	28. 2	29. 4	30. 4
31. 1	32. 4	33. 3	34. 1		

Exercise 6 (Grouping)

1. 4	2. 4	3. 4	4. 3	5. 4	6. 2
7. 1	8. 4	9. 2	10. 1	11. 1	12. 3
13. 4	14. 2	15. 3	16. 1	17. 2	18. 4
19. 1	20. 2	21. 1	22. 2	23. 4	24. 2
25. 4	26. 2	27. 1	28. 2	29. 1	30. 4
31. 4	32. 3	33. 2	34. 1	35. 4	36. 4
37. 4	38. 2				

Exercise 7 (Miscellaneous)

1. 1	2. 4	3. 2	4. 2	5. 2	6. 4
7. 1	8. 1	9. 4	10. 2	11. 2	12. 4
13. 2	14. 2	15. 1	16. 2	17. 4	18. 1
19. 4	20. 1	21. 2	22. 1	23. 3	24. 2
25. 3	26. 2	27. 4	28. 3	29. 1	30. 3

Exercise 8 (Mathematical & Logical Reasoning)

1. 4	2. 2	3. 2	4. 1	5. 2	6. 3
7. 1	8. 4	9. 4	10. 4	11. 1	12. 4
13. 1	14. 2	15. 3	16. 4	17. 2	18. 2
19. 1	20. 1	21. 2	22. 4	23. 2	24. 2
25. 3	26. 2	27. 3	28. 3	29. 1	30. 1
31. 2	32. 2	33. 2	34. 3	35. 2	36. 1
37. 1	38. 2	39. 4	40. 3		

Exercise 9 (Coding Decoding)

1. 2	2. 3	3. 2	4. 4	5. 4	6. 3
7. 2	8. 3	9. 2	10. 4	11. 2	12. 4
13. 4	14. 2	15. 2			

Exercise 10 (Number Series)

1. 1	2. 1	3. 4	4. 4	5. 4	6. 3
7. 1	8. 4	9. 1	10. 1	11. 2	12. 1
13. 2	14. 2	15. 4			

Exercise 11 (Data Interpretation)

1. b	2. a	3. c	4. a	5. c	6. c
7. a	8. d	9. c	10. b	11. b	12. d
13. a	14. c	15. b	16. a	17. d	18. b
19. b	20. b	21. a	22. d	23. b	24. c
25. b	26. c	27. d	28. b	29. a	30. c
31. c	32. b	33. a	34. a	35. a	36. b
37. d	38. a	39. c	40. c	41. c	42. c
43. b	44. d	45. a	46. a	47. d	48. a
49. c	50. d				

Exercise 12 (Syllogism)

1. c	2. d	3. a	4. a	5. b	6. c
7. a	8. a	9. a	10. a	11. c	12. c
13. b	14. a	15. d	16. d	17. c	18. d
19. a	20. d	21. d	22. b	23. c	24. d
25. d	26. a	27. d	28. b	29. d	30. b
31. a	32. c	33. c	34. c	35. c	36. c
37. c	38. d	39. b	40. c		