FACE Prep

CPCL23-01M

Data Arrangements and Blood relations

Concept 1: Linear arrangements: Linear arrangement is the arrangement of given items with the help of the given clues. The main idea here is to represent the given data in an organized manner. Once that is done, solving individual problems becomes very easy.

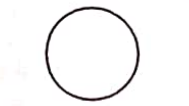
Concept 2: Circular arrangements: Questions on circular arrangements involve arrangement of people sitting around a table or arrangement of things in a circular manner.

In case of people sitting around a table, the table could be of any shape– rectangular, square, circular, etc. Circular arrangement is different from linear arrangement in that there is no first or last position and hence there is no reference point. Therefore, the positions taken by the objects are only relative to each other.

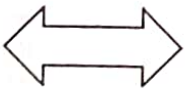
Once you read the question, first draw the shape specified in the question and then draw the slots for the arrangement. Then solve the given clues one by one.

Concept 3: Distribution: In this type of problems, we have to match two or more variables. These questions typically contain clues to club one object (variable) to another in either one-to-one mapping or one-to-many mapping.

Concept 4: Blood relations: Blood relation is one of the most often asked logical reasoning topics. A set of clues are given to determine the blood relationship between individuals in questions. Similar to data arrangement, once the given set of data is represented in an organized manner, these questions can be cracked in almost no time. The following symbols help in representing the given clues so as to solve the problems easily.


- Female


- Male


- Couple


- Sibling


- Next generation

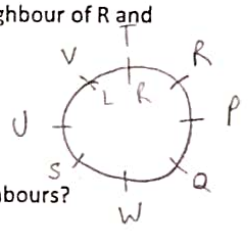
Drill

1. A Read the following information and answer the questions below:
   Six swimmers A, B, C, D, E and F compete in a race. The outcome is as follows:
   - Exactly 2 swimmers finish ahead of B.
   - Only two swimmers separate E and D.
   - A is behind D and E.
   - B is ahead of E, with one swimmer in-between.
   - F is ahead of D.

   F D B C E A

   (i) Who stood fifth in the race?
   a. A b. B c.C d.D e.E
   (ii) How many swimmers separate A and F?
   a. 1 b.2 c.3 d.4 e. Can't determined

2. P, Q, R, S, T, U, V and W are sitting in a circle and are facing the centre. Following information is also known:
   - P is second to the right of T, who is the neighbour of R and V.
   - S is not the neighbour of P.
   - V is the neighbour of U.
   - Q is not between S and W.
   - W is not between U and S.

   (i) Which of the following pairs are not neighbours?
   a. RV b. UV c. RP d. QW
   (ii) Who is to the immediate right of V?
   a. P b. U c. R d. T

3. Each of the four persons A, B, C and D wear a different coloured shirt- red, pink, blue and white. A has a red shirt and D does not have a pink shirt. C wears a white shirt. Match the shirt colours with the right persons. A → R, C → W, B → P, D → B
4. In a family of 3 generations, there are two couples and two pairs of brothers and sisters. We also know that,
   - Neeta is the sister-in-law of Leena.
   - Geeta is the daughter of Jai.
   - Jyotsna and Rajesh is the eldest couple in the family.
   - Jagdish is the son of Leena.
   - Jai is the son of Rajesh and his wife is Leena.

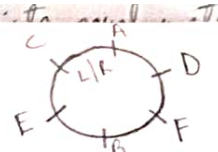
   Based on the given information, answer the following questions.
   (i) Leena is the_____of Rajesh?
   a. Aunt b. Sister c. Daughter-in-law d. Daughter
   (ii) Who is the aunt of Jagdish?
   a. Leena b.Geeta c. Jyotsna d. Neeta

Concept review questions

1. 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 andManju. Who would be second from the left in the photograph? S Re Ri M
   a. Reena b. Shikha c. Manju d. Rita

2. There are five different houses, P to T in a row. P is to the right of Q. T is to the left of R and right of P. Q is to the right of S. Which house is in the middle? S Q P T R
   a. P b. R c. S d. T

3. A, B, C, D, E and F are seated in a circle facing the centre. A and C are seated adjacent to each other and E and B are also adjacent to each other. B is to the immediate left of F. There



are 2 persons between D and E.A is not seated adjacent to E. Who is to the immediate left of E?

a. C b. B c. F d. Cannot be determined

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 in the middle of the row. Who is adjacent to Anuradha?

a. Rashi b. Sulekha
c. Abha d. Cannot be determined

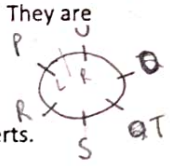
5. In a march past, seven persons are standing in a row. Q is standing leftof R but right of P. O is standing right of N and left of P. S is standingright of R and left of T. Find out who is standing in the middle.

a. P b. Q c. T d. O

Directions for questions 6 to 10: The questions are based on the following information:

There are six dishes P through U, among which two are starters, two are main course dishes and two are desserts. They are arranged in a circularorder.

- P is adjacent to U.
- R is not adjacent to either Q or T.
- S is a main course and is adjacent to the desserts.
- Both the starters are adjacent to each other.
- P is opposite a dessert which is not Q.



6. Which dish is opposite to T?

a. P b. Q c. R d. S

7. Which of the following is a correct combination?

a. Q dessert b. U main course
c. U starter d. Q starter

8. Which of the following is true?

a. One of the desserts is opposite to a main course
b. A main course is opposite to a starter
c. P is a starter
d. More than one of the above.

9. Which dishes are adjacent to R?

a. P and R b. T and U
c. S and U d. T and P

10. Which of the following dishes cannot be together?

a. P and T b. S and T
c. U and Q d. P and R

Directions for questions 11 to 12: The questions are based on the following statements.

- Rajinder and Surinder are the sons of Mrs. and Mr. Maudgil.
- Seeta is the sister of Surinder.
- Renu, Raja and Sunil are children of Mrs. and Mr. Bhaskar.
- Sunil and Seeta are married and Ashok and Sanjay are their children.
- Geeta and Rakesh are children of Mrs. and Mr. Jain.
- Geeta is married to Surinder and has three children named Rita,
- Sonu and Raju.

11. How is Rajinder related to Raju?

a. Brother b. Uncle
c. Brother-in-law d. Maternal uncle

12. How is Rajinder related to Ashok?

a. Brother-in-law b. Father-in-law
c. Cousin d. Uncle

13. On seeing a photograph of a boy, a man said, "He is the son of the only son of my mother." How is the man related to that boy?

a. Brother b. Uncle
c. Cousin d. Father

14. Rama told Lakshmana, 'Yesterday, I met the only brother of the daughterof my grandmother.' Whom did Rama meet?

a. Uncle b. Father
c. Father-in-law d. Either a or b

15. Pointing to a photo, Mr. Bean said: I have no brother or sister but that fellow's father is my father's son. Whose photo is it?

a. His nephew's b. His son's
c. His father's d. His Uncle's

Directions for questions 16 to 20: Six persons A, B, C, D, E and F are sitting in two rows, three in each. E is not at the end of any row. D is second to the left of F. C the neighbour of E, is sitting diagonally opposite to D. B is the neighbour of F.

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

a. F and C b. D and A
c. A and C d. A and F

17. Who is facing B?

a. A b. C
c. D d. E

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

a. A and E b. A and B
c. C and B d. E and D

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

a. FBC b. CEB
c. DBF d. AEF

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

a. C and A b. F and B
c. Only B d. Only A

quantization – splitting work into equal parts

FACE Prep

CPCQ23-05M

TIME AND WORK

Concepts

- If a man can do a piece of work in x days, then the work done by him in one day will be $\frac{1}{x}$ of the total work.
  The relation between Number of people working (N), Number of Days (D) worked, Number of hours (H) worked per day and the Quantity of Work (W) is
  $$\frac{N_1 \times D_1 \times H_1}{W_1} = \frac{N_2 \times D_2 \times H_2}{W_2}$$
- If A can complete a work in 'x' days, he will do $\frac{1}{x}$ of the work in one day.
- If B can complete a work in 'y' day, he will do $\frac{1}{y}$ of the work in one day.
- Total work done by both in one day = $\frac{1}{x} + \frac{1}{y} = \frac{x+y}{xy}$
- Time taken for them to complete the work = $\frac{xy}{x+y}$
- If you are solving questions by assuming the total amount of work to be done, assume the total amount of work to be completed as the LCM of time taken by different people to complete the same piece of work (to make calculations easier).
- The wages paid for any task has to be divided between workers in the proportion of their contribution towards the completion of the task.
- For questions based on Pipes and cisterns, the same concept of people working with different efficiencies is used. The work done in filling a cistern is taken as positive and the work done in emptying a cistern is taken as negative.

Drill

1. A can do a piece of work in 40 days and B can do the same work in 60days. Working together, in how many days will they complete the work? 24
2. Working together, Rajeev and Vikram can complete a piece of workin 48 days. Rajeev can complete the work alone in 64 days. Both of them worked together for 30 days and then Rajeev left. How long will Vikram take to complete the remaining work? 72
3. A can do a piece of work in 10 days, B in 12 days and C in 15 days. They all start the work together, but A leaves the work after 2 days and B leaves 3 days before the work is completed. How many days did thework last? 7
4. Two taps A and B can fill a cistern in 42 and 56 minutes respectively. If both the taps are opened together, then find the time taken to fill thecistern. 24
5. Two taps A and B can fill a cistern in 10 and 15 minutes respectively.Both the taps are opened together but at the end of 3 minutes, tap B is turned off. In how much time will the cistern be filled? 8
6. A cistern is fitted with three taps, namely P, Q and R. P and Q can fill a cistern in 10 and 15 minutes respectively whereas R (emptying tap fitted at the bottom of the cistern) can empty it in 12 minutes. If all the three pipes are kept open, in how much time will the cistern be filled? 8.5 mins
7. A cistern generally takes 20 minutes to be filled by a pipe, but due to a leak, it takes 10 extra minutes to get filled. Find the time in which the leak alone can empty the cistern filled with water.
8. 12 men can dig a well in 15 days, working 8 hours a day. How many days will 18 men require to dig a similar well working for 5 hours aday? 16
9. 30 workers can make 24 tables in 21 days, working 8 hours a day. If35 workers want to make 18 such tables in 12 days, how many hours should they work every day? 9
10. If 9 friends can eat 9 ice creams in 9 minutes, how long will 15 friends take to eat 15 such ice creams? 9
11. A mess has provisions for 360 men for 70 days. If the number of men increases by 90, for how many days will the provisions last?
12. 12 boys and 16 girls can do a piece of work in 10 days while 13 boys and 24 girls can do the same work in 8 days. Find the time taken by 15 boys and 20 girls to do the same work.
13. A can complete a piece of work in 30 days. B can complete the same work in 40 days. If they complete the work together and earn Rs. 350 for the job, find A's share.
14. A can do a piece of work in 25 days and B can do it in 20 days. They work together for 5 days and then A quits. B completes the remaining work. If they are paid Rs. 750 for the job, find B's share.
15. A and B can do a work in 20 and 30 days respectively. If both of them working along with C can finish the work in 8 days, then find C's share in the total wage of Rs. 1200.
16. In the question discussed earlier, "12 boys and 16 girls can do a piece ofwork in 10 days while 13 boys and 24 girls can do the same work in 8 days. Find the time taken by 15 boys and 20 girls to do the same work.", if the group is paid Rs. 40,000 for the task, what will be the wage paid to each boy and girl per day?

Concept review questions

1. A certain number of men can finish a job in 90 days. If there were 16 more men, the work could have been completed 18 days earlier. How many men were there initially?

   a. 108 b. 64 c. 80 d. 48

2. 12 men can build a wall 100 metres long, 3 metres high and 0.5 meter thick in 25 days. In how many days will 20 men build a wall 60 metres long, 4 metres high and 0.25 metres thick?

   a. 3 days b. 12 days c. 6 days d. 8 days

3. A man works twice as fast as a woman. A woman works twice as fast as a child. If 16 men can complete a job in 12 days, then how many days would be required for 32 women and 64 children together to complete the same job?

   a. 2 days b. 12 days c. 3 days d. 6 days

4. To complete a task in 45 days, a contractor employs 45 people. Upon reviewing the work after 30 days, he notices that only half of the task is complete. In order to complete the work in 45 days, how many extra people must he employ now?

   a. 90 b. 15 c. 60 d. 45

5. To complete a task, two men work on the first day, three men on the second day and so on, till it gets completed. If the same

work can becompleted by 9 men working for 15 days, in how many days will the work be completed in the earlier case?

a. 15 days b. 16 days c. 14 days d. 17 days

6. 4 men and 4 women can build a room in 5 days. 7 men and 2 women will take 4 days to complete the same piece of work. How many days will 6 men and 1 woman take to complete twice the job?

a. 10 days b. 20 days c. 5 days d. None

7. If 3 men or 4 women can reap a field in 43 days, how long will 7 men and 5 women take to reap it?

a. 12 days b. 1 day c. 6 days d. 8 days

8. A is thrice as good a work man as B. If together they can complete a task in 12 days, in how many days can A alone complete it?

a. 48 days b. 16 days c. 24 days d. None

9. Rajeev takes one hour to arrange 96 books. Sanjeev takes one and a half hour to arrange the same number of books. Working together, how many hours will they take to arrange 4000 books?

a. $20\frac{2}{3}$ hrs b. $31\frac{1}{4}$ hrs c. $41\frac{1}{3}$ hrs d. 25 hrs

10. Anil, Benny and Cyril work for a ship building company. Anil can build a ship in 10 days while Benny can build the same ship in 8 days. Working together, all three of them can build a similar ship in 4 days. In how many days can Cyril alone build it?

a. 20 days b. 80 days c. 40 days d. None

11. A and B can do a piece of work in 30 days. B and C can do it in 37.5 days. C and A can do it in 50 days. In how many days will they finish, if A, B and C work together?

a. 25 days b. 15 days c. 10 days d. None

12. A, working alone can make a cabinet in 12 days. B will take 6 days more than A to do the same work. A and B along with the help of C completes it in 5 days. If they are paid Rs. 9000 for the job, find C's share.

a. Rs. 2750 b. Rs. 2500 c. Rs. 2250 d. None

13. Two taps X and Y can fill a cistern in 32 and 40 minutes respectively. Both the taps are opened into the empty cisterns and after some time tap X is closed. Tap Y alone fills the remaining portion of the cistern. If it took 25 minutes to fill the tank, for how much time was tap X keptopen?

a. 13 min b. 25 min c. 12 min d. None

14. Taps X and Y can fill a tank in 30 and 40 minutes respectively. Tap Z can empty the filled tank in 60 minutes. If all the three taps are kept open for one minute each, how much time will the taps take to fill the tank?

a. 48 min b. 72 min c. 24 min d. None

15. A booster pump can be used for filling as well as emptying a tank of capacity 2400 m^3. The emptying capacity of the pump is 10 m^3 per minute higher than its filling capacity and the pump needs 8 minutes lesser to empty the tank than it needs to fill it. What is the filling capacity of the pump?

a. 20 m^3/min b. 60 m^3/min c. 40 m^3/min d. 50 m^3/min

16. A tap requires 18 hours to fill a tank. On a particular day, it was noticed that 18 hours after the tap was turned open, the tank was not filled due to leak at the bottom of the tank. The leak was plugged and it took the tap 3 more hours to fill the tank. Working alone, how long will the leak take to empty the tank?

a. 3 hrs b. 108 hrs c. 72 hrs d. None

PERCENTAGES, SIMPLE INTEREST AND COMPOUND INTEREST

Concepts

- To convert any fraction (a/b) to percentage, multiply it by 100. For example, ½ x 100% = 50%
- To convert a percent to fraction, divide it by 100. For example, 8% = 8/100.
- Percentage of a number is the product of equivalent fraction and the number. For example, 25% of 500 = (25/100) x 500 = 125.
- Percentage increase/decrease
  - ✓ If any number is increased by i%, then, New number = Initial number [1 + (i/100)]
  - ✓ If any number is decreased by d%, then New number = Initial number [1 – (d/100)]
- If the price of a commodity increases by a%, then the reduction in consumption so as not to increase expenditure is [a/(100 + a)] x 100 %
- If the price of a commodity decreases by a%, then the increase in consumption so as not to decrease expenditure is [a/(100 - a)] x 100 %
- If A is R% more than B, then B is less than A by [R/(100 + R)] x 100 %
- If A is R% less than B, then B is more than A by [(R/(100 - R)] x 100 %
- If the population of a town is P now and suppose it increases at the rate of R% per annum, then
  - ✓ Population after 'n' years = $P(1 + r/100)^n$
  - ✓ Population 'n' years ago = $P/(1 + r/100)^n$
- Simple Interest = Pnr/100
- Compound Interest = $P [1 - r/100]^n - P$
- Amount with CI = $P [1 + r/100]^n$
- Amount with SI = P + [Pnr/100]
- When rate of interest is compounded a times an year, amount= $P [1 + r/(a \times 100)]^{an}$
- When rate of interest is r_1%, r_2% and r_3% for 1st year, 2nd year and 3rd year respectively. Amount after 3 year = $P [1 + r_1/100] \times [1 + r_2/100] \times [1 + r_3/100]$

Drill

1. Calculate 25% of 80 _____
2. If 15% of apples are bad, out of 200 apples, how many apples are bad? _____
3. Express 3/8 in percentage form _____
4. Express 62.5% as a fraction _____
5. Express 1.25 in percentage form _____
6. The price of a pen is increased from Rs. 5 to Rs. 7. What is the percentage increase?
7. The number of employees in a company decreased from 40 to 28. What is the percentage decrease in the number of employees?
8. Salary of X is 20% more than that of Y. By what percentage is the salary of Y lesser than X?
9. Coconut oil is now being sold at Rs. 27 per kg. During last month, its cost was Rs. 24 per kg. Find by how much percent a family should reduce its consumption, to keep the expenditure the same.
10. A car increases its speed by 25%. After that, it again increases its speed by 20%. By what percentage is the car's final speed greater than its original speed?
11. Interest rates jump from 10% to 12%
    a. What is the percentage increase?
    b. What is the increase in terms of percentage points?
    c. What is the increase in terms of basis points?
12. The table below shows the population (in thousands) of a town over a 5 - year period. Which of the given years registered the maximum percentage change over the previous year?

Year	2002	2003	2004	2005	2006
Production	80	120	110	150	200

13. A man took a loan from a bank at the rate of 12% p.a. simple interest. After 3 years, he had to pay Rs. 5400 as interest for the period. What was the principal amount borrowed by him?
14. How much time will it take for an amount of Rs. 450 to yield Rs. 81 as interest at the rate of 4.5% p.a. simple interest?
15. An amount of Rs. 2400 is due after 6 years under simple interest at 10%p.a. Find its present value.
16. The compound interest on Rs. 30000 at 7% p.a. is Rs. 4347. The period (in years) is _____
17. At what rate of interest p.a. under C.I. will a sum of Rs. 1200 become Rs. 1348.32 in 2 years?
18. A man invests Rs. 10000 in an account that pays 8% interest per year, compounded quarterly. What is the amount of money that he will have after 1.5 years?
19. If a sum of money doubles itself in 5 years, in how many years does it becomes 8 times the original?
20. If the simple interest on a sum of money for 2 years at 5% p.a. is Rs. 50, what is the compound interest on the same amount at the same rate of interest and for the same time?
21. Given the difference between SI and CI for 2 years on the same sum and at the same rate of interest, compounded annually is Rs. 120. The difference between SI and CI for 3 years on the same sum and at the same rate of interest is Rs. 366. Find the rate of interest.

Concept review questions

1. If 45 is 120% of a number, then what is 80% of the same number?

   a. 30 b. 32 c. 36 d. 38

2. The population of a town was 3600 three years back. It is 4800 right now. What will be the population three years down the line, if the rate of growth of population is constant over the years?

   a.6400 b. 6000 c. 5800 d. 6600

3. Two students appeared for an examination. One of them secured 9 marks more than the other and his score was 56% of the sum of their marks. The marks obtained by them are:

   a. 39, 30 b. 43, 32 c.42, 33 d. 43, 34

4. Peter got 30% of the maximum marks in an examination and failed by 10 marks. However, Paul, who took the same

examination, got 40% of the total marks and got 15 marks more than the pass mark. What was the pass mark in the examination?

a. 75 b. 250 c. 90 d. 85

5. A shepherd has 1 million sheep at the beginning of the year 2000. The numbers grow by x%, (x > 0) during the year. A famine hits his village in the next year and many of his sheep die. The sheep population decreases by y% during 2001 and at the beginning of 2002 the shepherd finds that he is left with 1 million sheep. Which of the following is correct?

a. y>x b. x=y c. x>y d. xy=0

6. If the price of petrol increases by 25% and Kevin intends to spend only an additional 15% on petrol, then by what percentage must he reduce the quantity of petrol purchased?

a. 6.67% b. 10% c. 8% d. None

7. A vendor sells 60% of apples he had and throws away 15% of the remaining apples. Next day, he sells 50% of the remaining apples and throws away the rest. What % of the apples does the vendor throw away?

a. 23 b. 17 c. 77 d. 29

8. In how many years will a sum double itself at 12.5% p.a. simple interest?

a. 4 b. 8 c. 10 d. 16

9. Divide Rs. 3000 into two parts such that, the simple interest on the first part for 4 years at 8% per annum is equal to the simple interest on the second part for 2 years at 9% per annum.

a. 1000, 2000 b. 1280, 1720 c. 1160, 1840 d. 1080, 1920

10. Meena deposited a sum of Rs. 8000 in a bank paying simple interest. After one year, she withdraws Rs. 2000. At the end of 3 years, she received Rs. 7800. Find the rate of interest, assuming that she never collected her interests till then.

a. 9% b. 8% c. 10% d. 12%

11. A man invests Rs. 5000 for three years at a certain rate of interest, compounded annually. At the end of one year it amounts to Rs. 5600. Calculate the amount due at the end of the second year.

a. Rs.6200 b. Rs.6272 c. Rs.6260 d. Rs.6320

12. Find the amount due on Rs. 8000 in 2 years if the rate of interest is 10% for the first year and 12% for the second year.

a. Rs.9716 b. Rs.9856 c. Rs.10156 d. Rs.9756

13. Find the difference between S.I. and C.I. on Rs. 2500 for 2 years at 4% p.a., compound interest, interest being compounded semi-annually.

a. Rs.4.00 b. Rs.6.08 c. Rs.4.68 d. Rs.5.88

14. A man invests Rs. 6500 for 3 years at 4.5% p.a. compound interest, compounded annually. 20% is deducted at the end of each year from this investment for expenditures. Find the amount due at the end of the third year.

a. Rs. 3688.24 b. Rs. 4946.62 c. Rs. 3797.80 d. Rs. 5244.04

15. A sum of Rs. 550 was taken as a loan. This is to be paid back in two equal installments. If the rate of interest is 20% p.a. compound interest, being compounded annually, then the value of each installment is:

a. Rs.421 b. Rs.300 c. Rs.360 d. Rs.350

PROFIT & LOSS, PARTNERSHIPS AND AVERAGES

Concepts

Selling Price (SP) – Price at which an article is sold

Cost Price (CP) – Price at which an article is bought

Marked Price (MP) – Initial price quoted for the article

Profit/loss = SP – CP

Profit/loss percentage = $\frac{SP-CP}{CP} \times 100$

Mark-up amount = MP – CP

Mark-up percentage = $\frac{MP-CP}{CP} \times 100$

Discount = MP – SP

Discount percentage = $\frac{MP-SP}{MP} \times 100$

Note: Profit/loss percentage and mark-up percentage are always calculated on the cost price and discount percentage is always calculated on the marked price.

- If a seller sells his goods at cost price, but uses false weight, then the profit earned is given by the formula
  Gain % = $\frac{Error}{True\ value - Error} \times 100$
- If the investments are in the ratio a : b : c, for a fixed time period, then the profit should be divided in the ratio a : b : c.
- If the investments are in the ratio a : b : c for a time period, of x, y, z respectively, then the profit should be divided in the ratio ax : by : cz.
- Average of N items = $\frac{Total\ value\ of\ all\ the\ items}{Number\ of\ items\ (N)}$
- Average (using the deviations)
  =Assumed value $\pm \frac{Deviation}{Number\ of\ elements}$
- **Weighted Average:** If there are 'n' items with an average of 'a' and another 'm' items with an average of 'b', then the overall average = $\frac{an+bm}{n+m}$
- **Alligation Rule:** If two solutions of concentration P_1 and P_2 are mixed in the ratio Q_1:Q_2 to result in an average concentration of P ,then by rule of alligation, $\frac{P_2-P}{P-P_1} = \frac{Q_1}{Q_2}$

Drill

1. Assume that you are going to a shop to buy a dress. You find the dress on the mannequin very attractive and wish to buy it. The tag price of the dress is Rs. 5400. You buy that dress at a special discount of 20%. When you show that dress to your friend, he reveals that he was the one who designed that dress and had sold it to the shop for Rs. 1080.
   From the shop owners point of view,
   A. How is the amount Rs. 1080 called? CP
   B. How is the amount Rs. 5400 called? MP
   C. What is the discount given? 1080
   D. What is the profit/loss incurred by the shopkeeper? 3240
   E. What is the profit/loss %? 300% P
2. Now assume you are the owner of an ornaments shop.
   A. You are buying a diamond ring for Rs. 1,00,000
   B. What is your expected profit on the sale of that ring? 1,00,000
   C. What should be your selling price? 2,00,000
   D. If you wish to give a discount of 20% and still make the same profit, what should be the marked price? 2,40000
   E. From your marked price, if you give a discount of 20%, are you getting your selling price? Yes
3. Ram sells 2 flats for Rs. 198 lakhs each. On one transaction he loses 10% and on the other he gains 10%. What is his net profit or loss percentage?
   A. In the first transaction what is the cost price? 220
   B. In the second transaction what is the cost price? 180
   C. What is the total cost price? 400
   D. What is the total selling price? 396
   E. Total profit/ loss? 4
   F. Profit/ loss %? 1%
4. A dishonest shopkeeper professes to sell his goods at cost price, but he gives only 800 g instead of 1000 g. What is his profit %? 25%
5. Anand and Babu invest in a business in the ratio 4 : 3. If 2% of the total profit goes to charity and Anand's share is Rs. 854, what is Babu's share? 640.5
6. Dhivya and Ramya started a business. They both invested Rs. 100,000 each. At the end of 6 months, Ramya predicts that the business will end up in a loss and she withdrew Rs. 60,000 from the business. But, at the end of one year, the business generated a profit of Rs. 34,000. What will be the profit share of each person? 20,000 ; 14,000 Invest × time
7. You along with 5 of your friends go for an outing. You have Rs. 31,348, Rs. 26,348, Rs. 23,348, Rs. 27,348, Rs. 32,348 and Rs. 35,348 with you. You plan to divide that amount equally among yourselves before starting for this trip. All six of you agree to donate the unspent money to an orphanage.
   A. What is the amount with each person at the start of the journey? 29,348
   B. If the last person lost his money when he was about to reach the starting point and you still agree to share the money equally, what will be the amount with each of you when you are starting? 23,456.6
   C. If the last person is not coming for the trip, what will be the amount with each of you at the time of starting? 28,148
   D. If the expense per head at the end of the trip was Rs. 32,000, then, what is the total amount donated to the orphanage? 0
8. Four friends have an average weight of 68. If John is also included in the group, the average weight becomes 72. What is John's weight? 72 × 5 − 68 × 4 = 88
9. Average height of class A is 160 cm and that of class B is 170 cm. Find the average height of students of both the classes put together. 165
10. One litre of bottle A with 8% sugar solution is mixed with an unknown quantity of bottle B with 11% sugar solution such that the mixture has 10% sugar solution. How many litres of sugar solution from bottle B was mixed with bottle A? 2 litres
11. A milk man mixes two bottles of milk with concentrations of milk being 0.6 and 0.9. The resultant mixture has a
    P_1 P_2

concentration of 0.7. Find the ratio in which milk from the two bottles is mixed. 2 : 1

12. 20 ml of sulphuric acid of concentration 0.4 is diluted by adding water such that the concentration becomes 0.3. What is the quantity of water added? 6-6 l

Concept review questions

1. If the S.P. of 10 articles is the same as the C.P. of 11 articles, find the gain percentage.

   a. 20 b. 10 c. 15 d. 40

2. The price of sugar is raised by 10%. By how much percent must a man reduce his consumption of sugar so as to not increase his expenditure?

   a. 9.09 b. 8.08 c. 7.06 d. 9.50

3. An article worth Rs. 120 is sold for Rs. 145. What is the profit percent?

   a. 30.83 b. 20.83 c. 40.83 d. 25

4. A man purchased a scooter for Rs. 20000 and got it insured for 80% of its value. The scooter was totally destroyed in an accident and the insurance company compensated him for only 80% of the claim. What was the loss suffered (in %)?

   a. 30 b. 36 c. 38 d. 40

5. If an article is sold for Rs. X, the profit is 10% and if the price is reduced by Rs. 88, the loss is 10%. Find the cost price of the article.

   a. 440 b. 400 c. 444 d. 800

6. Two articles are sold at Rs. 199 each such that a profit of 10% is made on the first while a loss of 10% is incurred on the other. What would be the net profit/loss on the two transactions?

   a. loss of 1% b. gain of 1% c. loss of 10% d. gain of 10%

7. A and B together invested Rs. 18000 in a business. The ratio of their investments was 4 : 5. At the end of the year, a total profit of Rs. 2700 was generated. Find their profits.

   a. 1200, 1500 b. 1300, 1400 c. 1400, 1300 d. None

8. Monish started a business by investing Rs. 80000. Six months later, Mani joined him with a capital of Rs. 140000. If at the end of the year, the total profit is Rs. 37500, then what is Mani's share of profit?

   a. 25000 b. 17500 c. 15000 d. None

9. A, B, C rent a pasture. A puts 10 oxen for 7 months, B puts 12 oxen for 5 months and C puts 15 oxen for 3 months for grazing. If the rent of the pasture is Rs. 175, how much must C pay as his share of rent?

   a. Rs.45 b. Rs.50 c. Rs.55 d. Rs.60

10. In the first 5 overs of a cricket game, the run rate was 4.6. What should be the run rate in the remaining 15 overs to reach the target of 183 run in 20 overs match?

    a. 6.25 b. 10.5 c. 10.67 d. 10.75

11. The average weight of 32 students in class A is 78 kg and the average weight of 96 students in class B is 38 kg. Find the combined average of both the classes.

    a. 42 b. 58 c. 48 d. 59

12. The average score of 70 students is 35. The average score of first 28 students is 53. Find the average of the remaining students.

    a. 42 b. 23 c. 53 d. 67

13. A pupil's mark was wrongly entered as 83 instead of 63. Due to that, the average mark of the class increased by half a mark. The number of pupils in the class is:

    a. 40 b. 20 c. 10 d. 73

14. In what ratio must a grocer mix two varieties of pulses costing Rs. 15 per kg and Rs. 20 per kg respectively so as to get a mixture worth Rs. 16.50 per kg?

    a. 3:7 b. 5:7 c. 7:3 d. 7:5

15. A mixture of a certain quantity of milk and 10 litres of water is worth Rs. 80. If pure milk of same quantity is worth Rs. 100, what is the amount of milk in the mixture? (Assume water is free of cost)

    a. 10 b. 40 c. 50 d. None

199 = 0.9 × CP

CP = 1990 / 9

= 221.1

180.9

1990

11

= 180.9

402 398

4 × 100

402

14 × 6 = 84

8 × 12 = 96

PERMUTATION, COMBINATION AND PROBABILITY

Concepts

- In general, if a_1 can be done in p_1 ways, a_2 can be done in p_2 ways,... and a_n can be done in p_n ways, then the events a_1, a_2, a_3 ...and a_n can be done in $(p_1 \times p_2 \dots p_n)$ ways.
- Number of ways of arranging **n items** in **r places** is given by ${}^nP_r = n! / (n - r)!$
- The total number of permutations of **n** different things taken all at a time = **n!**
- The total number of arrangements of **n** different things taken **r** at a time, in which a particular thing always occurs = $r \times {}^{n-1}P_{r-1}$
- The total number of permutations of **n** different things taken **r** at a time in which a particular thing never occurs = ${}^{n-1}P_r$
- The total number of permutation of **n** dissimilar things taken **r** at a time with repetitions = n^r
- The number of permutations of **n** things taken all at a time when **p** of them are alike and of one kind, **q** of them are alike and of second kind, all other being different, is **n! / (p! x q!)**
- Number of ways of selecting **r** items out of n items is given by ${}^nC_r = {}^nP_r / r! = n! / r! (n - r)!$
- Number of combinations of **n** different things taken **r** at a time in which **p** particular things will always occur is ${}^{(n-p)}C_{r-p}$
- Number of combinations of **n** different things taken **r** at a time in which **p** particular things will never occur is ${}^{(n-p)}C_r$
- ${}^nC_0 + {}^nC_1 + {}^nC_2 + \dots {}^nC_n = 2^n$
- The number of ways in which **(m + n)** things can be divided into two groups containing **m & n** things respectively is **(m + n)! / (m! x n!)**
- If E & F are two mutually exclusive events, then the probability that either event E or event F will occur in a single trial is given by **P(E or F) = P(E) + P(F)**
- If the event are not mutually exclusive, then **P(E or F) = P(E) + P(F)– P(E & F together)**
- If the events E & F are independent then **P(E & F) = P(E) × P(F)**
- If **p** is the probability that an event will occur and **q = (1 – p)** is the probability of the non-occurrence of the event, then we say that the **odds in favour** of the event occurring are **p : q** and the **odds against** its occurring are **q : p.**

Drill

1. A shopping mall has 3 distinct glass doors and 2 distinct metal doors for entry and has 5 distinct glass doors and a wooden door for exit.
   In how many ways can you enter the mall? 5
   In how many ways can you leave the mall? 6
   In total, how many ways can you enter and leave the mall? 30
2. If there are three trains from A to B and 5 trains from B to C, in how many ways can one travel from A to C by train (assume there are no direct trains from A to C)? 15
3. The number of ways a cricket team of 11 can be selected from a 16 – member squad. P/C ${}^{16}C_{11}$
4. The number of ways 7 dignitaries can seat themselves in seven chairs kept on the stage. P/C 7!
5. The number of ways a panel of 4 judges can be formed from 6 retired judges. P/C ${}^6C_4$
6. The number of ways 5 friends can occupy 7 empty chairs in a theatre. P/C ${}^7P_5$
7. The number of ways Raghav can invite 3 out of 7 friends to his house for a party. P/C ${}^7C_3$
8. For the following questions, identify whether repetition is allowed (A) or not allowed (NA).
   (i) How many 3 - digit numbers can be formed using single digit prime numbers? A/NA
   (ii) In how many ways can 15 friends sit in 20 chairs in a movie theatre? A/NA
   (iii) In how many ways can 4 letters be posted in 6 post boxes? A / NA
9. In how many ways can 5 friends be seated in three chairs? ${}^5P_3$
10. What is the maximum number of attempts required to open a 3–slot number lock where each slot can have any digit between 0 and 9? 512
11. How many 5 letter words (with or without meaning) can be formed using the letters of the word 'GREAT'?
    (i) If repetition of alphabets is allowed=3125. (5^5)
    (ii) Without repetition of alphabets=120. 5!
    (iii) Such that all the vowels are together=4 x 4 x 3 x 2 x 1 x 2
    (iv) Such that the vowels are together and the consonants are together=24.
    (v) No two vowels are together=72.
12. Making use of the five digits 0, 2, 6, 7, and 9
    a. How many 4-digit numbers can you make without repetition of digits? 120 (5!)
    b. How many 4-digit even numbers can you form?
    c. How many 4-digit numbers divisible by four can you form?
13. In how many ways can three boys and three girls sit in six chairs? 6!
14. How many 4-letter words can be formed using all the letters of the word 'TEST'? 4!/2!
15. How many words can be formed using all the letters of the word 'ELEPHANT'? 8!/2!
16. In how many ways can 3 red balls and 2 blue balls be arranged in a straight line? 5!
17. In how many ways can 5 letters be posted in 4 post-boxes? 5^4
18. You go to a jewellery shop to buy a beaded necklace and the necklace displayed on the side is shown to you. After some time, the sales man rotates the displayed jewellery by a certain angle and claims it to be different jewellery. Will you accept it? No
19. In how many ways can 5 friends sit around a table? 4!
20. How many necklaces can be formed with 7 different beads? 6!
21. How many garlands can be formed with 6 different coloured roses? $\frac{5 \times 4 \times 3 \times 2 \times 1}{2}$ ($\frac{5!}{2}$)
22. In how many ways can 4 boys and 4 girls sit around a table, if no two boys should sit together? 1
23. From a squad of 8 members, in how many ways can you pick a team of 5 members? ${}^8C_5$
    Is selecting 3 members, who will not be a part of the team, the same as selecting 5 members who will be a part of the team? Yes
24. In how many ways can you form a cricket team of 11(comprising of 6 batsmen and 5 bowlers) from a squad of 16 (8 batsmen and 8 bowlers)? ${}^8C_6 \times {}^8C_5 = 1608$
25. In how many ways can you form a committee of 4 from 5 men and 3 women?
    (i) If the committee comprises of 2 men and 2 women? ${}^5C_2 \times {}^3C_2 = 30$
    (ii) The committee has at least 2 men? ${}^5C_2 \times {}^3C_2 + {}^5C_3 \times {}^3C_1 + {}^5C_4 \times {}^3C_0 = 65$

(iii) The committee has no more than 2 women? 65
(iv) One particular member always has to be selected? $^7C_3 = 35$
(v) One particular member should never be selected? $^7C_4 = 35$

26. From 6 friends, in how many ways can you invite
(i) 3 friends to your house for a party? $^6C_3 = 20$
(ii) 1 or more friends to your house for a party? $2^6 - 1 = 63$
(iii) At least 2 friends to your house for a party? $63 - {}^6C_1 = 57$
27. In how many ways can you give one or more toffees to your friend from the 5 similar orange and 4 similar grape flavoured toffees?
28. If a coin is tossed 4 times, how many different outcomes are possible?
(i) Number of outcomes per toss of a coin =_____.
(ii) Total number of outcomes for 4 tosses =_____.
(iii) If 4 coins are tossed at once, will the number of outcomes be the same? Yes/No
29. If a die is rolled 3 times, how many different outcomes are possible?
30. If 2 cards are drawn at random from a pack of cards, how many different outcomes are possible?
(i) With replacement _____
(ii) Without replacement _____
31. If two different letters are selected at random from the English alphabet, what is the probability that
(i) Both of them are vowels?
(ii) At least one of them is a vowel?
32. If 2 dice are rolled, what is the probability that the sum of the values on them is a prime number?
33. If 3 coins are tossed simultaneously, what is the probability that exactly 2 of them will show tails?
34. If 4 coins are tossed simultaneously, what is the probability of getting 2 or more tails?
35. If two cards are drawn at random from a pack of cards, what is the probability that
(i) Both of them are spades?
(ii) Both of them are red or both of them are kings?
36. Problems on odds in favour / odds against
(i) Two fair coins are tossed. What are the odds in favour of getting heads on both the coins?
(ii) If 3 dice are rolled simultaneously, what are the odds against getting a prime number on each of the 3 faces?

Concept review questions

1. How many ten letter words can be formed with all the letters of the word 'ENGAGEMENT'?

a. 10! b. 10! / (3! x 2! x 2!) c. 10! / (3! x 2!) d. None

2. How many 5 - digit numbers divisible by 4 can be formed using the digits 5, 6, 7, 8, and 9 such that there is no repetition of digits?

a.30 b. 21 c. 24 d. 18

3. Find the sum of all 4 - digit numbers formed by taking all the digits 2, 4, 5, and 7.

a. 118899 b. 119988 c. 19998 d. 19988

4. A conference is attended by 25 participants. If each participant shakes hand with every other participant, what will be the resultant number of handshakes?

a. 300 b. 25 c. 276 d. 325

5. How many diagonals does an octagon have?

a. 56 b. 20 c. 28 d. 24

6. How many parallelograms are formed by a set of 6 parallel lines intersecting another set of 4 parallel lines?

a. 24 b. 90 c. 15 d. None

7. If all the possible words using the letters of the word 'DRAW' are formed without repetition and arranged in alphabetical order, what will be the position of the word 'WARD'?

a. 23 b. 24 c. 19 d. 20

8. In how many ways can 6 tennis players be divided into 3 teams of 2 each?

a. 20 b. 45 c. 90 d. None

9. What is the probability that a clerk while randomly placing 5 letters (each intended for a particular recipient) in 5 addressed envelopes will place exactly one of those letters in a wrong envelope?

a.5! b. 1/5! c. 0 d. None

10. If two different numbers are randomly selected from the first 10 natural numbers, what is the probability that the sum of the selected numbers will be 11?

a. 1/55 b. 1/11 c. 1/9 d. 1/45

11. From a bag with 2 white, 3 black and 5 red marbles, 3 marbles are randomly selected. What is the probability that all the 3 selected marbles are red in colour?

a. 1/2 b. 1/120 c. 1/12 d. None

12. A football player was practicing penalty shots. If the probability of scoring a goal for each attempt is 80%, what is the probability that he will score a goal in each of his 3 attempts?

a. 80% b. 64% c. 0% d. 51%

13. If the letters of the word 'TRAP' are jumbled at random, what is the probability that the position in which the vowel appears will remain unchanged?

a. 6/23 b. 1/24 c. 1/6 d. 1/4

14. A man plays a game of dice in a casino. The man has to pay Rs. 100 for every roll of the dice. If a multiple of 3 turns up, the man doubles his money; else, he forfeits it. In the long run, what is his expected gain or loss per roll of the dice?

a. Rs. 33 1/3 gain b. No gain or loss

c. Rs. 33 1/3 loss d. Rs. 100 loss

15. There are two boxes with numerous balls in them. The first box has 13 red and 17 white balls. The second box has 12 red and 8 green balls. If one of those boxes is selected at random and a ball is selected at random from the selected box, what is the probability that the selected ball will be white?

a. 17/30 b. 17/50 c. 17/60 d. 29/60