CAT

MBA PIONEER 2024

QUANTITATIVE APTITUDE

DPP: 03

P and C - 3

Q1 Find the number of ways in which 10 persons are made to stand in a row such that A, B, C and D are all never together?

(A) 10! – (6! × 4!)

(B) 10! – (7! × 3!)

(C) 10! – (8! × 3!)

(D) 10! –(7! × 4!)

Q2 A seven–digit number consists of only 2's and 3's. How many of these are multiples of 4?

(A) 32
(B) 64
(C) 16
(D) 48

Q3 If all the rearrangements of the word DESERT are considered, then the number of words such that S will feature between the 2Es?

(A) 160
(B) 110
(C) 120
(D) 240

Q4 For the word SIGNATURE, find the number of ways in which all the letters when rearranged do not have 2 vowels together?

(A) $5! \times ^6C_4$

(B) $5! \times ^6C_4 \times 4!$

(C) $4! \times ^6C_4 \times 3!$

(D) $5! \times ^6C_4 \times 2!$

Q5 Find the number of ways in which 5 boys and 5 girls can be seated in a row so that all the girls sit together and all the boys sit together.

(A) $2 \times (5!)^2$

(B) $(5!)^2$

(C) 6! × 5!

(D) 2 × 5!

Q6 How many words can be formed using the letters of the word AQUARIUM such that the consonants are never together?

(A) $\frac{6! \times 5!}{3!2!2!}$

(B) 6! × 5!

(C) $\frac{6! \times 5!}{2}$

(D) $6! \times 6! \frac{5!}{2! \times 2!}$

Q7 In how many ways can we rearrange the letters of the word BANANA such that no two A's are adjacent to each other?

(A) 3!
(B) 3 * 3!
(C) 5!
(D) 12

Q8 In how many ways can five boys sit around a circular table having eight identical chairs around them?

(A) 840
(B) 910
(C) 980
(D) 990

Q9 You have been provided the following 9 digits of 5, 5, 6, 6, 6, 7, 7, 7 and 7. How many distinct four–digit numbers greater than 6000 can be formed using only the above 9 digits?

(A) 53
(B) 51
(C) 50
(D) 48

Q10 One day Nadar–bhai typed a 7 digit number on an HCL desktop with a keyboard having three faulty number keys. He noticed that 20016 got typed on the screen. In how many ways could Nadar–bhai have typed the 7 digit number?

(A) 1635
(B) 1765
(C) 2520
(D) 2760

Q11 8 friends (including Priya and Pooja) go to watch a movie. They get tickets for 8 consecutive seats in a row having just 8 seats, with aisle on either side of the row. If Priya and Pooja want to sit such that there are exactly 2 other friends in between them but Pooja does not want to sit in the aisle seat, in how many different ways can the friends sit?

(A) $8! - 2 \times 6!$

(B) 3600

(C) 5760

(D) 7200

Q12 In how many ways can the letters of the word NATIONALITY be arranged such that vowels and consonants are alternate?

(A) 21600 (B) 10800

(C) 5400 (D) 2700

Q13 A bag has 4 identical blue balls, 4 identical green balls and 4 identical red balls. How many ways can the balls be arranged in a row such that balls of all three colours are present for every selection of three consecutive positions?

(A) 6

(B) $6 \times (4!)^3$

(C) $6 \times 4! \times 3$

(D) 24

Q14 Arrange letters of the word 'nineteen' such that all vowels are together. How many distinct such arrangements are possible?

(A) 40 (B) 60

(C) 72 (D) 80

Q15 Letters of the word INDIAN are arranged in every possible way. How many of these ways will not have the first and last letters the same?

(A) 60 (B) 120

(C) 156 (D) 180

Q16 Using each of 0, 1, 1, 2, 2, 2 exactly once, how many six–digit numbers can be formed?

(A) 40 (B) 50

(C) 60 (D) None of these

Q17 In how many ways can 5 boys and 2 girls be seated in a row such that there is at least one boy between the two girls?

(A) $7! - 6! \times 2$

(B) $5! \times 6 \times 5$

(C) $7! - 6!$

(D) Both options (a) and (b)

Q18 4 distinctly numbered blue balls, 4 distinctly numbered red balls and 4 distinctly numbered green balls are to be arranged in a row such that the 3 balls in any 3 consecutive positions are of different colors. In how many ways can the arrangement be done?

(A) $6 \times (4!)^3$

(B) $6 \times 4! \times 3$

(C) $4! \times 4! \times 4!$

(D) $3 \times (4!)^3$

Q19 3 couples (husband and wives) and 1 child of each couple are to be seated in a row such that no two wives sit adjacent to each other and all the 3 children sit in consecutive positions. In how many ways can they be seated?

(A) 3456 (B) 8640

(C) 25920 (D) 29376

Q20 In a zoo, there are 7 enclosures in a row. And each of these enclosures must be assigned to one animal out of Lion, Tiger, Cheetah, Bear, Chimpanzee, Rhinoceros and a Panda. None of the cats (Lion, Tiger, Cheetah) must be in adjacent enclosures. Nor can the Chimpanzee and the Panda be in adjacent enclosures. In how many different ways can the enclosures be assigned to the animals?

(A) 504 (B) 540
(C) 1152 (D) 1296

Q21 A photograph needs to be clicked of the graduating batch. The photo will include the 12 students, the 5 supporting staff and the 3 faculty members. These 20 people need to be arranged in three rows – 4 kneeling in front, 7 seated in middle row and 9 standing in the last row. If those kneeling have to be students, the 3 faculty members have to be in the middle of those seated and the 5 support staff have to be in the middle of those standing, in how many different ways can the arrangement be done?
(A) 20!
(B) 12! × 5! × 3!
(C) 12! × 5! × 4! × 4! × 2!
(D) None of these

Q22 p = Number of distinct ways in which 4 people can be seated in a set–up having 7 chairs in a row.
q = Number of ways in which 4 chairs in a row can be occupied if there are 7 people present in the room.
In both cases, a person can sit only in one chair and one chair can accommodate only one person.
Which of the following is true?
(A) p > q (B) p = q
(C) $p = \frac{q}{120}$ (D) $p = \frac{q}{210}$

Q23 9 girls need to be seated in a row. Of the 9 girls, 6 insist on being seated in consecutive positions. And of these 6, further 3 girls insist on being seated adjacent to each other. In how many distinct ways can the 9 girls be seated?
(A) 103680 (B) 17136
(C) 13824 (D) 3456

Q24 2 female scientist, 3 males sportsmen, 2 male scientist and 2 females sportswomen need to be seated in a row such that males and females are alternate. And also scientists need to sit together and all sportsperson also need to sit together. In how many different ways can the 9 people be seated in a row?
(A) 80 (B) 84
(C) 90 (D) 96

Q25 Sharma's family having 2 adults and 1 children and Mishra's family having 1 adult and 2 children are to be seated in a row. If all the children need to be seated adjacent to each other and the two adults of Sharma's family also need to sit adjacent to each other, in how many distinct ways can the seating arrangement be made?
(A) 72 (B) 80
(C) 90 (D) 96

Q26 In how many ways can 7 friends sit around in a circular arrangement if one of the friend, Roopa does not want to sit besides either Prasoon or Mayank?
(A) 576 (B) 672
(C) 432 (D) 288

Q27 In how many ways can 5 couples be seated around a circular table such that every husband and wife sits opposite to each other?
(A) 384 (B) 4!
(C) 4! × 25 (D) None of these

Q28 6 boys and 4 girls are to be arranged in a circular arrangement such that no two girls are seated next to each other. In how many distinct ways can the boys and girls be arranged?
(A) 360 × 5!
(B) 2160 × 5!
(C) 840 × 5!
(D) 5! × 4!

Q29 A circular table has 8 equi–spaced chairs around it. The chairs are all identical except for their colors. The colors of the chairs are alternately white and black. In how many ways can 8 people be seated around this table?

(A) 8! (B) $4 \times 7!$

(C) $2 \times 7!$ (D) 7!

Q30 A bracelet needs to be made by stringing together 8 distinguishable beads in a circular arrangement. How many distinct patterns are possible?

Answer Key

Q1	(D)
Q2	(A)
Q3	(C)
Q4	(B)
Q5	(A)
Q6	(A)
Q7	(D)
Q8	(A)
Q9	(B)
Q10	(C)
Q11	(C)
Q12	(C)
Q13	(A)
Q14	(D)
Q15	(C)
Q16	(B)
Q17	(D)
Q18	(A)
Q19	(B)
Q20	(C)
Q21	(B)
Q22	(B)
Q23	(D)
Q24	(D)
Q25	(A)
Q26	(D)
Q27	(A)
Q28	(A)
Q29	(C)
Q30	2520

Hints & Solutions

Q1 Text Solution:

For finding the number of ways in which 10 persons are made to stand in a row such that A,B,C and D are all never together, we will first calculate the total arrangements possible with all 10 persons and then deduct the cases when all of the 4 persons, A, B, C and D are always together.

Hence, Required arrangements = Total arrangements – Arrangements when A, B, C and D are always together.

Total arrangements = 10!

Arrangements when A, B, C and D are always together

= We will tie A, B, C and D together and then have (6 +1)! = 7! ways in which A, B, C and D will be together. Among them, the 4 persons can arrange themselves in 4! ways.

So, Arrangements when A, B, C and D are always together = 7! × 4!

Therefore, required arrangements = 10! – (7! × 4!)

Q2 Text Solution:

We know that any number is divisible by 4 if the last 2 digits of the number is also divisible by 4.

In any case, any 7 digit number will be divisible by 4 if its last 2 digit is 32, as any other combination (33/22/23) at the last 2 places is not divisible by 4.

Hence, all the numbers are of the form XXXXX32.

Hence, in all the remaining 5 places, we have 2 options each to fit in every digit (either a 2 or a 3).

Therefore there are a total of 2 × 2 × 2 × 2 × 2 = 32 ways

Q3 Text Solution:

Let us see the number of arrangements possible for each of the positions of Es and S such that S always features between the Es.

E _ _ _ _ E (4 × 6 = 24 words) (S can take any of the 4 blank spaces and the remaining letters can thus be arranged in 3! = 6 ways)

E_ _ _ E _ (3 × 6 = 18 words)

E_ _ E _ _ (2 × 6 = 12 words)

E _ E _ _ _ (1 × 6 = 6 words)

_ E _ _ _ E (3 × 6 = 18 words)

_ E _ _ E _ (2 × 6 = 12 words)

_ E _ E _ _ (1 × 6 = 6 words)

_ _ E _ _ E (2 × 6 = 12 words)

_ _ E _ E _ (1 × 6 = 6 words)

_ _ _ E _ E (1 × 6 = 6 words)

Therefore, the total such words that can be formed will be 24 + 18 + 12 + 6 + 18 + 12 + 6 + 12 + 6 + 6

= 120 words.

Q4 Text Solution:

There are 4 vowels in the word SIGNATURE, which can be placed in the gaps between consonants.

First, we arrange the consonants in 5! ways. Now, there will be 6 gaps created in which we have to arrange the 4 vowels. This can be done in ways, and which can be further arranged in 4! ways.

So, the required permutations $= 5! \times {}^6C_4 \times 4!$

Q5 Text Solution:

The two groups of girls and boys can be arranged in 2! ways. 5 girls can be arranged among themselves in 5! ways. Similarly, 5 boys can be arranged among themselves in 5! ways. Hence, by the fundamental principle of counting, the total number of requisite seating arrangements

= 2!(5! × 5!) = 2(5!)^2

Q6 Text Solution:

The word AQUARIUM has AUAIU as vowels.

Consonants are Q R M. $\frac{5!}{2!\times2!}$

AAUUI can be arranged in at 5 places.

The adjacent 6 places will be used to accommodate Q, R and M.

Q R and M can be positioned at 6 options in $^6C_3$ ways and further arranged in 3! ways.

Therefore, the required number of words formed

$$={}^6C_3 \times 3! \times \frac{5!}{2!\times2!}$$
$$= \frac{6!}{3!3!} \times 3! \times \frac{5!}{2!\times2!} = \frac{6!\times5!}{3!2!2!}$$

Q7 Text Solution:

BANANA has 6 letters, of which 3 are A's

Now, let us place the letters that are not As on a straight line. We have BNN. These can be arranged in $\frac{3!}{2!}$ = 3 ways.

Now let us create slots between these letters to place the As in.

In order to ensure that no two As are adjacent to each other, let us create exactly one slot between any two letters.

B __N __ N

Additionally, let us add one slot at the beginning and end as well as the As can go there also.

__ B __N __ N __

Now, out of these 4 slots, some 3 can be A. That can be selected in $^4C_3$ ways.

So, total number of words = 3 × $^4C_3$ ways = 3*4

= 12 ways

Q8 Text Solution:

Firstly, a boy should sit on any of the 8 identical chairs arranged circularly

Then the circular arrangement should be broken from the position of the boy to make it into 7 identical chairs arranged linearly in which 4 boys are yet to sit.

The 4 boys should now choose position wise 4 chairs out of 7 in 7_{C_4} = 35 ways

Then having sat down on the chosen chairs, the 4 boys can arrange themselves in 4! = 24 ways

Hence the number of ways 5 boys can sit on 8 identical chairs arranged circularly = 35*24 = 840.

Q9 Text Solution:

(1) 7777 :– 1 number

(2) 6666 :– Can't happen, as only three 6s present

(3) 777 _ (1st vacancy choice 5 & 6) :– 2 numbers

(4) 666 _ (1st vacancy choice 5 & 7) :– 2 numbers

(5) 77 _ _ (1st vacancy choice 5 & 6, 2nd vacancy choice 5, 6 & 7) :– 2 * 3 = 6 numbers

(6) 66 _ _ (1st vacancy choice 5 & 7, 2nd vacancy choice 5, 6 & 7) :– 2 * 3 = 6 numbers

(7) 75 _ _ (1st vacancy choice 5, 6 & 7, 2nd vacancy choice 5, 6 & 7) [Special case = 7555 can't happen, as only two 5s present] :–

(3 * 3) –1 = 8 numbers

(8) 76 _ _ (1st vacancy choice 5, 6 & 7, 2nd vacancy choice 5, 6 & 7) :– 3 * 3 = 9 numbers

(9) 65 _ _ (1st vacancy choice 5, 6 & 7, 2nd vacancy choice 5, 6 & 7) [Special case = 6555 can't happen, as only two 5s present] :–

(3 * 3) –1 = 8 numbers

(10) 67 _ _ (1st vacancy choice 5, 6 & 7, 2nd vacancy choice 5, 6 & 7) :– 3 * 3 = 9 numbers

Hence total possible four digit numbers greater than 6000 that can be formed using only the 9 digits as given in the question without

any repetition = 1 + 2 + 2 + 6 + 6 + 8 + 9 + 8 + 9

= 51

Q10 Text Solution:

Since a five digit number has appeared on the screen while Nadar–bhai had typed a seven digit number,

Nadar–bhai must have used the faulty keys twice.

Now the three faulty keys must be any three except the 4 digits of 0, 1, 2 and 6, which one can clearly understand are not faulty, as the number showing on the screen is 20016.

Since total number keys in a keyboard = 10, so the faulty keys could be selected in $^6C_3$ ways.

Now he could have used the faulty keys twice in two different ways :–

(1) Used 2 different faulty keys once each, or

(2) Used 1 faulty key twice.

Again there could be two positions of the faulty key usage :–

(a) Consecutive usage, or

(b) Non consecutive usage.

No of ways as per (1a) = $^3C_2 * ^6C_1 = 3*6 = 18$ [$^3C_2$ because two faulty keys out of three, and $^6C_1$ because the consecutive usage can be done in any 1 of the 6 gaps created to the left, right and in between of digits printed in 20016, which themselves will always follow the same order as in 20016]

No of ways as per (1b) = $^3C_2 * ^6C_2 = 3*15 = 45$ [$^3C_2$ because two faulty keys out of three, and $^6C_2$ because the non consecutive usage can be done in any 2 of the 6 gaps created to the left, right and in between of digits printed in 20016, which themselves will always follow the same order as in 20016]

No of ways as per (2a) = $^3C_1 * ^6C^1 = 3 * 6 = 18$ [$^3C_1$ because one faulty key out of three, and $^6C_1$ because the consecutive usage can be done in any 1 of the 6 gaps created]

No of ways as per (2b) = $^3C_1 * ^6C_2 = 3*15 = 45$ [$^3C_1$ because one faulty key out of three, and $^6C_2$ because the non consecutive usage can be done in any 2 of the 6 gaps created]

So the total number of ways Nadar–bhai could have typed the 7 digit number on the HCL desktop = $^6C_3 * (18 + 45 + 18 + 45)$

= 20 * 126

= 2520 ways

Q11 Text Solution:

Seats for Priya and Pooja could be, in no order, (1, 4), (2, 5), (3, 6), (4, 7) or (5, 8)

If Priya and Pooja are in seats, in no order, (1, 4) or (5, 8), there is just one way for these two to sit i.e. Priya in aisle seat (for each of the above cases)

If Priya and Pooja are in seats, in no order, (2, 5) or (3,6) or (4, 7), there are two ways for them to seat (for each of the above two cases).

Thus, Pooja and Priya can sit in a total of $2 \times 1 + 3 \times 2 = 2 + 6 = 8$ ways.

And the rest 6 can sit in 6! ways.

Required answer = $8 \times 6! = 5760$ ways

Q12 Text Solution:

There are 6 consonants (N, T, N, L, T, Y) and 5 vowels (A, I, O, A, I). For the consonants and vowels to be alternate, it has to be of the form C V C V C V C V C V C.

Thus, the places for the 6 consonants are fixed. And hence the consonants can be arranged in $\frac{6!}{2! \times 2!}$ i.e. 180 ways.

And the places for the 5 vowels are also fixed. And hence the vowels can be arranged in $\frac{5!}{2! \times 2!}$ i.e. 30 ways.

And the entire word can be arranged, with given condition in $180 \times 30 = 5400$ ways.

Q13 Text Solution:

The condition for every selection of three consecutive positions, balls of all three colours are present means that the first 3 balls need to be of different colours.

Arranging B, G, R amongst themselves will result in 6 arrangements.

Once the arrangement of the first 3 balls is done, then the same sequence of colour needs to be continued for the successive set of 3 balls.

E.g. if the first three balls in order is R, G, B, then the arrangement has to continue as R G B R G B R G B R G B.

Also since all red balls are identical, which red ball goes in the 4 fixed position for the red balls does not matter.

Thus the question is about only determining the sequence of colors of the first 3 balls. And the answer is 6 ways.

Q14 Text Solution:

Considering the 4 vowels – i, e, e, e – as just one, say V

we need to arrange n, n, t, n, V.

And this can be done in = 20 ways

Next, the object V is not just one, but is made up of i, e, e, e, which keeping them together, can yet be arranged amongst themselves in = 4 ways.

Thus, required answer = 20 × 4 = 80 ways.

Q15 Text Solution:

Total number of ways of arranging all letters $= \frac{6!}{2! \times 2!}$ i.e. 180 ways.

Number of ways such that both first and last letters are l

i.e. arranging N, D, A, N in the 4 positions of l __ __ __ __ l $= \frac{4!}{2!}$ i.e. 12 ways.

Number of ways such that both first and last letter are N

i.e. arranging I, D, I, A, in the 4 positions of N __ __ __ __ N $= \frac{4!}{2!}$ i.e. 12 ways

Required answer = 180 – 12 – 12 = 156

Q16 Text Solution:

The 6 digits can be arranged in a total of $\frac{6!}{3! \times 2!}$ = 60 ways.

However, the question specifically mentions 6–digit numbers and thus, the number should not start with 0. The best way to handle this is to subtract all those numbers that start with a 0 as follows.

If 0 is assigned the leading position, the question becomes that of arranging 1, 1, 2, 2, 2. And this can be done in $\frac{5!}{3! \times 2!}$ i.e. 10 ways.

Thus, required number of 6– digit numbers = 60 – 10 = 50

Q17 Text Solution:

Atleast one boy between two girls' means that the two girls are not adjacent. And since there are just 2 girls, we can subtract the cases where both are adjacent from the total number of cases.

Total ways of arranging 7 objects = 7!

Number of ways in which the 2 girls are together........

Considering the two girls as 1, we have 5 + 1 = 6 objects. And they can be arranged in 6! ways. And the two girls can be arranged amongst themselves in 2! ways.

Thus, number of ways in which the 2 girls are together = 6! × 2

And required answer = 7! – 6! x 2.

The same answer can also be arrived at by the approach of no 2 are together.

The 5 boys can be arranged amongst themselves in 5! ways.

And the 2 girls can be arranged in the 6 'gaps' in 6 × 5 ways.

Thus, required answer = 5! × 6 × 5.

Q18 Text Solution:

Whatever is the sequence of colors in the first three balls, that same sequence will be repeated.

And that sequence can be every arrangement of B, R and G i.e. 3! i.e. 6 ways.

Once the sequence is fixed, the positions for the 4 balls of the same color are fixed. But since the 4 balls of the same color are distinct (they are numbered), the four balls can be arranged in 4 positions in 4! ways.

And the required answer is $6 \times (4!)^3$

Q19 Text Solution:

Consider the 3 children as just one object. Now we have 3 husbands, 3 wives and 1 child i.e. a total of 7 objects.

For the 3 wives to NOT be adjacent to each other, first arrange the other 4 amongst themselves. This can be done in 4! ways.

Now arrange the 3 wives in the 5 'gaps' i.e. in $5 \times 4 \times 3$ i.e. 60 ways.

Thus, the number of ways such that no 2 out of the 3 wives are sitting together (while considering the children as just one object) is $4! \times 60$.

And arranging the 3 children amongst themselves, the required answer is $4! \times 60 \times 3! = 8640$

Q20 Text Solution:

First allowing the possibility that Chimpanzee and Panda could be assigned adjacent enclosures....

Arranging the non–cats i.e. arranging 4 animals among themselves in every possible way, there are 4! ways to do this.

Now there are 5 'gaps'. And the three cats can be assigned in $5 \times 4 \times 3$ i.e. 60 ways.

Total number of ways such that the cats are not in adjacent enclosures is $4! \times 60 = 1440$.

Among the above 1440 ways, it is possible that the Chimpanzee and Panda are in adjacent enclosures. Finding the number of ways in which this can happen

Assuming the Chimpanzee and Panda as just one animal, say Panpanjee. The 3 animals (Bear, Rhino, Panpanjee) can be arranged in 3! ways.

Now there are 4 gaps. And the three cats can be assigned in $4 \times 3 \times 2$ i.e. 24 ways.

Further the Panpanjee is not just one animal, but two in adjacent enclosures. Thus, they can be arranged amongst themselves in 2! ways.

Total number of ways such that the cats are not in adjacent enclosures but the Chimpanzee and Panda are in adjacent enclosures is $3! \times 24 \times 2 = 288$.

Required number of ways = 1440 – 288 = 1152

Q21 Text Solution:

The 3 faculty members have 3 assigned positions. And hence can be arranged in 3! ways.

The 5 supporting staff have 5 assigned positions. And hence can be arranged in 5! ways.

And irrespective of the fact that the 12 positions for the students are in different rows, the only pertinent matter is that 12 students needs to be arranged in 12 distinct positions. And this can be done in 12! ways.

Thus, answer is $3! \times 5! \times 12!$

Q22 Text Solution:

1st person can sit in 7 ways, 2nd person in 6 ways, 3rd person in 5 ways and 4th person in 4 ways.

Thus, $p = 7 \times 6 \times 5 \times 4$

1st chair can be occupied in 7 ways, 2nd chair in 6 ways, 3rd chair in 5 ways and 4th chair in 4 ways.

Thus, $q = 7 \times 6 \times 5 \times 4$.

Q23 Text Solution:

Let us first focus on just the 6 girls who insist on being seated in adjacent positions. Say these 6 were the total number of girls. And of these, 3 wanted to be seated adjacent to each other.

Consider the 3 as just 1, we have a total of 4 objects. And can be arranged in 4! ways.

Further the 3 girls considered as 1 can be arranged amongst themselves in 3! ways.

Thus these 6 girls can be seated in 4! × 3! ways i.e. 24 × 6 = 144 ways.

Among the total 9 girls, considering the above 6 girls as just 1 object, we reduce the question to arranging 4 objects amongst themselves i.e. in 4! i.e. 24 ways. And the 6 specific girls who were considered as just 1 object, as found earlier, can be actually arranged in 144 ways.

Thus, total required answer = 24 × 144 = 3456 ways.

Q24 Text Solution:

5 males and 4 females can be alternate in only one way: M, F, M, F, M, F, M, F, M.

The 4 scientists can now occupy either the first 4 positions or the last 4 positions. And the leftover 5 positions will be for the sportspersons.

Thus, the total number of arrangements is:

2 × 2! × 2! × 3! × 2! = 96 ways.

Q25 Text Solution:

Assuming the three children as just 1, the two Sharma adults as just 1, we have a total of 3 objects.

And they can be arranged amongst themselves in 3! ways.

Narrowing our focus on children considered as 1 object but in fact being 3 individuals. These can be arranged amongst themselves, thus ensuring they are seated adjacent to each other, in 3! ways.

And narrowing our focus on Sharma adults considered as 1 object but in fact being 2 individuals. These can be arranged amongst themselves, thus ensuring they are seated adjacent to each other, in 2! ways.

And required answer = 3! × 3! × 2! = 72 ways.

Q26 Text Solution:

Approach 1:

Let Roopa pick her position first. Since she is the first one, she can sit in any position, all of them are alike i.e, there is just 1 choice for her.

Next, Prasoon can choose his position in 4 ways (out of 7 positions, one is occupied by Roopa and Prasoon cannot choose the ones adjacent to Roopa).

Prasoon having selected his position, Mayank can now choose his position in 3 ways.

And now three positions are occupied, 4 positions are to be occupied by 4 people in an already partially occupied circular arrangement. Thus, they can occupy their positions in 4! ways.

And the answer is 1 × 4 × 3 × 4! i.e. 288 ways.

Approach 2:

Total number of ways of 7 people arranging themselves in a circular arrangement with no conditions is 6! i.e. 720 ways.

Let's find the number of arrangements in which Roopa and Mayank are adjacent.

Considering Roopa and Mayank as just one, there are 6 objects to be arranged in a circle i.e. in 5! ways. But Roopa and Mayank can switch positions among themselves in 2! ways.

Thus, Roopa and Mayank will be adjacent in 5! × 2! i.e. 240 ways.

Similarly Roopa and Prasoon will be adjacent to each other in 240 ways.

And there will be positions common to the above 2 sets of 240 arrangements i.e. when Prasoon is on one side of Roopa and Mayank is on the other side.

Considering the trio as one object, we have a total of 5 objects to arrange in a circle, which can be done in 4! ways.

Now, among the trio, Roopa has to be in the middle. And Mayank and Prasoon can switch on the left and right sides of Roopa i.e. can arrange themselves in 2 ways.

Thus, the number of common positions to the two sets of 240 is 4! × 2 i.e. 48.

Therefore the required answer will still be 288.

Q27 Text Solution:

Consider the empty table. And the first couple. The first couple can be seated in just 1 way, any two opposite chairs. It does not matter in which chair (of the two opposite chairs) is the husband sitting and in which chair is the wife sitting. Because in an empty circle, they are just sitting opposite to each other, there is no other reference to start with.

With the first couple seated, one person of the second couple (either husband or wife) could choose any of the remaining 8 positions i.e. 8 ways. And then the other person of the couple can choose his/her position in only 1 way, opposite to the position chosen by the spouse.

And one person of the third couple can choose any of the remaining 6 positions, the other person of the couple in just 1 way.

And so on, we get the final answer to be 8 × 6 × 4 × 2 = 384

Q28 Text Solution:

Since girls are NOT to sit next to each other, let's arrange the boys first. 6 boys can be arranged in a circular arrangement in 5! ways.

With the 6 boys arranged in a circle, there will be 6 'gaps' i.e. space between any two adjacent boys. When not more than one girl is placed in each gap. the girls will always be separated by boys i.e. no two girls will be together.

Thus, we have 6 'gaps' or positions for girls and 4 girls. The girls can be arranged in 6 × 5 × 4 × 3 i.e. 360 ways.

Thus, answer = 360 × 5!

Q29 Text Solution:

The first person has ONLY 2 choices, either a black chair or a white chair. For the first person, it does not matter which black chair or which white chair – all black chairs are identical, they may be physically different, but because of their positioning around the circle, all 4 positions are identical for the 1st person.

With the first person seated, all the other 7 positions now become distinct because they can be referenced to with respect to the first person's position e.g. first chair clockwise, first chair anti–clockwise.

Thus, all 8 people can be seated in 2 × 7! ways.

Q30 Text Solution:

Bracelet or necklace is a special case of circular arrangement.

Since it is a bracelet, clockwise and anti–clockwise arrangements are going to be counted as one. Because it is the same bracelet, viewed by flipping it.

Thus, answer to a standard bracelet or necklace question, having n distinct beads and no specific conditions will be

$\frac{(n-1)!}{2}$

In this case, $\frac{7!}{2} = 2520$