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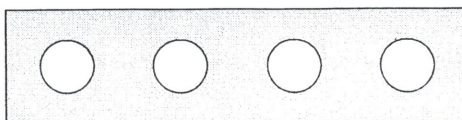
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Probability & Statistics 1

TOPIC- Permutation and combination

Permutation and combination

01



Pegs are to be placed in the four holes shown, one in each hole. The pegs come in different colours and pegs of the same colour are identical. Calculate how many different arrangements of coloured pegs in the four holes can be made using

(i) 6 pegs, all of different colours,

(ii) 4 pegs consisting of 2 blue pegs, 1 orange peg and 1 yellow peg.

Beryl has 12 pegs consisting of 2 red, 2 blue, 2 green, 2 orange, 2 yellow and 2 black pegs. Calculate how many different arrangements of coloured pegs in the 4 holes Beryl can make using

(iii) 4 different colours,

(iv) 3 different colours,

(v) any of her 12 pegs.



[1]

[1]

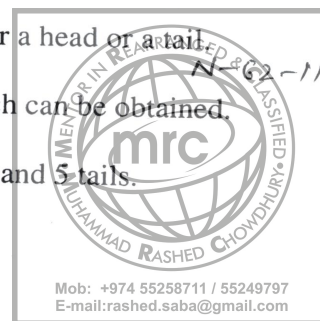
[1]

[3]

[3]

Permutation and combination

- 2 Twelve coins are tossed and placed in a line. Each coin can show either a head or a tail.
- (i) Find the number of different arrangements of heads and tails which can be obtained. [2]
- (ii) Find the number of different arrangements which contain 7 heads and 5 tails. [1]



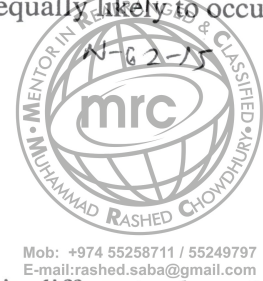
Permutation and combination

- 3 One plastic robot is given away free inside each packet of a certain brand of biscuits. There are four colours of plastic robot (red, yellow, blue and green) and each colour is equally likely to occur. Nick buys some packets of these biscuits. Find the probability that

- (i) he gets a green robot on opening his first packet,
- (ii) he gets his first green robot on opening his fifth packet.

Nick's friend Amos is also collecting robots.

- (iii) Find the probability that the first four packets Amos opens all contain different coloured robots.



[1]

[2]

[3]

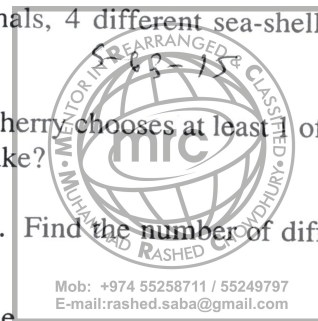
Permutation and combination

04 Rachel has 3 types of ornament. She has 6 different wooden animals, 4 different sea-shells and 3 different pottery ducks.

- (i) She lets her daughter Cherry choose 5 ornaments to play with. Cherry chooses at least 1 of each type of ornament. How many different selections can Cherry make? [5]

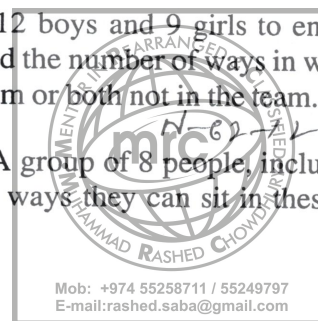
Rachel displays 10 of the 13 ornaments in a row on her window-sill. Find the number of different arrangements that are possible if

- (ii) she has a duck at each end of the row and no ducks anywhere else, [3]
- (iii) she has a duck at each end of the row and wooden animals and sea-shells are placed alternately in the positions in between. [3]



Permutation and combination

- 5 (a) A team of 3 boys and 3 girls is to be chosen from a group of 12 boys and 9 girls to enter a competition. Tom and Henry are two of the boys in the group. Find the number of ways in which the team can be chosen if Tom and Henry are either both in the team or both not in the team. [3]
- (b) The back row of a cinema has 12 seats, all of which are empty. A group of 8 people, including Mary and Frances, sit in this row. Find the number of different ways they can sit in these 12 seats if
- (i) there are no restrictions, [1]
 - (ii) Mary and Frances do not sit in seats which are next to each other, [3]
 - (iii) all 8 people sit together with no empty seats between them. [3]



Permutation and combination

- 6 A shop has 7 different mountain bicycles, 5 different racing bicycles and 8 different ordinary bicycles on display. A cycling club selects 6 of these 20 bicycles to buy.

- (i) How many different selections can be made if there must be no more than 3 mountain bicycles and no more than 2 of each of the other types of bicycle? [4]

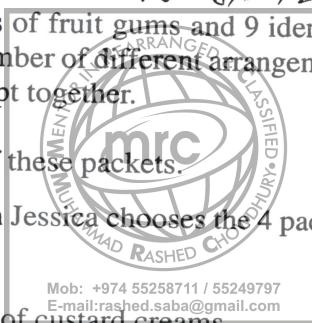
The cycling club buys 3 mountain bicycles, 1 racing bicycle and 2 ordinary bicycles and parks them in a cycle rack, which has a row of 10 empty spaces.

- (ii) How many different arrangements are there in the cycle rack if the mountain bicycles are all together with no spaces between them, the ordinary bicycles are both together with no spaces between them and the spaces are all together? [3]
- (iii) How many different arrangements are there in the cycle rack if the ordinary bicycles are at each end of the bicycles and there are no spaces between any of the bicycles? [3]



Permutation and combination

- 7 (a) In a sweet shop 5 identical packets of toffees, 4 identical packets of fruit gums and 9 identical packets of chocolates are arranged in a line on a shelf. Find the number of different arrangements of the packets that are possible if the packets of chocolates are kept together. [2]
- (b) Jessica buys 8 different packets of biscuits. She then chooses 4 of these packets.
- (i) How many different choices are possible if the order in which Jessica chooses the 4 packets is taken into account? [2]
- The 8 packets include 1 packet of chocolate biscuits and 1 packet of custard creams.
- (ii) How many different choices are possible if the order in which Jessica chooses the 4 packets is taken into account and the packet of chocolate biscuits and the packet of custard creams are both chosen? [3]
- (c) 9 different fruit pies are to be divided between 3 people so that each person gets an odd number of pies. Find the number of ways this can be done. [5]



Permutation and combination

08 There are 10 spaniels, 14 retrievers and 6 poodles at a dog show. 7 dogs are selected to go through to the final.

- (i) How many selections of 7 different dogs can be made if there must be at least 1 spaniel, at least 2 retrievers and at least 3 poodles? [4]

2 spaniels, 2 retrievers and 3 poodles go through to the final. They are placed in a line.

- (ii) How many different arrangements of these 7 dogs are there if the spaniels stand together and the retrievers stand together? [3]

- (iii) How many different arrangements of these 7 dogs are there if no poodle is next to another poodle? [3]

Permutation and combination

09 Fahad has 4 different coloured pairs of shoes (white, red, blue and black), 3 different coloured pairs of jeans (blue, black and brown) and 7 different coloured tee shirts (red, orange, yellow, blue, green, white and purple).

- (i) Fahad chooses an outfit consisting of one pair of shoes, one pair of jeans and one tee shirt. How many different outfits can he choose? [1]
- (ii) How many different ways can Fahad arrange his 3 jeans and 7 tee shirts in a row if the two blue items are not next to each other? [2]

Fahad also has 9 different books about sport. When he goes on holiday he chooses at least one of these books to take with him.

- (iii) How many different selections are there if he can take any number of books ranging from just one of them to all of them? [3]



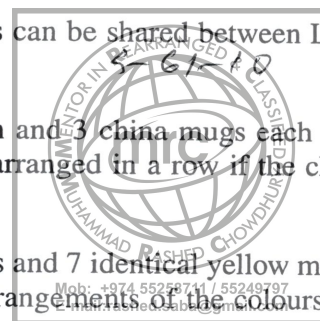
Permutation and combination

- 10 (a) Geoff wishes to plant 25 flowers in a flower-bed. He can choose from 15 different geraniums, 10 different roses and 8 different lilies. He wants to have at least 11 geraniums and also to have the same number of roses and lilies. Find the number of different selections of flowers he can make. [4]
- (b) Find the number of different ways in which the 9 letters of the word GREENGAGE can be arranged if exactly two of the Gs are next to each other. [3]

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Permutation and combination

- 11 (i) Find the number of different ways that a set of 10 different mugs can be shared between Lucy and Monica if each receives an odd number of mugs. [3]
- (ii) Another set consists of 6 plastic mugs each of a different design and 3 china mugs each of a different design. Find in how many ways these 9 mugs can be arranged in a row if the china mugs are all separated from each other. [3]
- (iii) Another set consists of 3 identical red mugs, 4 identical blue mugs and 7 identical yellow mugs. These 14 mugs are placed in a row. Find how many different arrangements of the colours are possible if the red mugs are kept together. [3]



Permutation and combination

12

Mary saves her digital images on her computer in three separate folders named 'Family', 'Holiday' and 'Friends'. Her family folder contains 3 images, her holiday folder contains 4 images and her friends folder contains 8 images. All the images are different.

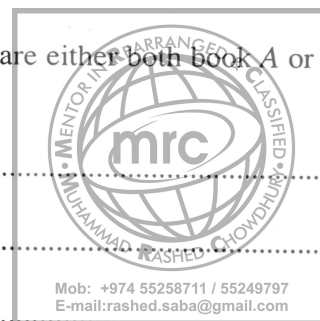
- (i) Find in how many ways she can arrange these 15 images in a row across her computer screen if she keeps the images from each folder together. [3]
- (ii) Find the number of different ways in which Mary can choose 6 of these images if there are 2 from each folder. [2]
- (iii) Find the number of different ways in which Mary can choose 6 of these images if there are at least 3 images from the friends folder and at least 1 image from each of the other two folders. [4]



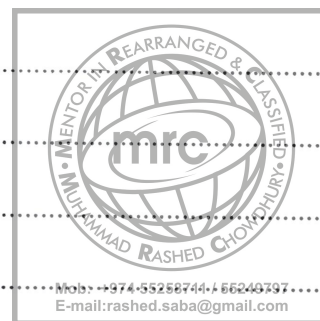
13

A library contains 4 identical copies of book *A*, 2 identical copies of book *B* and 5 identical copies of book *C*. These 11 books are arranged on a shelf in the library.

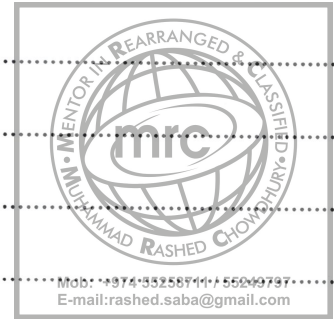
- (i) Calculate the number of different arrangements if the end books are either both book *A* or both book *B*. [4]



- (ii) Calculate the number of different arrangements if all the books A are next to each other and none of the books B are next to each other. [5]



- (i) A plate of cakes holds 12 different cakes. Find the number of ways these cakes can be shared between Alex and James if each receives an odd number of cakes. [3]



- (ii) Another plate holds 7 cup cakes, each with a different colour icing, and 4 brownies, each of a different size. Find the number of different ways these 11 cakes can be arranged in a row if no brownie is next to another brownie. [3]

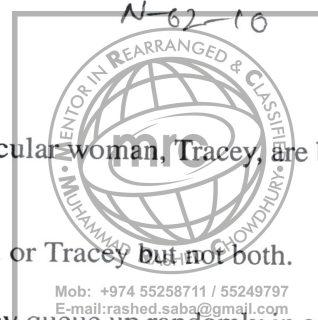


- (iii) A plate of biscuits holds 4 identical chocolate biscuits, 6 identical shortbread biscuits and 2 identical gingerbread biscuits. These biscuits are all placed in a row. Find how many different arrangements are possible if the chocolate biscuits are all kept together. [3]

Permutation and combination

15 A committee of 6 people, which must contain at least 4 men and at least 1 woman, is to be chosen from 10 men and 9 women.

- (i) Find the number of possible committees that can be chosen. [3]
- (ii) Find the probability that one particular man, Albert, and one particular woman, Tracey, are both on the committee. [2]
- (iii) Find the number of possible committees that include either Albert or Tracey but not both. [3]
- (iv) The committee that is chosen consists of 4 men and 2 women. They queue up randomly in a line for refreshments. Find the probability that the women are not next to each other in the queue. [3]



Permutation and combination

- 16 A town council plans to plant 12 trees along the centre of a main road. The council buys the trees from a garden centre which has 4 different hibiscus trees, 9 different jacaranda trees and 2 different oleander trees for sale.

- (i) How many different selections of 12 trees can be made if there must be at least 2 of each type of tree? [4]

The council buys 4 hibiscus trees, 6 jacaranda trees and 2 oleander trees.

- (ii) How many different arrangements of these 12 trees can be made if the hibiscus trees have to be next to each other, the jacaranda trees have to be next to each other and the oleander trees have to be next to each other? [3]
- (iii) How many different arrangements of these 12 trees can be made if no hibiscus tree is next to another hibiscus tree? [3]



Permutation and combination

17 A committee of 6 people is to be chosen from 5 men and 8 women. In how many ways can this be done

- (i) if there are more women than men on the committee, [4]
- (ii) if the committee consists of 3 men and 3 women but two particular men refuse to be on the committee together? [3]

One particular committee consists of 5 women and 1 man.

- (iii) In how many different ways can the committee members be arranged in a line if the man is not at either end? [3]



Permutation and combination

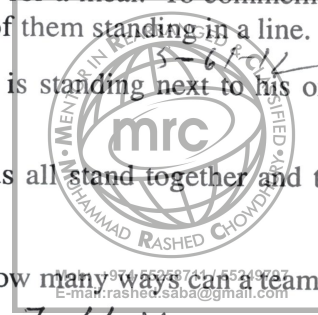
- 18 A committee of 5 people is to be chosen from 4 men and 6 women. William is one of the 4 men and Mary is one of the 6 women. Find the number of different committees that can be chosen if William and Mary refuse to be on the committee together. [3]



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Permutation and combination

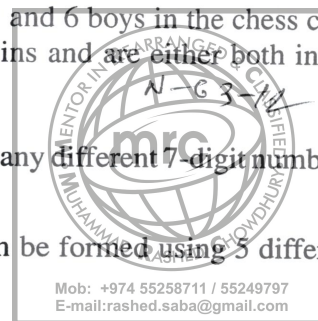
- 19 (a) Seven friends together with their respective partners all meet up for a meal. To commemorate the occasion they arrange for a photograph to be taken of all 14 of them standing in a line.
- (i) How many different arrangements are there if each friend is standing next to his or her partner? [3]
- (ii) How many different arrangements are there if the 7 friends all stand together and the 7 partners all stand together? [2]
- (b) A group of 9 people consists of 2 boys, 3 girls and 4 adults. In how many ways can a team of 4 be chosen if
- (i) both boys are in the team, [1]
- (ii) the adults are either all in the team or all not in the team, [2]
- (iii) at least 2 girls are in the team? [2]



Permutation and combination

20

- (a) A chess team of 2 girls and 2 boys is to be chosen from the 7 girls and 6 boys in the chess club. Find the number of ways this can be done if 2 of the girls are twins and are either both in the team or both not in the team. [3]
- (b) (i) The digits of the number 1 244 687 can be rearranged to give many different 7-digit numbers. How many of these 7-digit numbers are even? [4]
- (ii) How many different numbers between 20 000 and 30 000 can be formed using 5 different digits from the digits 1, 2, 4, 6, 7, 8? [2]
- (c) Helen has some black tiles, some white tiles and some grey tiles. She places a single row of 8 tiles above her washbasin. Each tile she places is equally likely to be black, white or grey. Find the probability that there are no tiles of the same colour next to each other. [3]



Permutation and combination

21

A cricket team of 11 players is to be chosen from 21 players consisting of 10 batsmen, 9 bowlers and 2 wicketkeepers. The team must include at least 5 batsmen, at least 4 bowlers and at least 1 wicketkeeper.

- (i) Find the number of different ways in which the team can be chosen. [4]

Each player in the team is given a present. The presents consist of 5 identical pens, 4 identical diaries and 2 identical notebooks.

- (ii) Find the number of different arrangements of the presents if they are all displayed in a row. [1]

- (iii) 10 of these 11 presents are chosen and arranged in a row. Find the number of different arrangements that are possible. [3]



Permutation and combination

22 Nine cards, each of a different colour, are to be arranged in a line.

(i) How many different arrangements of the 9 cards are possible?

The 9 cards include a pink card and a green card.

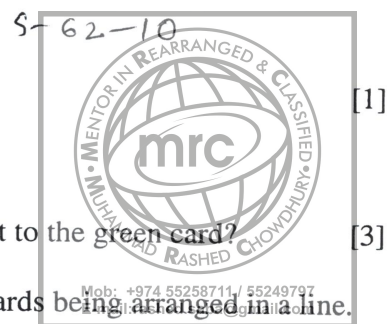
(ii) How many different arrangements do not have the pink card next to the green card?

Consider all possible choices of 3 cards from the 9 cards with the 3 cards being arranged in a line.

(iii) How many different arrangements in total of 3 cards are possible?

(iv) How many of the arrangements of 3 cards in part (iii) contain the pink card?

(v) How many of the arrangements of 3 cards in part (iii) do not have the pink card next to the green card?



23

- (a) Eight children of different ages stand in a random order in a line. Find the number of different ways this can be done if none of the three youngest children stand next to each other. [3]

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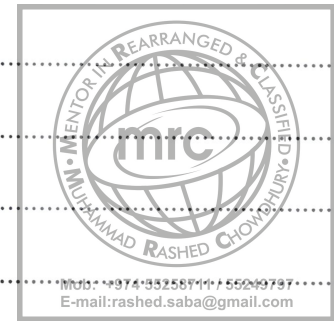
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- (b) David chooses 5 chocolates from 6 different dark chocolates, 4 different white chocolates and 1 milk chocolate. He must choose at least one of each type. Find the number of different selections he can make. [4]

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(c) A password for Chelsea's computer consists of 4 characters in a particular order. The characters are chosen from the following.

- The 26 capital letters A to Z
- The 9 digits 1 to 9
- The 5 symbols # ~ * ? !

The password must include at least one capital letter, at least one digit and at least one symbol. No character can be repeated. Find the number of different passwords that Chelsea can make.

[4]

