

Permutations & Combinations 2

Q1.

- (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]
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Q2.

- (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]
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Q3.

- (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]
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Q4.

Four families go to a theme park together. Mr and Mrs Lin take their 2 children. Mr O'Connor takes his 2 children. Mr and Mrs Ahmed take their 3 children. Mrs Burton takes her son. The 14 people all have to go through a turnstile one at a time to enter the theme park.

- (i) In how many different orders can the 14 people go through the turnstile if each family stays together? [3]
- (ii) In how many different orders can the 8 children and 6 adults go through the turnstile if no two adults go consecutively? [3]

Once inside the theme park, the children go on the roller-coaster. Each roller-coaster car holds 3 people.

- (iii) In how many different ways can the 8 children be divided into two groups of 3 and one group of 2 to go on the roller-coaster? [3]

Q5.

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]

Q6.

Find the number of different ways in which all 8 letters of the word TANZANIA can be arranged so that

- (i) all the letters A are together, [2]
- (ii) the first letter is a consonant (T, N, Z), the second letter is a vowel (A, I), the third letter is a consonant, the fourth letter is a vowel, and so on alternately. [3]

4 of the 8 letters of the word TANZANIA are selected. How many possible selections contain

- (iii) exactly 1 N and 1 A, [2]
 - (iv) exactly 1 N? [3]
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Q7.

Find how many different numbers can be made from some or all of the digits of the number 1 345 789 if

- (i) all seven digits are used, the odd digits are all together and no digits are repeated, [2]
 - (ii) the numbers made are even numbers between 3000 and 5000, and no digits are repeated, [3]
 - (iii) the numbers made are multiples of 5 which are less than 1000, and digits can be repeated. [3]
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Q8.

Nine cards are numbered 1, 2, 2, 3, 3, 4, 6, 6, 6.

- (i) All nine cards are placed in a line, making a 9-digit number. Find how many different 9-digit numbers can be made in this way
 - (a) if the even digits are all together, [4]
 - (b) if the first and last digits are both odd. [3]
 - (ii) Three of the nine cards are chosen and placed in a line, making a 3-digit number. Find how many different numbers can be made in this way
 - (a) if there are no repeated digits, [2]
 - (b) if the number is between 200 and 300. [2]
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Q9.

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]
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