

Permutations & Combinations 1

Q1.

- (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]
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Q2.

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? [1]

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? [3]

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? [2]
 - (iv) How many of the arrangements of 3 cards in part (iii) contain the pink card? [2]
 - (v) How many of the arrangements of 3 cards in part (iii) do not have the pink card next to the green card? [2]
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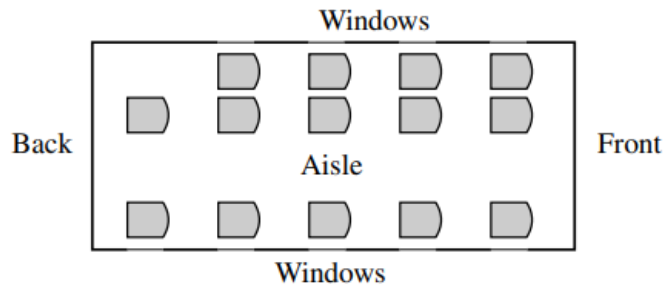
Q3.

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]
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Q4.



A small aeroplane has 14 seats for passengers. The seats are arranged in 4 rows of 3 seats and a back row of 2 seats (see diagram). 12 passengers board the aeroplane.

- (i) How many possible seating arrangements are there for the 12 passengers? Give your answer correct to 3 significant figures. [2]

These 12 passengers consist of 2 married couples (Mr and Mrs Lin and Mr and Mrs Brown), 5 students and 3 business people.

- (ii) The 3 business people sit in the front row. The 5 students each sit at a window seat. Mr and Mrs Lin sit in the same row on the same side of the aisle. Mr and Mrs Brown sit in another row on the same side of the aisle. How many possible seating arrangements are there? [4]
- (iii) If, instead, the 12 passengers are seated randomly, find the probability that Mrs Lin sits directly behind a student and Mrs Brown sits in the front row. [4]

Q5.

- (i) Find the number of different ways that the 9 letters of the word HAPPINESS can be arranged in a line. [1]
- (ii) The 9 letters of the word HAPPINESS are arranged in random order in a line. Find the probability that the 3 vowels (A, E, I) are not all next to each other. [4]
- (iii) Find the number of different selections of 4 letters from the 9 letters of the word HAPPINESS which contain no Ps and either one or two Ss. [3]

Q6.

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]
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Q7.

- (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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Q8.

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]
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Q9.

An English examination consists of 8 questions in Part A and 3 questions in Part B. Candidates must choose 6 questions. The order in which questions are chosen does not matter. Find the number of ways in which the 6 questions can be chosen in each of the following cases.

- (i) There are no restrictions on which questions can be chosen. [1]
- (ii) Candidates must choose at least 4 questions from Part A. [3]
- (iii) Candidates must either choose both question 1 and question 2 in Part A, or choose neither of these questions. [3]
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