M/J/2007/Q5

(i) Find the number of ways in which all twelve letters of the word REFRIGERATOR can be arranged

(a) if there are no restrictions, [2]

(b) if the Rs must all be together. [2]

(ii) How many different selections of four letters from the twelve letters of the word REFRIGERATOR contain no Rs and two Es? [3]

M/J/2011/Q4

(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]

O/N/2013/Q6

The 11 letters of the word REMEMBRANCE are arranged in a line.

(i) Find the number of different arrangements if there are no restrictions. [1]

(ii) Find the number of different arrangements which start and finish with the letter M. [2]

(iii) Find the number of different arrangements which do not have all 4 vowels (E, E, A, E) next to each other. [3]

4 letters from the letters of the word REMEMBRANCE are chosen.

(iv) Find the number of different selections which contain no Ms and no Rs and at least 2 Es. [3]

M/J/2015/Q6

(a) Find the number of different ways the 7 letters of the word BANANAS can be arranged

(i) if the first letter is N and the last letter is B, [3]

(ii) if all the letters A are next to each other. [3]

(b) Find the number of ways of selecting a group of 9 people from 14 if two particular people cannot both be in the group together. [3]

M/J/2018/Q6

(a) Find the number of ways in which all 9 letters of the word AUSTRALIA can be arranged in each of the following cases.

(i) All the vowels (A, I, U are vowels) are together. [3]

(ii) The letter T is in the central position and each end position is occupied by one of the other consonants (R, S, L). [3]

(b) Donna has 2 necklaces, 8 rings and 4 bracelets, all different. She chooses 4 pieces of jewellery. How many possible selections can she make if she chooses at least 1 necklace and at least 1 bracelet? [4]

O/N/2018/Q1

(i) How many different arrangements are there of the 11 letters in the word MISSISSIPPI? [2]

(ii) Two letters are chosen at random from the 11 letters in the word MISSISSIPPI. Find the probability that these two letters are the same. [3]

O/N/2019/Q7

(i) Find the number of different ways in which the 9 letters of the word TOADSTOOL can be arranged so that all three Os are together and both Ts are together. [1]

(ii) Find the number of different ways in which the 9 letters of the word TOADSTOOL can be arranged so that the Ts are not together. [4]

(iii) Find the probability that a randomly chosen arrangement of the 9 letters of the word TOADSTOOL has a T at the beginning and a T at the end. [2]

(iv) Five letters are selected from the 9 letters of the word TOADSTOOL. Find the number of different selections if the five letters include at least 2 Os and at least 1 T. [4]

M/J/2017/Q6

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]

M/J/2005/Q7

(a) A football team consists of 3 players who play in a defence position, 3 players who play in a midfield position and 5 players who play in a forward position. Three players are chosen to collect a gold medal for the team. Find in how many ways this can be done

(i) if the captain, who is a midfield player, must be included, together with one defence and one forward player, [2]

(ii) if exactly one forward player must be included, together with any two others. [2]

(b) Find how many different arrangements there are of the nine letters in the words GOLD MEDAL

(i) if there are no restrictions on the order of the letters, [2]

(ii) if the two letters D come first and the two letters L come last. [2]

O/N/2005/Q3

A staff car park at a school has 13 parking spaces in a row. There are 9 cars to be parked.

(i) How many different arrangements are there for parking the 9 cars and leaving 4 empty spaces? [2]

(ii) How many different arrangements are there if the 4 empty spaces are next to each other? [3]

(iii) If the parking is random, find the probability that there will **not** be 4 empty spaces next to each other. [2]

O/N/2006/Q6

Six men and three women are standing in a supermarket queue.

(i) How many possible arrangements are there if there are no restrictions on order? [2]

(ii) How many possible arrangements are there if no two of the women are standing next to each other? [4]

(iii) Three of the people in the queue are chosen to take part in a customer survey. How many different choices are possible if at least one woman must be included? [3]

O/N/2007/Q3

The six digits 4, 5, 6, 7, 7, 7 can be arranged to give many different 6-digit numbers.

(i) How many different 6-digit numbers can be made? [2]

(ii) How many of these 6-digit numbers start with an odd digit and end with an odd digit? [4]

M/J/2008/Q3

Issam has 11 different CDs, of which 6 are pop music, 3 are jazz and 2 are classical.

(i) How many different arrangements of all 11 CDs on a shelf are there if the jazz CDs are all next to each other? [3]

(ii) Issam makes a selection of 2 pop music CDs, 2 jazz CDs and 1 classical CD. How many different possible selections can be made? [3]

M/J/2009/Q4

A choir consists of 13 sopranos, 12 altos, 6 tenors and 7 basses. A group consisting of 10 sopranos, 9 altos, 4 tenors and 4 basses is to be chosen from the choir.

(i) In how many different ways can the group be chosen? [2]

(ii) In how many ways can the 10 chosen sopranos be arranged in a line if the 6 tallest stand next to each other? [3]

(iii) The 4 tenors and 4 basses in the group stand in a single line with all the tenors next to each other and all the basses next to each other. How many possible arrangements are there if three of the tenors refuse to stand next to any of the basses? [3]

O/N/2009/Q5

(a) Find how many numbers between 5000 and 6000 can be formed from the digits 1, 2, 3, 4, 5 and 6

(i) if no digits are repeated, [2]

(ii) if repeated digits are allowed. [2]

(b) Find the number of ways of choosing a school team of 5 pupils from 6 boys and 8 girls

(i) if there are more girls than boys in the team, [4]

(ii) if three of the boys are cousins and are either all in the team or all not in the team. [3]

M/J/2010/Q7

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]

O/N/2010/Q7

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]

O/N/2012/Q5

(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]

M/J/2013/Q6

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]

M/J/2015/Q6

(a) Find the number of different ways the 7 letters of the word BANANAS can be arranged

(i) if the first letter is N and the last letter is B, [3]

(ii) if all the letters A are next to each other. [3]

(b) Find the number of ways of selecting a group of 9 people from 14 if two particular people cannot both be in the group together. [3]

O/N/2017/Q6

(a) Find the number of different 3-digit numbers greater than 300 that can be made from the digits 1, 2, 3, 4, 6, 8 if

(i) no digit can be repeated, [3]

(ii) a digit can be repeated and the number made is even. [3]

(b) A team of 5 is chosen from 6 boys and 4 girls. Find the number of ways the team can be chosen if

(i) there are no restrictions, [1]

(ii) the team contains more boys than girls. [3]

M/J/2019/Q7

(a) A group of 6 teenagers go boating. There are three boats available. One boat has room for 3 people, one has room for 2 people and one has room for 1 person. Find the number of different ways the group of 6 teenagers can be divided between the three boats. [3]

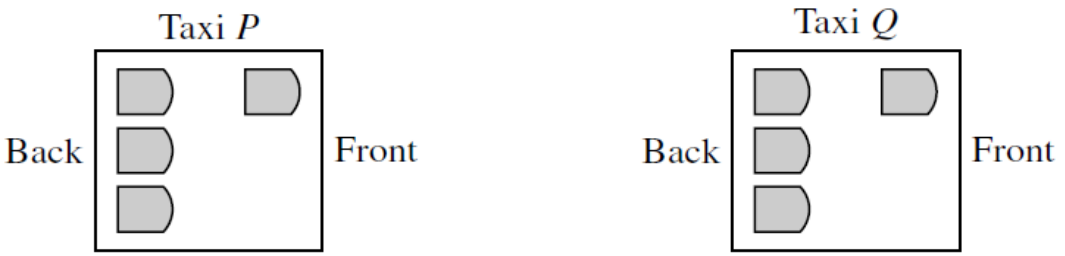
(b) Find the number of different 7-digit numbers which can be formed from the seven digits 2, 2, 3, 7, 7, 7, 8 in each of the following cases.

(i) The odd digits are together and the even digits are together. [3]

O/N/2015/Q4

A group of 8 friends travels to the airport in two taxis, P and Q. Each taxi can take 4 passengers.

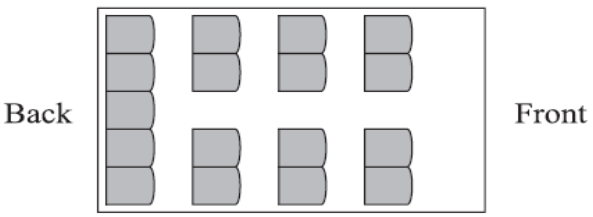
(i) The 8 friends divide themselves into two groups of 4, one group for taxi P and one group for taxi Q, with Jon and Sarah travelling in the same taxi. Find the number of different ways in which this can be done. [3]



Each taxi can take 1 passenger in the front and 3 passengers in the back (see diagram). Mark sits in the front of taxi P and Jon and Sarah sit in the back of taxi P next to each other.

(ii) Find the number of different seating arrangements that are now possible for the 8 friends. [4]

M/J/2006/Q4



The diagram shows the seating plan for passengers in a minibus, which has 17 seats arranged in 4 rows. The back row has 5 seats and the other 3 rows have 2 seats on each side. 11 passengers get on the minibus.

(i) How many possible seating arrangements are there for the 11 passengers? [2]

(ii) How many possible seating arrangements are there if 5 particular people sit in the back row? [3]