Permutations and Combinations Problem Set

1. **[ACJC Prelims 17]**
   A group of 12 students consists of 5 bowlers, 4 canoeists and 3 footballers.

   (a) The group sits at a round table with 12 seats. In how many different ways can they sit so that all the players of the same sport sit together? [2]

   (b) The group stands in a line. In how many different ways can they stand so that either the bowlers are all next to one another or the canoeists are all next to one another or both? [2]

   (c) Find the number of ways in which a delegation of 8 can be selected from this group if it must include at least 1 student from each of the 3 sports. [2]

2. **[AJC Prelims 17]**
   Four families arrive at Science Centre together. Mr and Mrs A brought their 2 children while Mr B brought his 2 children. Mr and Mrs C brought their 3 children while Mrs D brought her only child. All these 14 people have to go through a gate one at a time to enter the centre.

   (a) In how many different ways can they go through the gate if each family goes in one after another? [2]

   There are two experiments at the Science Magic Experience station.

   (b) In one experiment, participants are to be in groups of twos or threes.In how many different ways can the 8 children from the four families be grouped among themselves? [3]

   (c) In another experiment, the four families have to hold hands to form two separate circles of equal size to experience a science phenomenon. Each circle must have exactly four children and members of the same family must be in the same circle. Find the number of ways of arranging these 14 people in the two circles such that there is no more than one adult between any two children. [3]

3. **[CJC Prelims 17]**
A planning committee of 12 students consisting of one male and one female student from each of the 6 Arts stream classes (Class A to Class F) in a junior college is to be formed for the Humanities Seminar. There are 10 male and 10 female students in Class A.

(a) How many ways can the representatives from Class A be chosen? [1]

The committee meets for their first planning meeting and is seated at a round table.

(b) How many ways can the committee be seated if all the members need to be seated together with the member from the same class? [2]

At the seminar, the committee members are to be seated in a row of 14 seats in the theatre together with the Principal and the Guest of Honour. The chairperson and the secretary are selected from the committee and they are both from Class F.

(c) How many ways can this be done if the Principal and the Guest of Honour occupy the middle seats and the committee members are seated together with the member from the same class except for the chairperson and the secretary? [4]

4. **[DHS Prelims 17]**
The wore DISTRIBUTION has 12 letters.

(a) Find the number of different arrangements of the 12 letters that can be made. [1]

(b) Find the number of different arrangements which can be made if there are exactly 8 letters between the two Ts. [3]

One of the Is is removed from the word and the remaining letters are arranged randomly.

(c) Find the probability that no adjacent letters are the same. [4]

5. **[HCI Prelims 17]**
Mandy has 10 beads, of which 5 are spherical and 5 are cubical, each of different colours. She wishes to decorate a card by forming a circle using 8 of the 10 beads. Find the number of ways Mandy can arrange the beads if

   (a) there are no restrictions, [1]

   (b) 3 particular beads are used and not all are next to one another, [3]

   (c) spherical beads and cubic beads must altenate. [3]

6. **[IJC Prelims 17]**
A group of twelve people consists of six married couples. Each couple consists of a husband and a wife.

   (a) The twelve people are to stand in a straight line. Find the number of different arrangements if each husband must stand next to his wife. [2]

   (b) The group of twelve people finds a round table with ten chairs. Assuming only ten people are to be seated, find the probability that five married couples are seated such that each husband sits next to his wife and husbands and wives alternate. [3]

7. **[YJC Prelims 17]**

   (a) Find the number of ways to arrange the letters of the word TOTORO such that

      i. all the Os are together, [1]

      ii. all the Os are separated, [2]

      iii. the last letter is a consonant. [3]

   (b) Tontoro soft toys are sold in four different colours, of which each varies in three sizes, small, medium and large. Each set of Tontoro soft toys consists of a small, a medium and a large sized soft toy and exactly two are of the same colour. Find the number of different possible sets of Tontoro soft toys. [2]

Answers

1. (a) 34 560.
   (b) 13 201 920.
   (c) 485.
2. (a) 829 440.
   (b) 385.
   (c) 20 736.
3. (a) 100.
   (b) 7680.
   (c) 92 160.
4. (a) 39 916 800.
   (b) 1 814 400.
   (c) 3 265 920.
5. (a) 226 800.
   (b) 90 720.
   (c) 3600.
6. (a) 46 080.
   (b) 0.000 0120.
7. (a) i. 12.
      ii. 12.
      iii. 30.
   (b) 36.