

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. **[CJC Prelims 18]**

A seven-digit number is formed by writing down the digits 1, 2, 2, 3, 4, 5, 5 in some order. Find how many of such numbers can be formed if

- (a) the two '5's are not next to each other, [2]
- (b) there are exactly three digits between the two '5's, [3]
- (c) the number is an odd number between 1 000 000 and 2 000 000. [3]

3. **[DHS Prelims 17]**

The word 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]

4. **[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 alternate. [3]

5. **[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]

6. [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]

7. [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]

8. [HCI Prelims 18]

Six married couples are to be seated in a row at a concert. Find the number of ways they can sit if

- (a) each couple is to sit together, [2]
- (b) all women are next to one another and all men are next to one another, such that no man can sit next to his wife. [3]

After the concert, one particular married couple leaves. The rest go to a restaurant where they sit at a round table. Find the probability that each man sits next to his wife, and men and women alternate. [2]

9. [VJC Prelims 18]

- (a) Twelve cards, numbered from 1 to 12 are arranged in a straight line. Find the number of ways this can be done if
- i. there are no restrictions, [1]
 - ii. the cards numbered 2 and 3 are together, and all the six even numbered cards are adjacent. [3]
- (b) The twelve cards are arranged in a circle. Find the number of ways this can be done if all the cards numbered as multiples of 3 are separated. [2]
- (c) Six of the cards are selected at random, without replacement. Find the probability that at least two of the chosen cards are even numbered. [3]

10. [TPJC Prelims 18]

Find the number of ways in which the letters of the word DIGITISE can be arranged if

- (a) there are no restrictions, [1]
- (b) G and S must not be next to each other, [2]
- (c) consonants (D, G, T, S) and vowels (I, E) must alternate, [3]
- (d) between any two Is there must be at least 2 other letters. [3]

11. [TJC Prelims 18]

5 French, 3 Croatian and 2 Belgian dancers were invited to perform at a charity event, where a dinner was held to welcome them.

- (a) In how many ways can these dancers be seated at a round table if those of the same nationality must sit next to one another? [2]

For the opening item, the dancers were randomly divided into two groups of 3 dancers each and one group of 4 dancers.

- (b) Find the number of ways this can be done. [2]

At the end of the performance, 5 of the 10 dancers were chosen to pose for photographs.

- (c) Find the number of ways the dancers can be arranged in a row, if exactly 3 of the chosen dancers are of the same nationality. [3]

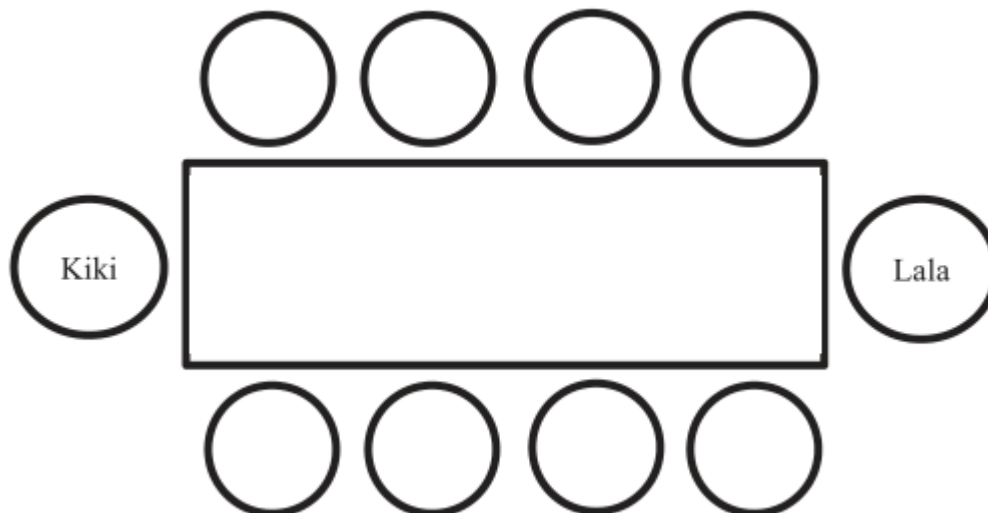
12. [SRJC Prelims 18]

A group of twelve people consists of one pair of sisters, one set of three brothers, a family of three and 4 others.

- (a) The twelve people are grouped into three groups of 4. Find the number of ways where the family of three are together. [2]
- (b) The twelve people are arranged randomly in a line. Find the number of ways that the sisters are not together and the brothers are all separated. [3]

13. [MJC Prelims 18]

Kiki and Lala host a dinner for four other married couples. They sit at a rectangular table with Kiki and Lala at the left and right ends of the table respectively as shown in the diagram below.



Find the number of ways to seat the four couples such that

- (a) there are no restrictions. [1]
- (b) each married couple is seated directly facing each other on opposite sides. [2]
- (c) each married couple is seated directly facing each other on opposite sides and two particular ladies cannot be seated next to each other on the same side. [3]

14. [JJC Prelims 18]

There are ten boys and twelve girls in a school table tennis club. A team of seven boys and seven girls will be selected randomly to represent the school in a table tennis friendly match.

- (a) In how different ways can the team be formed? [2]
- (b) Jason is the youngest boy and Joyce is the youngest girl in the club. What is the probability that the team includes both Jason and Joyce? [2]
- (c) Joel is the oldest boy in the club. Given that Joel is selected for the team, what is the probability that the team includes Jason or Joyce, but not both? [4]

Answers

1. (a) 34 560.
(b) 13 201 920.
(c) 485.
2. (a) 900.
(b) 180.
(c) 90.
3. (a) 39 916 800.
(b) 1 814 400.
(c) 3 265 920.
4. (a) 226 800.
(b) 90 720.
(c) 3600.
5. (a) 46 080.
(b) 0.000 0120.
6. (a) i. 12.
ii. 12.
iii. 30.
(b) 36.
7. (a) 829 440.
(b) 385.
(c) 20 736.
8. (a) 46 080.
(b) 864 000.
 $\frac{1}{7560}$.
9. (a) i. 479 001 600.
ii. 172 800.
(b) 8 467 200.
(c) $\frac{887}{924}$.
10. (a) 6 720.
(b) 5 040.
(c) 192.
(d) 480.

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11. (a) 2 880.
(b) 121.
(c) 14 520.
12. 1 890.
13. 220 631 040.
14. (a) 40 320.
(b) 384.
(c) 288.
15. (a) 95 040.
(b) $\frac{49}{120}$.
(c) $\frac{17}{36}$.