

Jodie tosses a biased coin and throws two fair tetrahedral dice. The probability that the coin shows a head is $\frac{1}{3}$. Each of the dice has four faces, numbered 1, 2, 3 and 4. Jodie's score is calculated from the numbers on the faces that the dice land on, as follows:

- if the coin shows a head, the two numbers from the dice are added together;
- if the coin shows a tail, the two numbers from the dice are multiplied together.

Find the probability that the coin shows a head given that Jodie's score is 8. [5]

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]

The 50 members of a club include both the club president and the club treasurer. All 50 members want to go on a coach tour, but the coach only has room for 45 people. In how many ways can 45 members be chosen if both the club president and the club treasurer must be included? [3]

Find the number of different ways that 6 boys and 4 girls can stand in a line if

- (i) all 6 boys stand next to each other, [3]
- (ii) no girl stands next to another girl. [3]

- (a) Seven fair dice each with faces marked 1, 2, 3, 4, 5, 6 are thrown and placed in a line. Find the number of possible arrangements where the sum of the numbers at each end of the line add up to 4. [3]
- (b) Find the number of ways in which 9 different computer games can be shared out between Wainah, Jingyi and Hebe so that each person receives an odd number of computer games. [6]

A shop has 7 different mountain bicycles, 5 different racing bicycles and 8 different ordinary bicycles on display. A cycling club selects 6 of these 20 bicycles to buy.

- (i) How many different selections can be made if there must be no more than 3 mountain bicycles and no more than 2 of each of the other types of bicycle? [4]

The cycling club buys 3 mountain bicycles, 1 racing bicycle and 2 ordinary bicycles and parks them in a cycle rack, which has a row of 10 empty spaces.

- (ii) How many different arrangements are there in the cycle rack if the mountain bicycles are all together with no spaces between them, the ordinary bicycles are both together with no spaces between them and the spaces are all together? [3]
- (iii) How many different arrangements are there in the cycle rack if the ordinary bicycles are at each end of the bicycles and there are no spaces between any of the bicycles? [3]

On trains in the morning rush hour, each person is either a student with probability 0.36, or an office worker with probability 0.22, or a shop assistant with probability 0.29 or none of these.

- (i) 8 people on a morning rush hour train are chosen at random. Find the probability that between 4 and 6 inclusive are office workers. [3]
- (ii) 300 people on a morning rush hour train are chosen at random. Find the probability that between 31 and 49 inclusive are neither students nor office workers nor shop assistants. [6]

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]

- (i) Find the number of different ways that the 9 letters of the word AGGREGATE can be arranged in a line if the first letter is R. [2]
- (ii) Find the number of different ways that the 9 letters of the word AGGREGATE can be arranged in a line if the 3 letters G are together, both letters A are together and both letters E are together. [2]
- iii) The letters G, R and T are consonants and the letters A and E are vowels. Find the number of different ways that the 9 letters of the word AGGREGATE can be arranged in a line if consonants and vowels occur alternately. [3]
- iv) Find the number of different selections of 4 letters of the word AGGREGATE which contain exactly 2 Gs or exactly 3 Gs. [3]

Fabio drinks coffee each morning. He chooses Americano, Cappuccino or Latte with probabilities 0.5, 0.3 and 0.2 respectively. If he chooses Americano he either drinks it immediately with probability 0.8, or leaves it to drink later. If he chooses Cappuccino he either drinks it immediately with probability 0.6, or leaves it to drink later. If he chooses Latte he either drinks it immediately with probability 0.1, or leaves it to drink later.

- (i) Find the probability that Fabio chooses Americano and leaves it to drink later. [1]
- (ii) Fabio drinks his coffee immediately. Find the probability that he chose Latte. [4]
- (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]