Permutations and combinations
Question Paper 2

Level	International A Level
Subject	Maths
Exam Board	CIE
Topic	Permutations and combinations
Sub Topic	
Booklet	Question Paper 2

Time Allowed: **66 minutes**

Score: **/55**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1   On trains in the morning rush hour, each person is either a student with probability 0.36, or an off ce

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 off ce 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 off ce workers nor shop assistants.   [6]

2   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 f nish 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]

3   **(i)** Find the number of different ways that the 9 letters of the word AGGREGATE can be arranged
   in a line if the fi st 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]

4 Fabio drinks coffee each morning. He chooses Americano, Cappucino 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 Cappucino 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]

5 **(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]

6 **(a)** A chess team of 2 girls and 2 boys is to be chosen from the 7 girls and 6 boys in the chess club. Find the number of ways this can be done if 2 of the girls are twins and are either both in the team or both not in the team. [3]

  (b) **(i)** The digits of the number 1 244 687 can be rearranged to give many different 7-digit numbers. How many of these 7-digit numbers are even? [4]

    (ii) How many different numbers between 20 000 and 30 000 can be formed using 5 different digits from the digits 1, 2, 4, 6, 7, 8? [2]

  (c) Helen has some black tiles, some white tiles and some grey tiles. She places a single row of 8 tiles above her washbasin. Each tile she places is equally likely to be black, white or grey. Find the probability that there are no tiles of the same colour next to each other. [3]