OCR Maths S1

Topic Questions from Papers

Arrangements and Combinations

1   An examination paper consists of 8 questions, of which one is on geometric distributions and one is on binomial distributions.

   (i) If the 8 questions are arranged in a random order, find the probability that the question on geometric distributions is next to the question on binomial distributions.   [3]

   Four of the questions, including the one on geometric distributions, are worth 7 marks each, and the remaining four questions, including the one on binomial distributions, are worth 9 marks each. The 7-mark questions are the first four questions on the paper, but are arranged in random order. The 9-mark questions are the last four questions, but are arranged in random order. Find the probability that

   (ii) the questions on geometric distributions and on binomial distributions are next to one another,
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   (iii) the questions on geometric distributions and on binomial distributions are separated by at least 2 other questions.   [4]

                                                                                                  (Q8, Jan 2005)

2   A committee of 7 people is to be chosen at random from 18 volunteers.

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

   The 18 volunteers consist of 5 people from Gloucester, 6 from Hereford and 7 from Worcester. The committee is to be chosen randomly. Find the probability that the committee will

   (ii) consist of 2 people from Gloucester, 2 people from Hereford and 3 people from Worcester,   [4]

   (iii) include exactly 5 people from Worcester,   [4]

   (iv) include at least 2 people from each of the three cities.   [4]

                                                                                                  (Q7, June 2005)

3   Each of the 7 letters in the word DIVIDED is printed on a separate card. The cards are arranged in a row.

   (i) How many different arrangements of the letters are possible?   [3]

   (ii) In how many of these arrangements are all three Ds together?   [2]

   The 7 cards are now shuffled and 2 cards are selected at random, without replacement.

   (iii) Find the probability that at least one of these 2 cards has D printed on it.   [3]

                                                                                                  (Q3, June 2006)

4 The digits 1, 2, 3, 4 and 5 are arranged in random order, to form a five-digit number.

   (i) How many different five-digit numbers can be formed?   [1]

   (ii) Find the probability that the five-digit number is

      (a) odd,   [2]

      (b) less than 23 000.   [3]

                                                                    (Q3, Jan 2007)

5   **(i)** How many different teams of 7 people can be chosen, without regard to order, from a squad of 15?   [2]

   (ii) The squad consists of 6 forwards and 9 defenders. How many different teams containing 3 forwards and 4 defenders can be chosen?   [2]

                                                                    (Q3, June 2007)

6   **(i)** The letters A, B, C, D and E are arranged in a straight line.

      (a) How many different arrangements are possible?   [2]

      (b) In how many of these arrangements are the letters A and B next to each other?   [3]

   (ii) From the letters A, B, C, D and E, two different letters are selected at random. Find the probability that these two letters are A and B.   [2]

                                                                   (Q1, Jan 2008)

7 A test consists of 4 algebra questions, A, B, C and D, and 4 geometry questions, G, H, I and J.

The examiner plans to arrange all 8 questions in a random order, regardless of topic.

   (i) (a) How many different arrangements are possible?   **[2]**

      (b) Find the probability that no two Algebra questions are next to each other and no two Geometry questions are next to each other.   **[3]**

Later, the examiner decides that the questions should be arranged in two sections, Algebra followed by Geometry, with the questions in each section arranged in a random order.

   (ii) (a) How many different arrangements are possible?   **[2]**

      (b) Find the probability that questions A and H are next to each other.   **[1]**

      (c) Find the probability that questions B and J are separated by more than four other questions.   **[4]**

                                                                   (Q6, Jan 2009)

8 Three letters are selected at random from the 8 letters of the word COMPUTER, without regard to order.

   (i) Find the number of possible selections of 3 letters. **[2]**

   (ii) Find the probability that the letter P is included in the selection. **[3]**

Three letters are now selected at random, one at a time, from the 8 letters of the word COMPUTER, and are placed in order in a line.

   (iii) Find the probability that the 3 letters form the word TOP. **[3]**

(Q7, June 2009)

9 The five letters of the word NEVER are arranged in random order in a straight line.

   (i) How many different orders of the letters are possible? **[2]**

   (ii) In how many of the possible orders are the two Es next to each other? **[2]**

   (iii) Find the probability that the first two letters in the order include exactly one letter E. **[3]**

(Q8, Jan 2010)

10 The menu below shows all the dishes available at a certain restaurant.

Rice dishes	Main dishes	Vegetable dishes
Boiled rice	Chicken	Mushrooms
Fried rice	Beef	Cauliflower
Pilau rice	Lamb	Spinach
Keema rice	Mixed grill	Lentils
	Prawn	Potatoes
	Vegetarian	

A group of friends decide that they will share a total of 2 different rice dishes, 3 different main dishes and 4 different vegetable dishes from this menu. Given these restrictions,

   (i) find the number of possible combinations of dishes that they can choose to share, **[3]**

   (ii) assuming that all choices are equally likely, find the probability that they choose boiled rice. **[2]**

The friends decide to add a further restriction as follows. If they choose boiled rice, they will not choose potatoes.

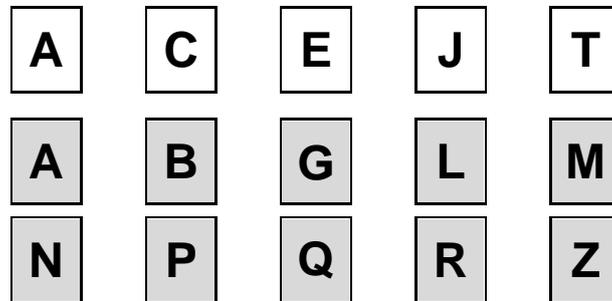   **(iii)** Find the number of possible combinations of dishes that they can now choose. **[3]**

(Q7, June 2010)

11 **(i)** The diagram shows 7 cards, each with a digit printed on it. The digits form a 7-digit number.

| 1 | 3 | 3 | 3 | 5 | 5 | 9 |

How many different 7-digit numbers can be formed using these cards? **[3]**

(ii) The diagram below shows 5 white cards and 10 grey cards, each with a letter printed on it.

A	C	E	J	T
A	B	G	L	M
N	P	Q	R	Z

From these cards, 3 white cards and 4 grey cards are selected at random **without** regard to order.

(a) How many selections of seven cards are possible? **[3]**

(b) Find the probability that the seven cards include exactly one card showing the letter A. **[4]**

(Q6, Jan 2011)

12 A group of 7 students sit in random order on a bench.

(i) (a) Find the number of orders in which they can sit. **[1]**

(b) The 7 students include Tom and Jerry. Find the probability that Tom and Jerry sit next to each other. **[3]**

(ii) The students consist of 3 girls and 4 boys. Find the probability that

(a) no two boys sit next to each other, **[2]**

(b) all three girls sit next to each other. **[3]**

(Q6, June 2011)

13 A bag contains 9 discs numbered 1, 2, 3, 4, 5, 6, 7, 8, 9.

   (i) Andrea chooses 4 discs at random, without replacement, and places them in a row.

   (a) How many different 4-digit numbers can be made? **[2]**

   (b) How many different **odd** 4-digit numbers can be made? **[3]**

   (ii) Andrea's 4 discs are put back in the bag. Martin then chooses 4 discs at random, without replacement. Find the probability that

   (a) the 4 digits include at least 3 odd digits, **[4]**

   (b) the 4 digits add up to 28. **[3]**

(Q9, Jan 2012)

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14 **(i)** 5 of the 7 letters A, B, C, D, E, F, G are arranged in a random order in a straight line.

   (a) How many different arrangements of 5 letters are possible? **[2]**

   (b) How many of these arrangements end with a vowel (A or E)? **[3]**

   (ii) A group of 5 people is to be chosen from a list of 7 people.

   (a) How many different groups of 5 people can be chosen? **[1]**

   (b) The list of 7 people includes Jill and Jo. A group of 5 people is chosen at random from the list. Given that either Jill and Jo are both chosen or neither of them is chosen, find the probability that both of them are chosen. **[3]**

(Q7, June 2012)

15 **(i)** How many different 3-digit numbers can be formed using the digits 1, 2 and 3 when

   (a) no repetitions are allowed, **[1]**

   (b) any repetitions are allowed, **[2]**

   (c) each digit may be included at most twice? **[2]**

   (ii) How many different **4-digit** numbers can be formed using the digits 1, 2 and 3 when each digit may be included at most twice? **[5]**

(Q4, Jan 2013)