

Permutations and Combinations Exam Questions (From OCR 4732)

Q1, (Jun 2005, Q7)

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]

Q2, (Jan 2006, Q6)

An examination paper consists of two parts. Section A contains questions A1, A2, A3 and A4. Section B contains questions B1, B2, B3, B4, B5, B6 and B7.

Candidates must choose three questions from section A and four questions from section B. The order in which they choose the questions does not matter.

- (i) In how many ways can the seven questions be chosen? [3]
 (ii) Assuming that all selections are equally likely, find the probability that a particular candidate chooses question A1 but does **not** choose question B1. [3]
 (iii) Following a change of syllabus, the form of the examination remains the same except that candidates who choose question A1 are not allowed to choose question B1. In how many ways can the seven questions now be chosen? [3]

Q3, (Jun 2006, Q3)

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]

Q4, (Jan 2007, Q3)

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]

Q5, (Jun 2007, Q3)

- (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]
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Q6, (Jan 2008, Q1)

- (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]
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Q7, (Jun 2008, Q2)

A class consists of 7 students from Ashville and 8 from Bewton. A committee of 5 students is chosen at random from the class.

- (i) Find the probability that 2 students from Ashville and 3 from Bewton are chosen. [3]
- (ii) In fact 2 students from Ashville and 3 from Bewton are chosen. In order to watch a video, all 5 committee members sit in a row. In how many different orders can they sit if no two students from Bewton sit next to each other? [2]
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Q8, (Jan 2009, Q6)

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]
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Q9, (Jan 2010, Q8)

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]
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Q10, (Jun 2009, Q7)

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

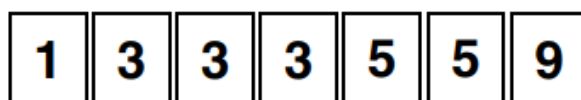
- (i) Find the number of possible selections of 3 letters. [2]
- (ii) Find the probability that the letter P is included in the selection. [3]

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]

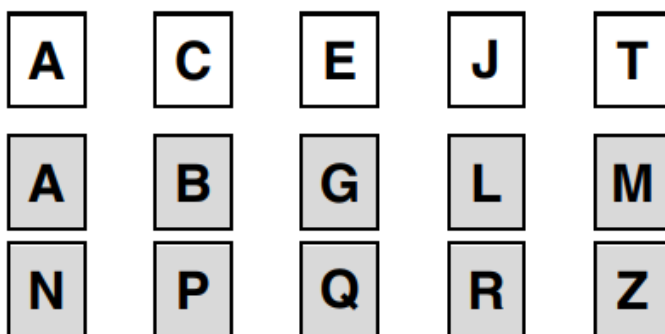
Q11, (Jan 2011, Q6)

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



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.



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]

Q12, Jun 2011, Q6)

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]

Q13, (Jan 2012, Q9)

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]

Q14, (Jan 2013, Q4)

- (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]

Q15, (Jun 2014, Q8)

A group of 8 people, including Kathy, David and Harpreet, are planning a theatre trip.

- (i) Four of the group are chosen at random, without regard to order, to carry the refreshments. Find the probability that these 4 people include Kathy and David but not Harpreet. [3]
- (ii) The 8 people sit in a row. Kathy and David sit next to each other and Harpreet sits at the left-hand end of the row. How many different arrangements of the 8 people are possible? [3]
- (iii) The 8 people stand in a line to queue for the exit. Kathy and David stand next to each other and Harpreet stands next to them. How many different arrangements of the 8 people are possible? [3]

Q16, (Jun 2015, Q6)

- (i) The seven digits 1, 1, 2, 3, 4, 5, 6 are arranged in a random order in a line. Find the probability that they form the number 1 452 163. [3]
- (ii) Three of the seven digits 1, 1, 2, 3, 4, 5, 6 are chosen at random, without regard to order.
- (a) How many possible groups of three digits contain two 1s? [1]
- (b) How many possible groups of three digits contain exactly one 1? [2]
- (c) How many possible groups of three digits can be formed altogether? [2]