UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2013**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

5808329184

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 50.
Questions carrying smaller numbers of marks are printed earlier in the paper, and questions carrying larger numbers of marks later in the paper.

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1 It is given that $X \sim \mathrm{N}(30, 49)$, $Y \sim \mathrm{N}(30, 16)$ and $Z \sim \mathrm{N}(50, 16)$. On a single diagram, with the horizontal axis going from 0 to 70, sketch three curves to represent the distributions of X, Y and Z. [3]

2 The people living in two towns, Mumbok and Bagville, are classified by age. The numbers in thousands living in each town are shown in the table below.

	Mumbok	Bagville
Under 18 years	15	35
18 to 60 years	55	95
Over 60 years	20	30

One of the towns is chosen. The probability of choosing Mumbok is 0.6 and the probability of choosing Bagville is 0.4. Then a person is chosen at random from that town. Given that the person chosen is between 18 and 60 years old, find the probability that the town chosen was Mumbok. [5]

3 Swati measured the lengths, x cm, of 18 stick insects and found that $\Sigma x^2 = 967$. Given that the mean length is $\frac{58}{9}$ cm, find the values of $\Sigma(x - 5)$ and $\Sigma(x - 5)^2$. [5]

4 The following are the house prices in thousands of dollars, arranged in ascending order, for 51 houses from a certain area.

253 270 310 354 386 428 433 468 472 477 485 520 520 524 526 531 535
536 538 541 543 546 548 549 551 554 572 583 590 605 614 638 649 652
666 670 682 684 690 710 725 726 731 734 745 760 800 854 863 957 986

(i) Draw a box-and-whisker plot to represent the data. [4]

An expensive house is defined as a house which has a price that is more than 1.5 times the interquartile range above the upper quartile.

(ii) For the above data, give the prices of the expensive houses. [2]

(iii) Give one disadvantage of using a box-and-whisker plot rather than a stem-and-leaf diagram to represent this set of data. [1]

5 Lengths of a certain type of carrot have a normal distribution with mean 14.2 cm and standard deviation 3.6 cm.

(i) 8% of carrots are shorter than c cm. Find the value of c. [3]

(ii) Rebekah picks 7 carrots at random. Find the probability that at least 2 of them have lengths between 15 and 16 cm. [6]

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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]

7 James has a fair coin and a fair tetrahedral die with four faces numbered 1, 2, 3, 4. He tosses the coin once and the die twice. The random variable X is defined as follows.

- If the coin shows a **head** then X is the **sum** of the scores on the two throws of the die.
- If the coin shows a **tail** then X is the score on the **first throw** of the die only.

(i) Explain why $X = 1$ can only be obtained by throwing a tail, and show that $P(X = 1) = \frac{1}{8}$. [2]

(ii) Show that $P(X = 3) = \frac{3}{16}$. [4]

(iii) Copy and complete the probability distribution table for X. [3]

x	1	2	3	4	5	6	7	8
$P(X = x)$	$\frac{1}{8}$		$\frac{3}{16}$		$\frac{1}{8}$		$\frac{1}{16}$	$\frac{1}{32}$

Event Q is 'James throws a tail'. Event R is 'the value of X is 7'.

(iv) Determine whether events Q and R are exclusive. Justify your answer. [2]

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