Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

6367992828

MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions in the space provided. If additional space is required, you should use the lined page at the end of this booklet. The question number(s) must be clearly shown.
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.

This document consists of **14** printed pages and **2** blank pages.

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1 9 people are to be divided into a group of 4, a group of 3 and a group of 2. In how many different ways can this be done? [3]

2 A random variable X has the probability distribution shown in the following table, where p is a constant.

x	-1	0	1	2	4
$\mathrm{P}(X = x)$	p	p	$2p$	$2p$	0.1

(i) Find the value of p. [1]

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(ii) Given that $\mathrm{E}(X) = 1.15$, find $\mathrm{Var}(X)$. [2]

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3 In an orchestra, there are 11 violinists, 5 cellists and 4 double bass players. A small group of 6 musicians is to be selected from these 20.

(i) How many different selections of 6 musicians can be made if there must be at least 4 violinists, at least 1 cellist and no more than 1 double bass player? [4]

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The small group that is selected contains 4 violinists, 1 cellist and 1 double bass player. They sit in a line to perform a concert.

(ii) How many different arrangements are there of these 6 musicians if the violinists must sit together? [3]

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4 **(a)** It is given that $X \sim \mathrm{N}(31.4, 3.6)$. Find the probability that a randomly chosen value of X is less than 29.4. [3]

(b) The lengths of fish of a particular species are modelled by a normal distribution. A scientist measures the lengths of 400 randomly chosen fish of this species. He finds that 42 fish are less than 12 cm long and 58 are more than 19 cm long. Find estimates for the mean and standard deviation of the lengths of fish of this species. [5]

5 At the Nonland Business College, all students sit an accountancy examination at the end of their first year of study. On average, 80% of the students pass this examination.

(i) A random sample of 9 students who will take this examination is chosen. Find the probability that at most 6 of these students will pass the examination. [3]

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(ii) A random sample of 200 students who will take this examination is chosen. Use a suitable approximate distribution to find the probability that more than 166 of them will pass the examination. [5]

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(iii) Justify the use of your approximate distribution in part **(ii)**. [1]

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6 The daily rainfall, x mm, in a certain village is recorded on 250 consecutive days. The results are summarised in the following cumulative frequency table.

Rainfall, x mm	$x \leqslant 20$	$x \leqslant 30$	$x \leqslant 40$	$x \leqslant 50$	$x \leqslant 70$	$x \leqslant 100$
Cumulative frequency	52	94	142	172	222	250

(i) On the grid, draw a cumulative frequency graph to illustrate the data. [2]

(ii) On 100 of the days, the rainfall was k mm or more. Use your graph to estimate the value of k. [2]

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(iii) Calculate estimates of the mean and standard deviation of the daily rainfall in this village. [6]

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7 In a group of students, the numbers of boys and girls studying Art, Music and Drama are given in the following table. Each of these 160 students is studying exactly one of these subjects.

	Art	Music	Drama
Boys	24	40	32
Girls	15	12	37

(i) Find the probability that a randomly chosen student is studying Music. [1]

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(ii) Determine whether the events 'a randomly chosen student is a boy' and 'a randomly chosen student is studying Music' are independent, justifying your answer. [2]

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(iii) Find the probability that a randomly chosen student is not studying Drama, given that the student is a girl. [2]

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(iv) Three students are chosen at random. Find the probability that exactly 1 is studying Music and exactly 2 are boys. [5]

Additional Page

If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.

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