Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2016**

1 hour 15 minutes

Additional Materials: List of Formulae (MF9)

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READ THESE INSTRUCTIONS FIRST

An answer booklet and a graph paper booklet are provided inside this question paper. You should follow the instructions on the front cover of both booklets. If you need additional answer paper or graph paper ask the invigilator for a continuation booklet or graph paper booklet.

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.

This document consists of **3** printed pages, **1** blank page and **2** inserts.

CAMBRIDGE International Examinations

1 When Anya goes to school, the probability that she walks is 0.3 and the probability that she cycles is 0.65; if she does not walk or cycle she takes the bus. When Anya walks the probability that she is late is 0.15. When she cycles the probability that she is late is 0.1 and when she takes the bus the probability that she is late is 0.6. Given that Anya is late, find the probability that she cycles. [5]

2 Noor has 3 T-shirts, 4 blouses and 5 jumpers. She chooses 3 items at random. The random variable X is the number of T-shirts chosen.

(i) Show that the probability that Noor chooses exactly one T-shirt is $\frac{27}{55}$. [3]

(ii) Draw up the probability distribution table for X. [4]

3 On any day at noon, the probabilities that Kersley is asleep or studying are 0.2 and 0.6 respectively.

(i) Find the probability that, in any 7-day period, Kersley is either asleep or studying at noon on at least 6 days. [3]

(ii) Use an approximation to find the probability that, in any period of 100 days, Kersley is asleep at noon on at most 30 days. [5]

4 The time taken to cook an egg by people living in a certain town has a normal distribution with mean 4.2 minutes and standard deviation 0.6 minutes.

(i) Find the probability that a person chosen at random takes between 3.5 and 4.5 minutes to cook an egg. [3]

12% of people take more than t minutes to cook an egg.

(ii) Find the value of t. [3]

(iii) A random sample of n people is taken. Find the smallest possible value of n if the probability that none of these people takes more than t minutes to cook an egg is less than 0.003. [3]

5 The number of people a football stadium can hold is called the 'capacity'. The capacities of 130 football stadiums in the UK, to the nearest thousand, are summarised in the table.

Capacity	3000–7000	8000–12 000	13 000–22 000	23 000–42 000	43 000–82 000
Number of stadiums	40	30	18	34	8

(i) On graph paper, draw a histogram to represent this information. Use a scale of 2 cm for a capacity of 10 000 on the horizontal axis. [5]

(ii) Calculate an estimate of the mean capacity of these 130 stadiums. [2]

(iii) Find which class in the table contains the median and which contains the lower quartile. [2]

6 Find the number of ways all 10 letters of the word COPENHAGEN can be arranged so that

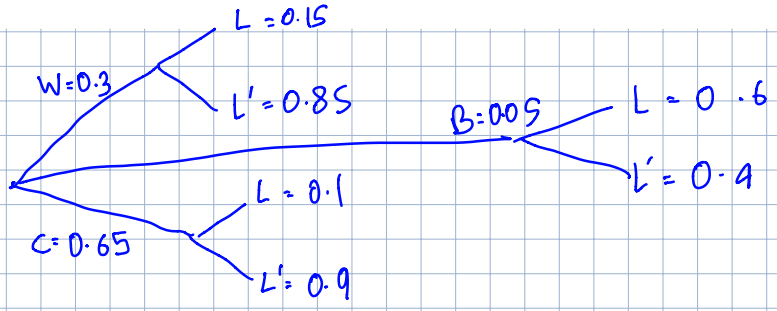
(i) the vowels (A, E, O) are together and the consonants (C, G, H, N, P) are together, [3]

(ii) the Es are not next to each other. [4]

Four letters are selected from the 10 letters of the word COPENHAGEN.

(iii) Find the number of different selections if the four letters must contain the same number of Es and Ns with at least one of each. [5]

1 When Anya goes to school, the probability that she walks is 0.3 and the probability that she cycles is 0.65; if she does not walk or cycle she takes the bus. When Anya walks the probability that she is late is 0.15. When she cycles the probability that she is late is 0.1 and when she takes the bus the probability that she is late is 0.6. Given that Anya is late, find the probability that she cycles. [5]



$$P(C|L) = \frac{P(C \cap L)}{P(L)} = \frac{0.65 \times 0.1}{(0.3 \times 0.15) + (0.05 \times 0.6) + (0.65 \times 0.1)} = 0.464$$

2 Noor has 3 T-shirts, 4 blouses and 5 jumpers. She chooses 3 items at random. The random variable X is the number of T-shirts chosen.

(i) Show that the probability that Noor chooses exactly one T-shirt is $\frac{27}{55}$. [3]

(ii) Draw up the probability distribution table for X. [4]

i) ∴

$$^3C_1 \times \frac{3}{12} \times \frac{9}{11} \times \frac{8}{10} = \frac{27}{55}$$

ii)

0	1	2	3
$\frac{84}{220}$	$\frac{108}{220}$	$\frac{27}{220}$	$\frac{1}{220}$

3 On any day at noon, the probabilities that Kersley is asleep or studying are 0.2 and 0.6 respectively.

(i) Find the probability that, in any 7-day period, Kersley is either asleep or studying at noon on at least 6 days. [3]

(ii) Use an approximation to find the probability that, in any period of 100 days, Kersley is asleep at noon on at most 30 days. [5]

i) $X \sim B(7, 0.8)$

$P(X \geq 5) = P(6, 7)$

$^7C_6 \times 0.8^6 \times 0.2^1 = 0.367$

$^7C_7 \times 0.8^7 \times 0.2^0 = 0.2097$

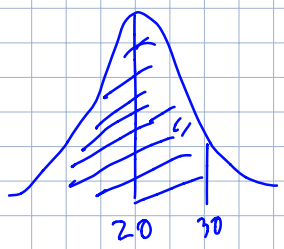
0.5767

0.577

$X \sim B(100, 0.2)$

$P(X \leq 30) = P(X < 30.5)$

$X \sim N(20, 16)$



$\Phi\left(\frac{30.5 - 20}{4}\right)$

$\Phi(2.625) = 0.9957 = 0.996$

4 The time taken to cook an egg by people living in a certain town has a normal distribution with mean 4.2 minutes and standard deviation 0.6 minutes.

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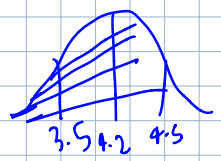
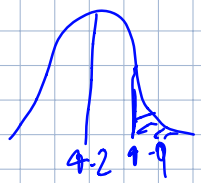
12% of people take more than t minutes to cook an egg.

(ii) Find the value of t. [3]

(iii) A random sample of n people is taken. Find the smallest possible value of n if the probability that none of these people takes more than t minutes to cook an egg is less than 0.003. [3]

i)





$P(X < 4.5) = \Phi\left(\frac{0.3}{0.6}\right) = \Phi(0.5) = 0.6915$

0.6915

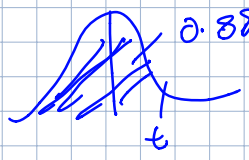
$1 - \Phi\left(\frac{0.7}{0.6}\right) = 1 - \Phi(1.16666)$

$= 1 - 0.8784 = 0.1216$

$0.6915 - 0.1216 = 0.5699$

$\therefore 0.570$

ii)



$\Phi\left(\frac{t-4.2}{0.6}\right) = 0.88$

$\frac{t-4.2}{0.6} = 1.175$

$t = 4.905$

$= 4.91$

iii) ${}^{n}C_0 \times 0.12^0 \times 0.88^n < 0.003$

$n > \frac{\ln 0.003}{\ln 0.88}$

$n > 45.4$

$n = 46$

5 The number of people a football stadium can hold is called the 'capacity'. The capacities of 130 football stadiums in the UK, to the nearest thousand, are summarised in the table.

2500 7500 12500 22500 42500 82500

Capacity	3000–7000	8000–12 000	13 000–22 000	23 000–42 000	43 000–82 000
Number of stadiums	40	30	18	34	8

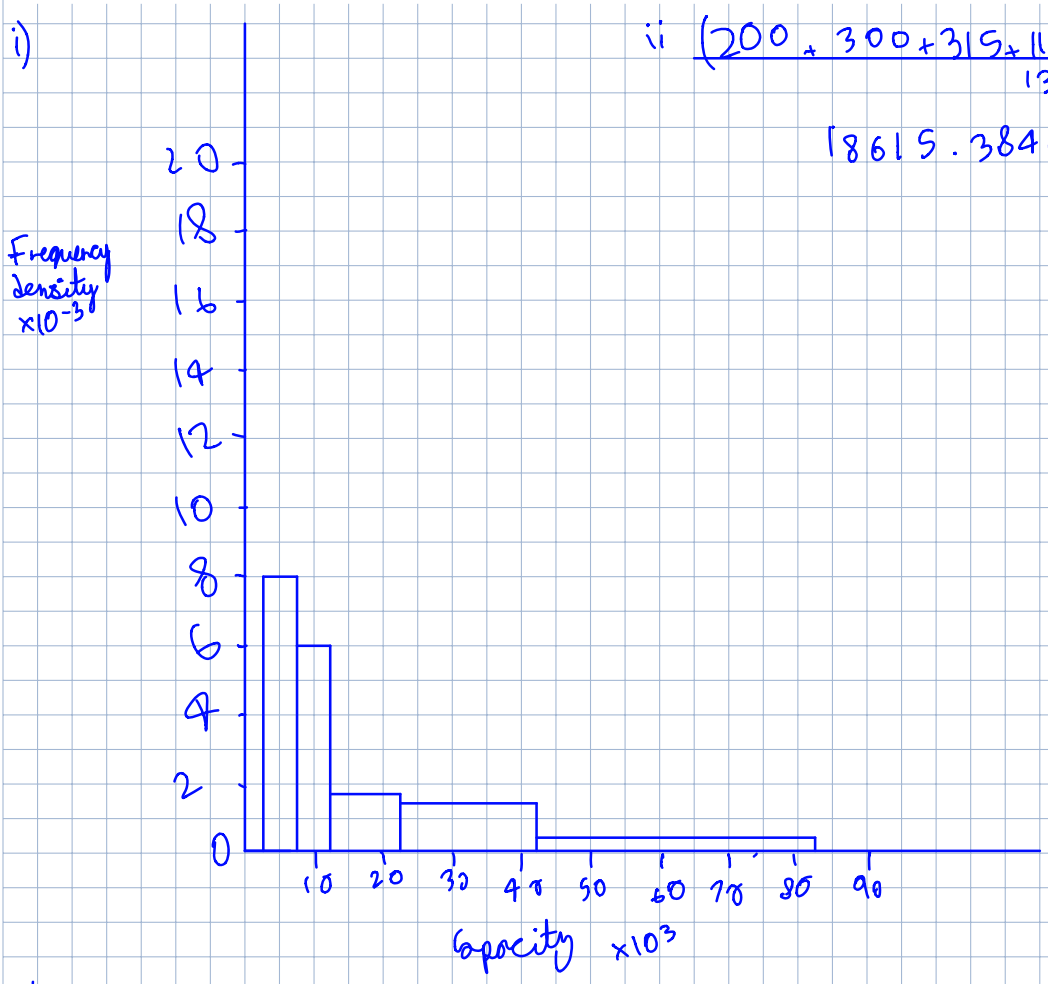
fD 0.608 0.006 0.0018 0.0017 0.0002

(i) On graph paper, draw a histogram to represent this information. Use a scale of 2 cm for a capacity of 10 000 on the horizontal axis. [5]

(ii) Calculate an estimate of the mean capacity of these 130 stadiums. [2]

(iii) Find which class in the table contains the median and which contains the lower quartile. [2]

i)



ii $\frac{(200 + 300 + 315 + 1105 + 502) \times 1000}{130}$

18615.38462 ≈ 18600

iii) mode: 8000 – 12000
LQ = 3000 – 7000

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(iii) Find the number of different selections if the four letters must contain the same number of Es and Ns with at least one of each. [5]

i) V: AEEO C: CPNHGN

$\frac{4!}{2!} \times \frac{6!}{2!} \times 2! = 8640$

ii) _ _ _ _ _ _ _ _ _ _

$\frac{8!}{2!} \times \frac{9P_2}{2!} = 725760$

iii) E N _ _

$EN \times {}^6C_2 = 15$

EENN = 1

16 ways

1E, 1N, 2 other

2E, 2N,

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