Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2015**

1 hour 15 minutes

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

3202615932

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 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.
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.

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

CAMBRIDGE International Examinations

1 The lengths, in metres, of cars in a city are normally distributed with mean μ and standard deviation 0.714. The probability that a randomly chosen car has a length more than 3.2 metres and less than μ metres is 0.475. Find μ. [4]

2 The table summarises the lengths in centimetres of 104 dragonflies.

Length (cm)	2.0 – 3.5	3.5 – 4.5	4.5 – 5.5	5.5 – 7.0	7.0 – 9.0
Frequency	8	25	28	31	12

(i) State which class contains the upper quartile. [1]

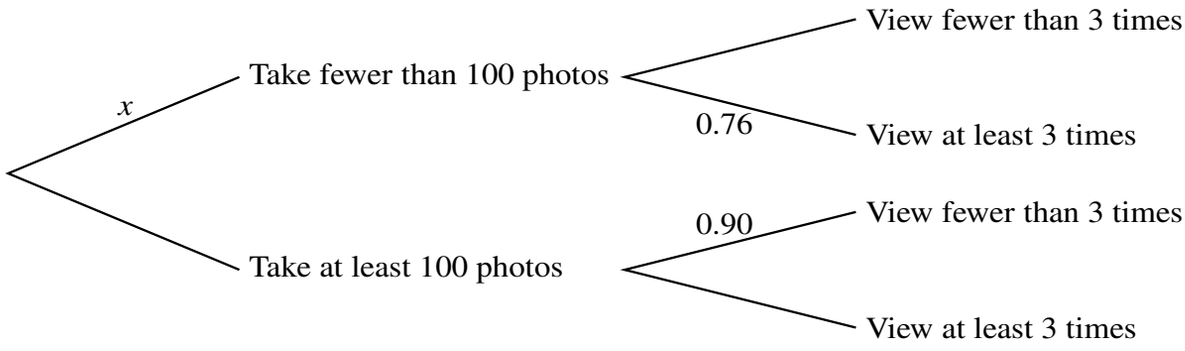
(ii) Draw a histogram, on graph paper, to represent the data. [4]

3 Jason throws two fair dice, each with faces numbered 1 to 6. Event A is 'one of the numbers obtained is divisible by 3 and the other number is not divisible by 3'. Event B is 'the product of the two numbers obtained is even'.

(i) Determine whether events A and B are independent, showing your working. [5]

(ii) Are events A and B mutually exclusive? Justify your answer. [1]

4



A survey is undertaken to investigate how many photos people take on a one-week holiday and also how many times they view past photos. For a randomly chosen person, the probability of taking fewer than 100 photos is x. The probability that these people view past photos at least 3 times is 0.76. For those who take at least 100 photos, the probability that they view past photos fewer than 3 times is 0.90. This information is shown in the tree diagram. The probability that a randomly chosen person views past photos fewer than 3 times is 0.801.

(i) Find x. [3]

(ii) Given that a person views past photos at least 3 times, find the probability that this person takes at least 100 photos. [4]

5 The table shows the mean and standard deviation of the weights of some turkeys and geese.

	Number of birds	Mean (kg)	Standard deviation (kg)
Turkeys	9	7.1	1.45
Geese	18	5.2	0.96

(i) Find the mean weight of the 27 birds. [2]

(ii) The weights of individual turkeys are denoted by x_t kg and the weights of individual geese by x_g kg. By first finding Σx_t^2 and Σx_g^2, find the standard deviation of the weights of all 27 birds. [5]

6 **(i)** In a certain country, 68% of households have a printer. Find the probability that, in a random sample of 8 households, 5, 6 or 7 households have a printer. [4]

(ii) Use an approximation to find the probability that, in a random sample of 500 households, more than 337 households have a printer. [5]

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

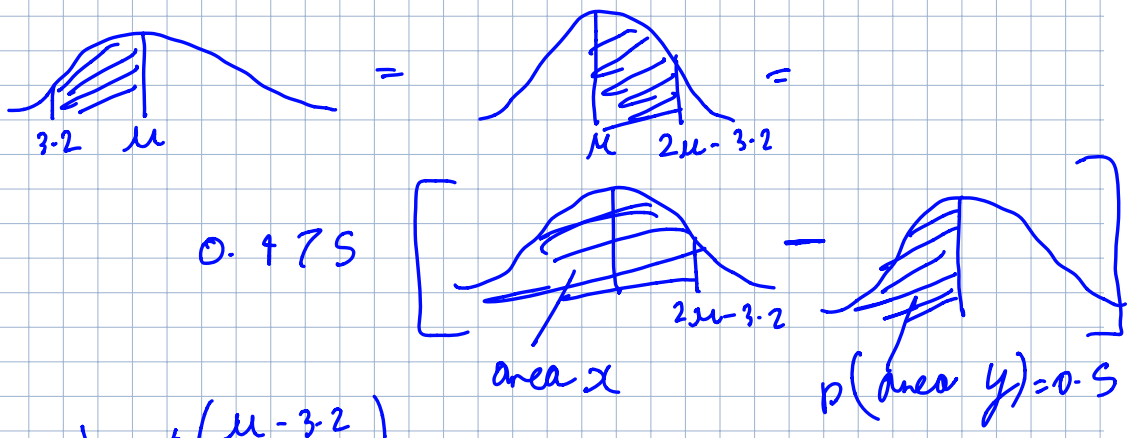
7 **(a)** Find how many different numbers can be made by arranging all nine digits of the number 223 677 888 if

(i) there are no restrictions, [2]

(ii) the number made is an even number. [4]

(b) Sandra wishes to buy some applications (apps) for her smartphone but she only has enough money for 5 apps in total. There are 3 train apps, 6 social network apps and 14 games apps available. Sandra wants to have at least 1 of each type of app. Find the number of different possible selections of 5 apps that Sandra can choose. [5]

1 The lengths, in metres, of cars in a city are normally distributed with mean μ and standard deviation 0.714. The probability that a randomly chosen car has a length more than 3.2 metres and less than μ metres is 0.475. Find μ. [4]



$$p(\text{area } x) = \Phi\left(\frac{\mu - 3.2}{0.714}\right)$$

$$\Phi\left(\frac{\mu - 3.2}{0.714}\right) - 0.5 = 0.475$$

$$\Phi\left(\frac{\mu - 3.2}{0.714}\right) = 0.975$$

$$\frac{\mu - 3.2}{0.714} = 1.96$$

$$\mu = 4.59944$$

$$\mu = 4.6$$

2 The table summarises the lengths in centimetres of 104 dragonflies.

Length (cm)	2.0 – 3.5	3.5 – 4.5	4.5 – 5.5	5.5 – 7.0	7.0 – 9.0
Frequency	8	25	28	31	12
FD	5.33	25	28	20.666	6

(i) State which class contains the upper quartile. [1]

(ii) Draw a histogram, on graph paper, to represent the data. [4]

i) 5.5 – 7.0

ii)

3 Jason throws two fair dice, each with faces numbered 1 to 6. Event A is 'one of the numbers obtained is divisible by 3 and the other number is not divisible by 3'. Event B is 'the product of the two numbers obtained is even'.

(i) Determine whether events A and B are independent, showing your working. [5]

(ii) Are events A and B mutually exclusive? Justify your answer. [1]

i)

B \ A	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8	12	16	20	24
5	5	10	15	20	25	30
6	6	12	18	24	30	36

If A and B are independent, the $P(A \cap B) = P(A) \cdot P(B)$

$D = 3, 6 \quad P(D) = \frac{2}{6}$

$X = 1, 2, 4, 5$

$P(X) = \frac{4}{6}$

A B

A: $D(X) = \frac{2}{6} \times \frac{4}{6} = \frac{2}{9}$

$(X)' D = \frac{4}{6} \times \frac{2}{6} = \frac{2}{9}$

$P(A) = \frac{4}{9}$ $\qquad P(A \text{ and } B) = \frac{12}{36}$

$P(B) = \frac{27}{36}$

$\frac{4}{9} \times \frac{27}{36} = \frac{12}{36}$

$\frac{1}{3} = \frac{1}{3}$

∴ Events are independent

ii) if A and B are m.... ex...

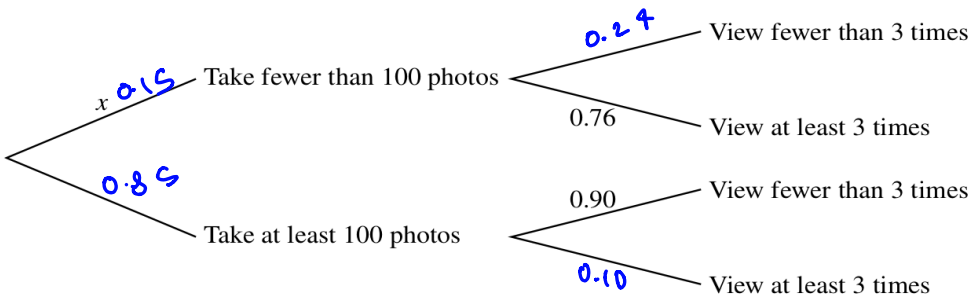
then $P(A \cup B) = P(A) + P(B)$

$\frac{30}{36} \neq \frac{4}{9} + \frac{27}{36}$

$\frac{5}{6} \neq \frac{43}{36}$

∴ not mutually excusive

4



A survey is undertaken to investigate how many photos people take on a one-week holiday and also how many times they view past photos. For a randomly chosen person, the probability of taking fewer than 100 photos is x. The probability that these people view past photos at least 3 times is 0.76. For those who take at least 100 photos, the probability that they view past photos fewer than 3 times is 0.90. This information is shown in the tree diagram. The probability that a randomly chosen person views past photos fewer than 3 times is 0.801.

(i) Find x. [3]

(ii) Given that a person views past photos at least 3 times, find the probability that this person takes at least 100 photos. [4]

i) $0.24x + (1-x).0.9 = 0.801$

$0.24x - 0.9x = -0.099$

$0.66x = 0.099$

$x = 0.15$

ii) $P(\text{100 photos or least} \mid \text{views past photos at least 3 times}) = \dfrac{P(\text{100 photos and views past photos})}{P(\text{views past photos})}$

$= \dfrac{0.85 \times 0.10}{1-0.801}$

$= 0.4271$

5 The table shows the mean and standard deviation of the weights of some turkeys and geese.

	Number of birds	Mean (kg)	Standard deviation (kg)
Turkeys	9	7.1	1.45
Geese	18	5.2	0.96

(i) Find the mean weight of the 27 birds. [2]

(ii) The weights of individual turkeys are denoted by x_t kg and the weights of individual geese by x_g kg. By first finding Σx_t^2 and Σx_g^2, find the standard deviation of the weights of all 27 birds. [5]

i) $\frac{7.1 \times 9 + 5.2 \times 18}{27} = 5.83$

ii) $\sqrt{\frac{\Sigma x_t^2}{9} - 7.1^2} = 1.45$ | $\sqrt{\frac{\Sigma x_g^2}{18} - 5.2^2} = 0.96$

$\Sigma x_t^2 = 472.6125$ | $\Sigma x_g^2 = 503.3088$

$$\sqrt{\frac{472.6125 + 503.3088}{27} - 5.833^2}$$

$= 1.46$

6 **(i)** In a certain country, 68% of households have a printer. Find the probability that, in a random sample of 8 households, 5, 6 or 7 households have a printer. [4]

(ii) Use an approximation to find the probability that, in a random sample of 500 households, more than 337 households have a printer. [5]

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

i) $X \sim B(8, 0.68)$

${}^8C_5 \times 0.68^5 \times 0.32^3 = 0.2668$

${}^8C_6 \ldots = 0.2835$

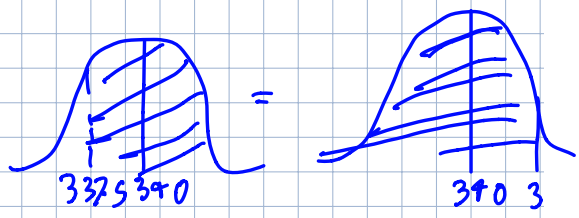
${}^8C_7 \ldots = 0.1721$

0.7224 ans

$= 0.722$

ii) $X \sim B(500, 0.68)$

$X \sim N(340, 108.8^2)$



$\frac{2.5}{\sqrt{108.8}} = z$

$z = 0.239677$

$\Phi(z) = 0.5910 + 35 = 0.5945$

0.595

7 **(a)** Find how many different numbers can be made by arranging all nine digits of the number 223 677 888 if

(i) there are no restrictions, [2]

(ii) the number made is an even number. [4]

(b) Sandra wishes to buy some applications (apps) for her smartphone but she only has enough money for 5 apps in total. There are 3 train apps, 6 social network apps and 14 games apps available. Sandra wants to have at least 1 of each type of app. Find the number of different possible selections of 5 apps that Sandra can choose. [5]

Q7 i) $\frac{9!}{2! \times 2! \times 3!} = 15120$

2 2 3 6 7 7 8 8 8

ii) _ _ _ _ _ _ _ _ _

$\frac{2}{6}$ $\frac{8}{8}$ $\frac{8!}{2}$ $= 3360$

$\frac{8!}{2! \times 2! \times 3!} = 1680$

$\frac{8!}{2! \times 2! \times 2!} = 5040$

10080

b) _ _ _ _ _

T	S	G
3	1	1
1	3	1
1	1	3
2	2	1
2	1	2
1	2	2

$^3C_3 \times {}^6C_1 \times {}^{14}C_1 = 84$

$^3C_1 \times {}^6C_3 \times {}^{14}C_1 = 840$

$= 6552$

$= 630$

$= 1638$

$= 4095$

$= 13839$

BLANK PAGE