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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Thursday 17 October 2024

Afternoon (Time: 1 hour 30 minutes)

Paper reference **WST01/01**

Mathematics

International Advanced Subsidiary/Advanced Level
Statistics S1

You must have:
Mathematical Formulae and Statistical Tables (Yellow), calculator

Total Marks

Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Values from the statistical tables should be quoted in full. If a calculator is used instead of the tables, the value should be given to an equivalent degree of accuracy.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 8 questions in this question paper. The total mark for this paper is 75.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Turn over ▶

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1. The back-to-back stem and leaf diagram on page 3 shows information about the running times of 31 Action films and 31 Comedy films.
The running times are given to the nearest minute.

(a) Write down the modal running time for these Action films.

(1)

Some of the quartiles for these two distributions are shown in the table below.

	Action films	**Comedy films**
Lower quartile	121	a
Median	b	117
Upper quartile	138	c

(b) Find the value of a, the value of b and the value of c

(3)

(c) For these Action films find, to one decimal place,

(i) the mean running time,

(ii) the standard deviation of the running times.

(You may use $\sum x = 4016$ and $\sum x^2 = 525056$ where x is the running time, in minutes, of an Action film.)

(3)

One measure of skewness is found using

$$\frac{\text{mean} - \text{mode}}{\text{standard deviation}}$$

(d) Evaluate this measure and describe the skewness for the running times of these Action films.

(2)

(e) Comment on one difference between the distribution of the running times of these Action films and the distribution of the running times of these Comedy films.
State the values of any statistics you have used to support your comment.

(1)

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Question 1 continued

Totals	Action films		Comedy films	Totals
(1)	0	9	2 2 3 5 8	(5)
(0)		10	3 5 6 6 8 9	(6)
(5)	9 8 6 4 2	11	0 2 4 6 7 9 9 9	(8)
(10)	9 9 8 7 6 5 4 3 1 0	12	1 2 4 6 6 7 7 7 7 8 9	(11)
(8)	8 7 7 7 5 4 2 1	13	1	(1)
(7)	7 7 6 6 4 3 1	14		(0)

Key: 0 | 9 | 2 means 90 minutes for an Action film and 92 minutes for a Comedy film

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Question 1 continued

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Question 1 continued

(Total for Question 1 is 10 marks)

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2. A biologist records the length, y cm, and the weight, w kg, of 50 rabbits.
The following summary statistics are calculated from these data.

$$\sum y = 2015 \quad \sum y^2 = 81938.5 \quad \sum w = 125 \quad S_{ww} = 72.25 \quad S_{yw} = 219.55$$

(a) (i) Show that $S_{yy} = 734$

(ii) Calculate the product moment correlation coefficient for these data.
Give your answer to 3 decimal places.

(3)

(b) Interpret your value of the product moment correlation coefficient.

(1)

The biologist believes that a linear regression model may be appropriate to describe these data.

(c) State, with a reason, whether or not your value of the product moment correlation coefficient is consistent with the biologist's belief.

(1)

(d) Find the equation of the regression line of w on y, giving your answer in the form $w = a + by$

(4)

Jeff has a pet rabbit of length 45 cm.

(e) Use your regression equation to estimate the weight of Jeff's rabbit.

(2)

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Question 2 continued

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Question 2 continued

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Question 2 continued

(Total for Question 2 is 11 marks)

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3. A group of 200 adults were asked whether they read cooking magazines, travel magazines or sport magazines.
Their replies showed that

- 29 read only cooking magazines
- 33 read only travel magazines
- 42 read only sport magazines
- 17 read cooking magazines and sport magazines but **not** travel magazines
- 11 read travel magazines and sport magazines but **not** cooking magazines
- 22 read cooking magazines and travel magazines but **not** sport magazines
- 32 **do not** read cooking magazines, travel magazines or sport magazines

(a) Using this information, complete the Venn diagram on page 11

(3)

One of these adults was chosen at random.

(b) Find the probability that this adult,

(i) reads cooking magazines and travel magazines and sport magazines,

(1)

(ii) does **not** read cooking magazines.

(2)

Given that this adult reads travel magazines,

(c) find the probability that this adult also reads sport magazines.

(2)

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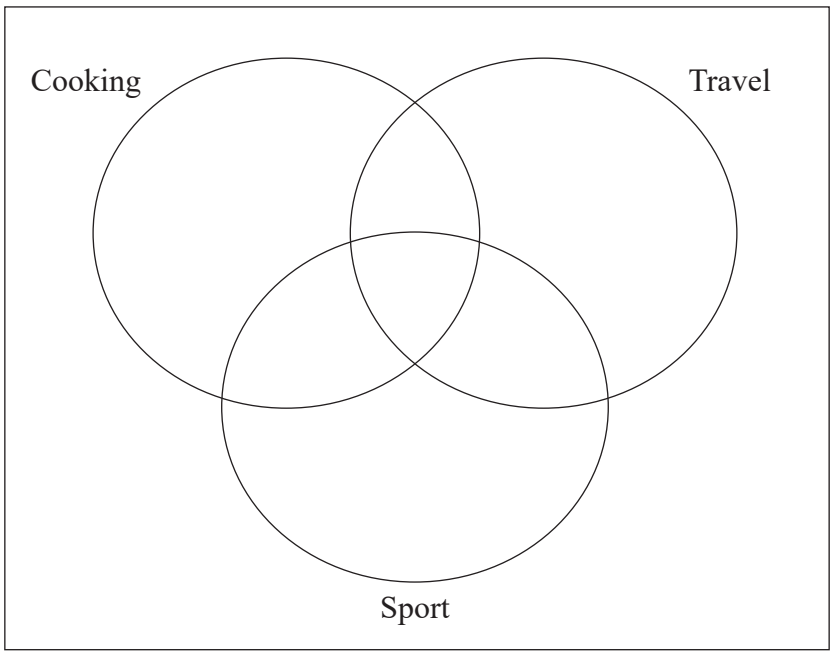
Question 3 continued



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Question 3 continued

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Question 3 continued

(Total for Question 3 is 8 marks)

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4. **In this question you must show all stages of your working.**
Solutions relying entirely on calculator technology are not acceptable.

The distances, m miles, a motorbike travels on a full tank of petrol can be modelled by a normal distribution with mean 170 miles and standard deviation 16 miles.

(a) Find the probability that, on a randomly selected journey, the motorbike could travel at least 190 miles on a full tank of petrol.

(2)

The probability that, on a randomly selected journey, the motorbike could travel at least d miles on a full tank of petrol is 0.9

(b) Find the value of d

(3)

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Question 4 continued

(Total for Question 4 is 5 marks)

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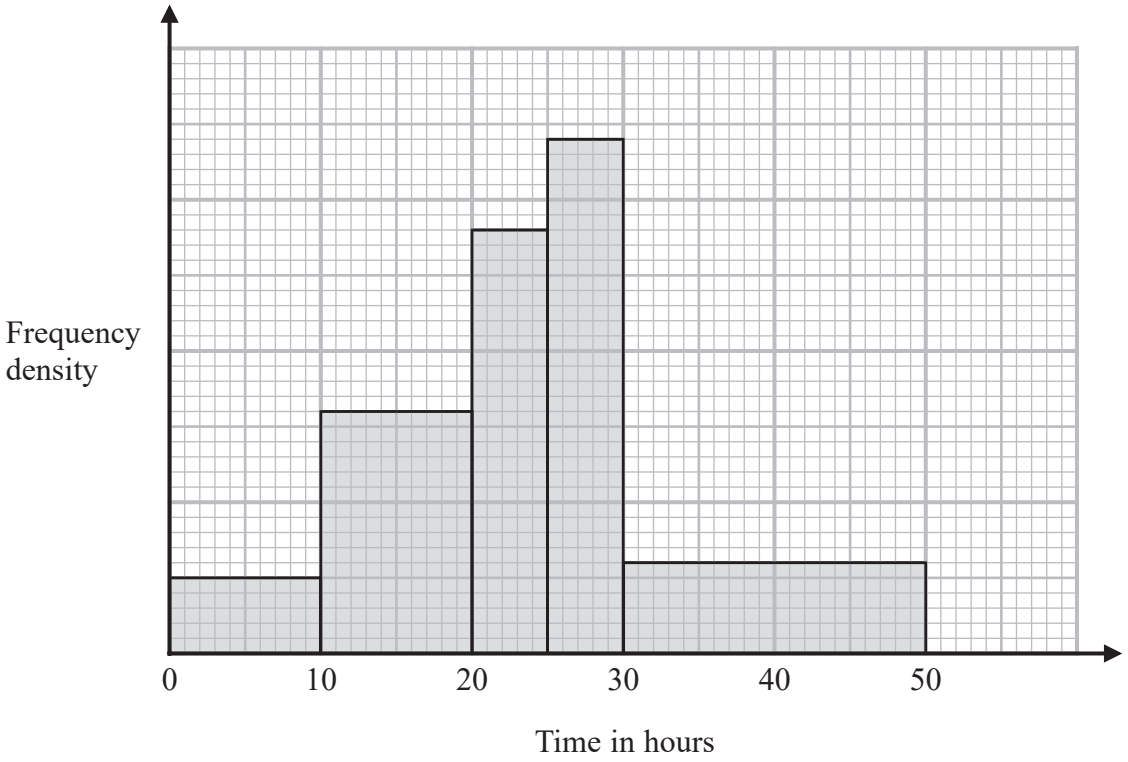
5.



The histogram shows the number of hours worked in a given week by a group of 64 freelance photographers.

(a) Give a reason to justify the use of a histogram to represent these data.

(1)

Given that 16 of these freelance photographers spent between 10 and 20 hours working in this week,

(b) estimate the number that spent between 12 and 24 hours working in this week.

(3)

(c) Find an estimate for the median time spent working in this week by these 64 freelance photographers.

(2)

Charlie decides to model these data using a normal distribution.
Charlie calculates an estimate of the mean to be 23.9 hours to one decimal place.

(d) Comment on Charlie's decision to use a normal distribution.
Give a justification for your answer.

(2)

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Question 5 continued

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Question 5 continued

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Question 5 continued

(Total for Question 5 is 8 marks)

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6. A biased die with six faces is rolled. The discrete random variable X represents the score which is uppermost. The **cumulative** distribution function of X is shown in the table below.

x	1	2	3	4	5	6
F(x)	0.1	0.2	$3k$	$5k$	$7k$	$10k$

(a) Find the value of the constant k

(1)

(b) Find the probability distribution of X

(3)

A biased die with eight faces is rolled. The discrete random variable Y represents the score which is uppermost. The probability distribution of Y is shown in the table below, where a and b are constants.

y	1	2	3	4	5	6	7	8
P($Y = y$)	a	a	a	b	b	b	0.11	0.05

Given that $\mathrm{E}(Y) = 4.02$

(c) form and solve two equations in a and b to show that $a = 0.15$
You must show your working.

(*Solutions relying on calculator technology are not acceptable.*)

(3)

(d) Show that $\mathrm{E}(Y^2) = 20.7$

(2)

(e) Find $\mathrm{Var}(5 - 2Y)$

(3)

These dice are each rolled once. The scores on the two dice are independent.

(f) Find the probability that the sum of these two scores is 3

(2)

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Question 6 continued

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Question 6 continued

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Question 6 continued

(Total for Question 6 is 14 marks)

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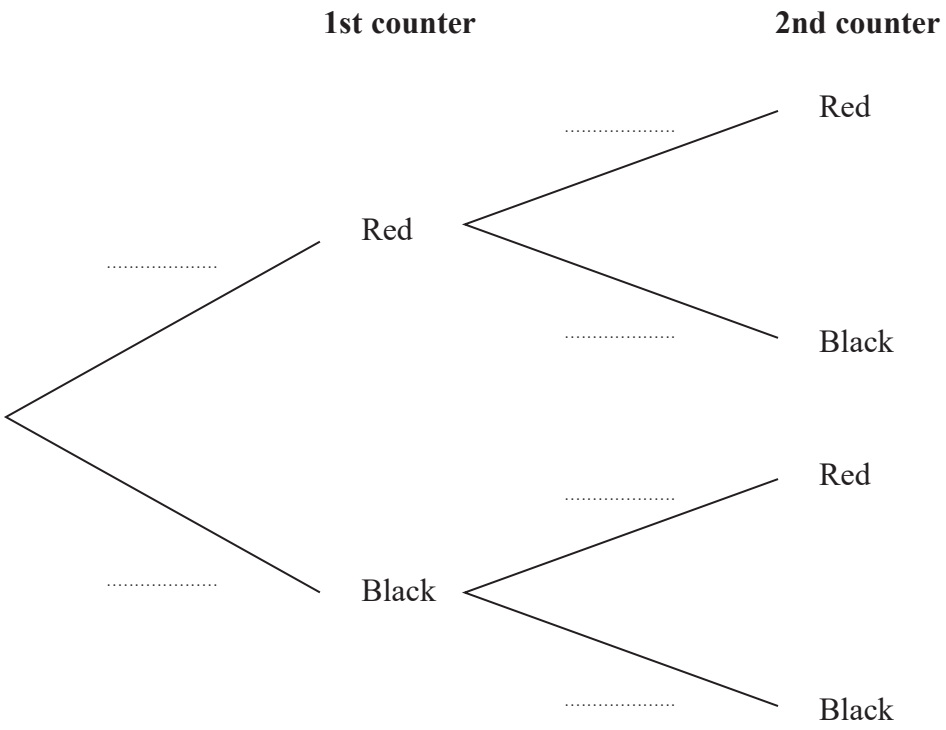
7. A box contains only red counters and black counters.

There are n red counters and $n + 1$ black counters.

Two counters are selected at random, one at a time **without** replacement, from the box.

(a) Complete the tree diagram for this information. Give your probabilities in terms of n where necessary.



(3)

(b) Show that the probability that the two counters selected are different colours is

$$\frac{n+1}{2n+1}$$

(2)

The probability that the two counters selected are different colours is $\frac{25}{49}$

(c) Find the total number of counters in the box before any counters were selected.

(2)

Given that the two counters selected are different colours,

(d) find the probability that the 1st counter is black.
You must show your working.

(2)

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Question 7 continued

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Question 7 continued

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8. An orchard produces apples.

The weights, A grams, of its apples are normally distributed with mean μ grams and standard deviation σ grams.

It is known that

$$P(A < 162) = 0.1 \text{ and } P(162 < A < 175) = 0.7508$$

(a) Calculate the value of μ and the value of σ

(5)

A second orchard also produces apples.

The weights, B grams, of its apples have distribution $B \sim N(215, 10^2)$

An outlier is a value that is

greater than $Q_3 + 1.5 \times (Q_3 - Q_1)$ or smaller than $Q_1 - 1.5 \times (Q_3 - Q_1)$

An apple is selected at random from this second orchard.

Using $Q_3 = 221.74$ grams,

(b) find the probability that this apple is an outlier.

(5)

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Question 8 continued

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Question 8 continued

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Question 8 continued

(Total for Question 8 is 10 marks)

TOTAL FOR PAPER IS 75 MARKS

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