Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number	Candidate Number

Mock Paper Set 3

Paper Reference **9MA0/31**

Mathematics

Advanced

Paper 31: Statistics

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

Total Marks

Candidates may use any calculator allowed 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 statistical tables should be quoted in full. If a calculator is used instead of 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.
- The total mark for this part of the examination is 50. There are 5 questions.
- 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.

Turn over ▶

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Pearson

1. Sam is playing a computer game.

When Sam earns a reward in the game, she randomly receives either a Silver reward or a Gold reward.

Each time that Sam earns a reward, the probability of receiving a Gold reward is 0.4

One day Sam plays the computer game and earns 11 rewards.

(a) Find the probability that she receives

(i) exactly 2 Gold rewards,

(2)

(ii) at least 5 Gold rewards.

(2)

In the next month Sam earns 300 rewards.

She decides to use a Normal distribution to estimate the probability that she will receive at least 135 Gold rewards.

(b) (i) Find the mean and variance of this Normal distribution.

(2)

(ii) Estimate the probability that Sam will receive at least 135 Gold rewards.

(2)

Question 1 continued

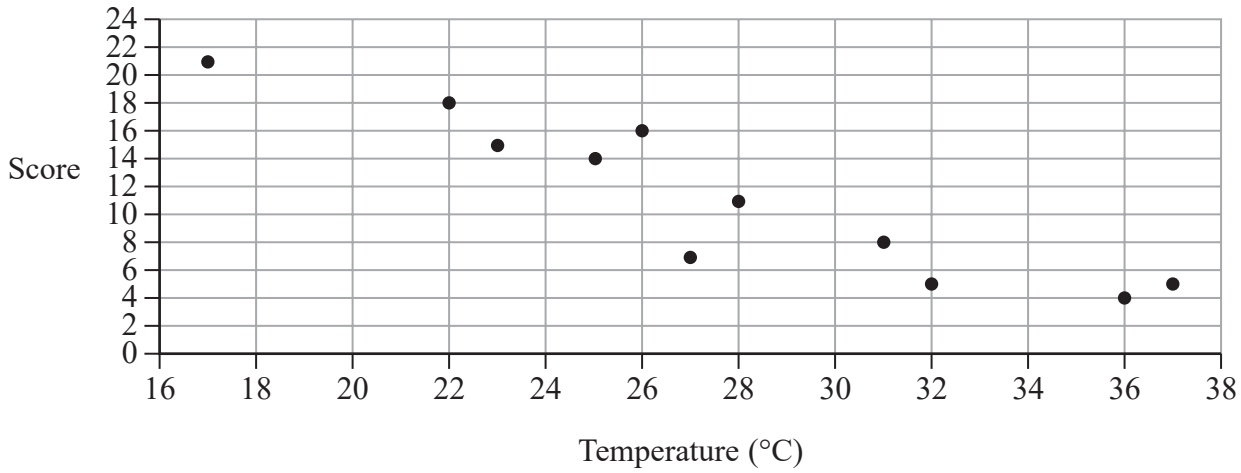
(Total for Question 1 is 8 marks)

2. Xiang is investigating how room temperature affects a person's score in a task.

She gets Simon to complete the task 11 times at various controlled room temperatures, x °C.

Xiang records the temperature, x, and Simon's score, y, where y is an integer.

The results are shown in the scatter diagram below.



(a) Use the scatter diagram to find

(i) the median score

(ii) the range of the scores.

(2)

The temperature was increased each time Simon completed the task.

Xiang believes that as the room temperature increases, Simon's score will decrease.

Xiang calculates the product moment correlation coefficient from her data as –0.9286

(b) Use this calculated value to carry out a suitable hypothesis test to investigate her belief at a 5% level of significance.
State clearly

- your hypotheses
- your critical value

(3)

Xiang is concerned that because Simon is repeating the same task his scores may improve.

(c) Comment on how this concern may affect Xiang's conclusion to the test in part (b).

(1)

Question 2 continued

(Total for Question 2 is 6 marks)

3.

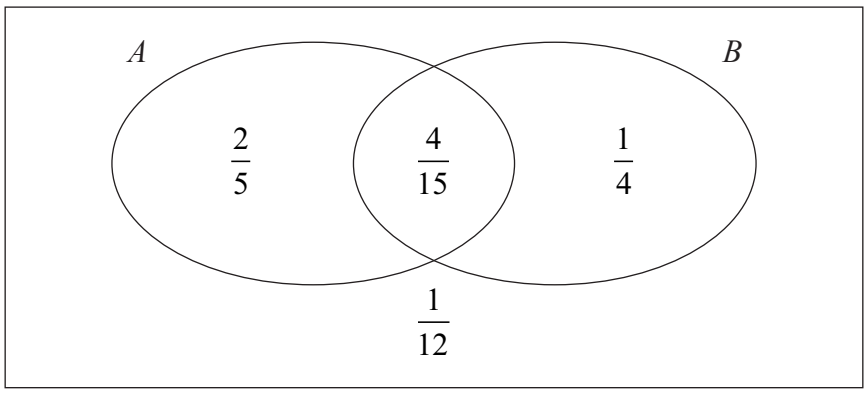


Figure 1

Figure 1 shows a Venn diagram with two events, A and B, and their associated probabilities.

(a) Explain whether or not events A and B are independent.
Show your working clearly.

(3)

(b) Find $P(B|A')$

(2)

(c) Complete the tree diagram in Figure 2 by calculating the probabilities associated with each branch.

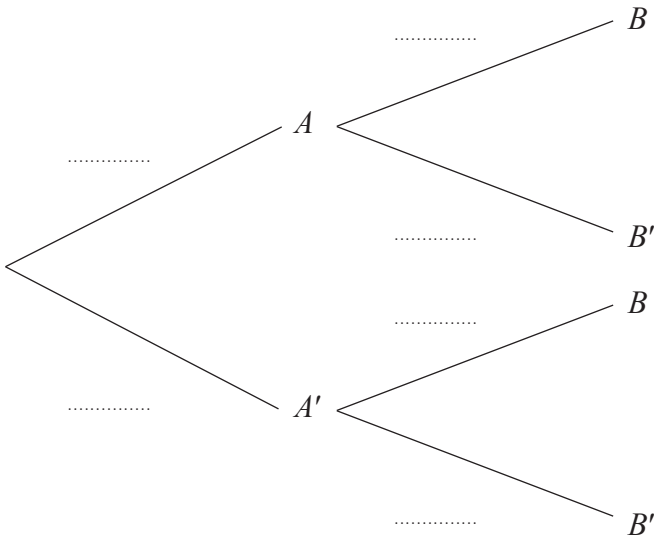


Figure 2

(4)

Turn over for a spare copy of Figure 2 if you need to redraw your tree diagram.

Question 3 continued

Question 3 continued

Only use this copy of Figure 2 if you need to redraw your tree diagram.

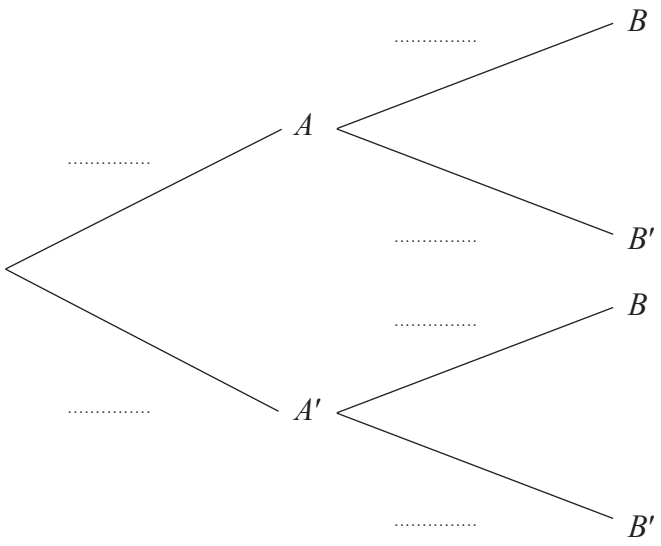


Figure 2

Question 3 continued

(Total for Question 3 is 9 marks)

4. Kaiyang and Maggie are studying the pattern of rainfall where they live in Hurn.

Kaiyang decides to record whether or not it is raining at 6 a.m. for the next 10 days.

(a) State the name of the sampling method Kaiyang is using.

(1)

Kaiyang suggests that the binomial distribution with $n = 10$ would be a good model for the number of days in a 10-day period when it is raining at 6 a.m.

(b) Explain why the binomial distribution might not be a good model in this situation.

(1)

Maggie uses data from the large data set for Hurn in 2015.
She randomly selects 30 days from the large data set for Hurn in 2015 and for each day records the Daily Total Rainfall, x (mm)
Some of her 30 days have 'tr' recorded as the Daily Total Rainfall.

(c) Using your knowledge of the large data set

- state what 'tr' means
- suggest what Maggie could do with these 'tr' entries to clean her data set
- explain what effect this action is likely to have on an estimate of the mean Daily Total Rainfall

(3)

Maggie summarises her data in the grouped frequency table shown below.

Daily Total Rainfall, x (mm)	0	$0 < x \leqslant 1$	$1 < x \leqslant 3$	$3 < x \leqslant 7$	$7 < x \leqslant 15$
Frequency, f	7	10	2	7	4

(d) Use this information to estimate the mean Daily Total Rainfall for these 30 days.

(2)

(e) Show that the estimated value of S_{xx} for the Daily Total Rainfall for these 30 days is 411.4 to 1 decimal place.

(3)

Maggie defines an outlier as a value which is more than 3 standard deviations from the mean.

(f) State, giving a reason, whether or not there could be any possible outliers in Maggie's data.

(3)

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Question 4 continued

Question 4 continued

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Question 4 continued

(Total for Question 4 is 13 marks)

5. Kim and Tom are both learning to tune a violin.

Kim's teacher asks her to tune the *A-string* of her violin to the correct frequency in hertz (Hz).

When Kim tunes the *A-string*, its frequency may be modelled by a Normal distribution.

When Kim first starts learning, she tunes the *A-string* with a mean frequency of 443 Hz and a standard deviation of 6 Hz.

The correct frequency for the *A-string* is 440 Hz.

Find the probability that Kim tunes the *A-string*

(a) lower than the correct frequency,

(2)

(b) more than 5 Hz away from the correct frequency.

(2)

After practising for a month, Kim tunes the *A-string* with a standard deviation of 4.5 Hz.

She claims that the mean frequency when she tunes the *A-string* is now less than 443 Hz.

Kim's teacher asks Kim to tune the *A-string* 20 times and finds that the mean frequency is 442 Hz.

(c) Test at the 5% level of significance whether or not there is evidence to support Kim's claim.

You should state your hypotheses and show your working clearly.

(4)

When Tom tunes the *A-string*, its frequency, T Hz, may be modelled by $T \sim N(\mu,\sigma^2)$

Given that $P(T < 438) = 0.2$ and that $P(T > 445) = 0.1$

(d) find the value of μ and the value of σ, giving your answers, in Hz, to 1 decimal place.

(6)

Question 5 continued

Question 5 continued

(Total for Question 5 is 14 marks)

TOTAL FOR STATISTICS IS 50 MARKS

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