Pearson LCCI

Certificate in Business Statistics (VRQ)
Level 2

Friday 9 September 2016
Time: 2 hours 30 minutes

Paper Reference
ASE20096

Complete the details below in block capitals.

Candidate name

Centre Code

Candidate Number

Candidate ID Number

You must have:
HB pencil, eraser

Total Marks

Instructions

- Use **black** ink or ball-point pen
  – *use a pencil to draw diagrams/graphs.*
- **Fill in the boxes** at the top of this page with your name, candidate number, centre code and your candidate ID number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Answers should be given to an appropriate degree of accuracy.

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- A formulae sheet is provided at the front of the question paper.
- Calculators may be used.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- You are advised to show your workings.
- Check your answers if you have time at the end.

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Pearson LCCI Level 2 Certificate in Business Statistics formulae sheet

Median for grouped data $l_{m+\frac{c_m}{f_m}\left(\frac{n}{2}-F_{m-1}\right)}$

where l_m , c_m and f_m are the lower boundary, width and frequency respectively of the median class, n is the total number of observations and F_{m-1} is the cumulative frequency corresponding to l_m.

Mean for ungrouped data $\bar{x} = \frac{\Sigma x}{n}$

Mean for grouped data $\bar{x} = \frac{\Sigma fx}{\Sigma f}$

Standard deviation for ungrouped data $S = \sqrt{\frac{\Sigma x^2}{n} - (\bar{x})^2}$

Standard deviation for grouped data $S = \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f}\right)^2}$

Quartile deviation $\frac{Q_3 - Q_1}{2}$

Mean deviation $\frac{\Sigma f|x - mean|}{\Sigma f}$

Coefficient of variation $\frac{s}{\bar{x}} \times 100$

Product moment correlation coefficient $r = \frac{n\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{(n\Sigma x^2 - (\Sigma x)^2)(n\Sigma y^2 - (\Sigma y)^2)}}$

Spearman's rank correlation coefficient $r_s = 1 - \frac{6\Sigma d^2}{n(n^2-1)}$

Least squares regression line $\hat{y} = a + bx$

$$b = \frac{n\Sigma xy - (\Sigma x)(\Sigma y)}{n\Sigma x^2 - (\Sigma x)^2}$$

$$a = \frac{\Sigma y}{n} - \frac{b\Sigma x}{n}$$

	Price	**Quantity**
Laspeyres index	$\frac{\Sigma p_1 q_0}{\Sigma p_0 q_0} \times 100$	$\frac{\Sigma p_0 q_1}{\Sigma p_0 q_0} \times 100$
Paasche index	$\frac{\Sigma p_1 q_1}{\Sigma p_0 q_1} \times 100$	$\frac{\Sigma p_1 q_1}{\Sigma p_1 q_0} \times 100$
Weighted index	$\frac{\Sigma WI}{\Sigma W}$	

Multiplication rule of probability $P(A \cap B) = P(A) \times P(B)$ if A and B independent

Addition rule of probability $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

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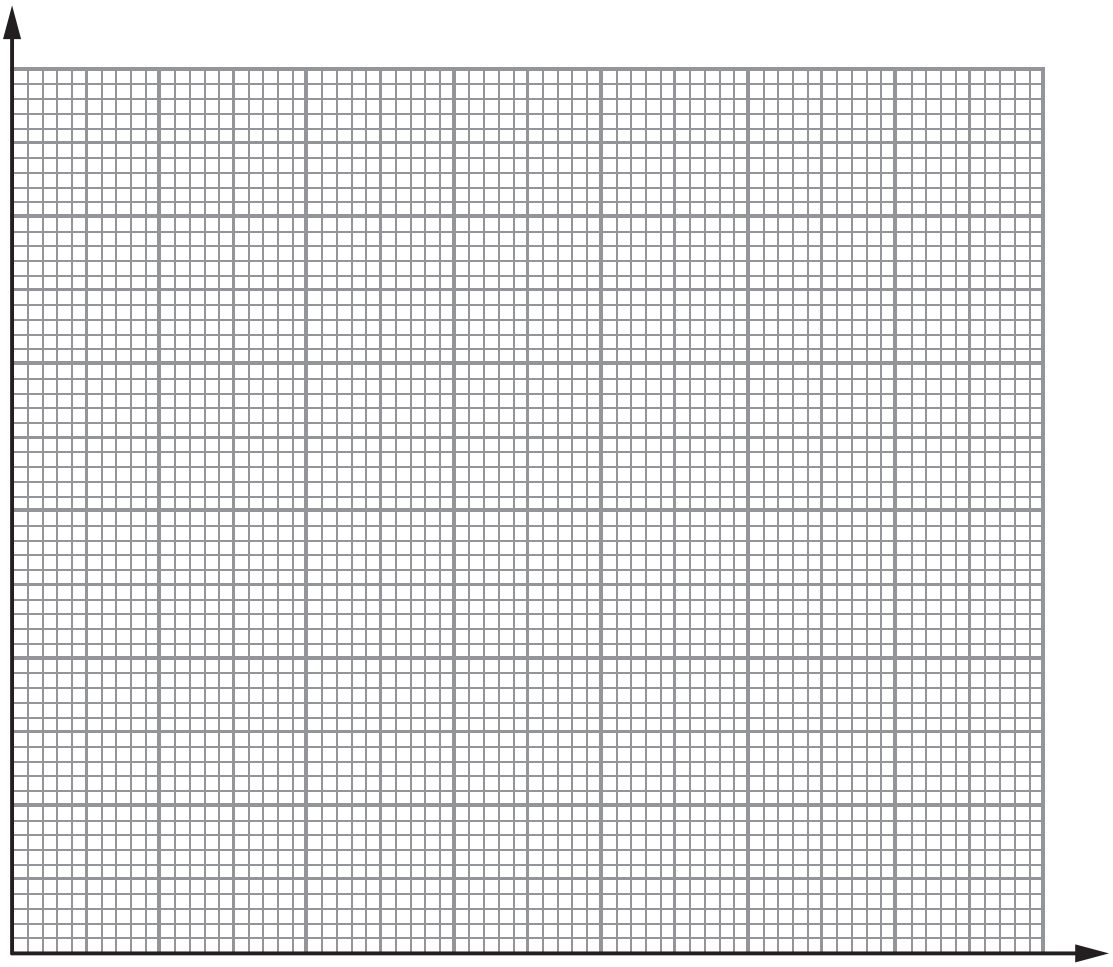
Answer ALL questions. Write your answers in the spaces provided.

1 Elsmore plc manufactures electrical decorations for festive occasions on a make-to-order basis. The financial accountant at the company obtains the following data for a bestselling item that is produced on a batch basis to satisfy customer orders. The following table shows details of the batch sizes and manufacturing times for the last eight customer orders received.

Order code	Batch size (x)	Manufacturing time (hours) (y)
AJ12B	10	21.5
AJ15K	12	27
AJ24C	15	30
AJ29D	20	35
AJ34E	24	40.5
AJ39U	25	42
AJ42L	30	44.5
AJ45F	32	50

(a) (i) Plot the data as a scatter diagram on the grid opposite to show the relationship between batch size and manufacturing time for the eight customer orders received.

(3)



(ii) Give **one** comment on the relationship between batch size and manufacturing time.

(1)

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Using a statistical software package, an analysis of the data has been carried out to obtain an estimate for the least squares regression line of y on x. A summary of the output from the analysis is given below.

	Manufacturing time on batch size
Slope coefficient	1.2
Intercept	11.7
Correlation coefficient	0.99

(b) Use this information to:

(i) state the least squares regression equation in the form $\boldsymbol{y = a + bx}$ for manufacturing time based on batch size

(2)

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(ii) explain what ***a*** and ***b*** represent in the regression equation.

(2)

a .....

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b .....

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(c) (i) Estimate the manufacturing time for batch order AJ50P, having a batch size of 18.

(2)

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(ii) Give **two** comments on the reliability of the estimate in (c)(i).

(2)

(d) (i) Calculate the coefficient of determination.

(2)

(ii) Interpret the coefficient of determination in the context of this data.

(2)

(e) State whether the following variables are categorical, discrete or continuous, giving a reason for your choice.

(i) Batch size

(2)

choice

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reason

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(ii) Manufacturing time of a batch

(2)

choice

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reason

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(Total for Question 1 = 20 marks)

2 Battle Housing Company records the number of visitors to its sales office each day.
The following shows the number of visitors over a 19-day period.

12 16 19 11 15 7 21 18 12 10

19 25 20 18 17 15 24 10 23

(a) For this data calculate the:

(i) range

(1)

(ii) median

(2)

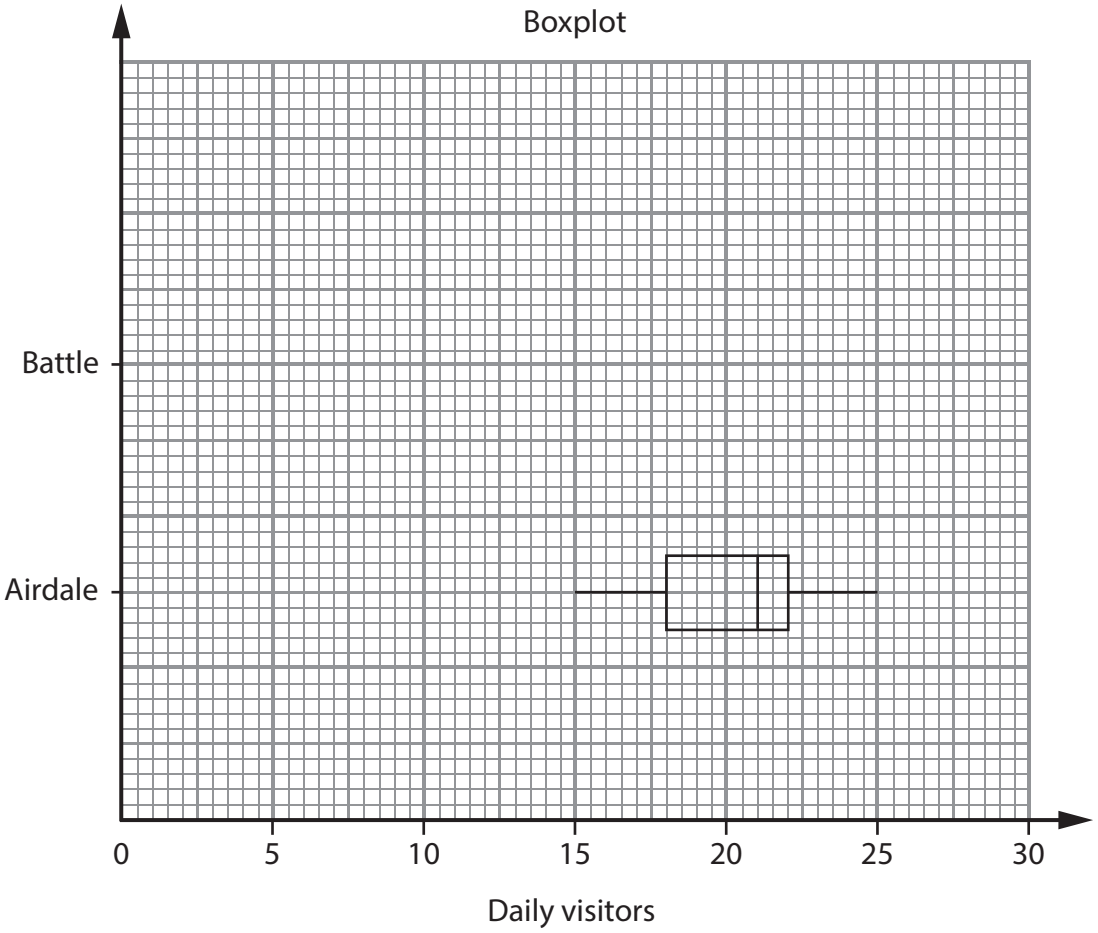
(iii) quartile deviation.

(4)

Airdale Housing Company, a competitor of Battle Housing Company, also records the daily visitors to its sales office over the same time period. The graph below shows a boxplot for the number of visitors to the Airdale Housing Company sales office.

(b) (i) Draw a boxplot of the daily visitors to the **Battle Housing Company** sales office **on the same grid**.

(4)



(ii) Give **two** differences in the daily number of visitors to the two sales offices.

(2)

1 .....

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2 .....

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The manager of Battle Housing Company plans to email a survey questionnaire to potential customers about their intentions to buy a house.

(c) (i) State **three** considerations the manager should take into account when designing the questions to include in the questionnaire.

(3)

1 .....

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2 .....

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3 .....

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(ii) State **two** ways the manager might try to obtain a good response rate for the survey in this situation.

(2)

1 .....

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2 .....

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(iii) Give **one** advantage and **one** disadvantage of using an email questionnaire compared to a personal interview.

(2)

Advantage

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Disadvantage

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(Total for Question 2 = 20 marks)

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3 Sunbrite Tiles plc is a medium-sized company manufacturing ceramic tiles. The 80 company employees are classified by gender into one of three grades: management, production or administration.

20 employees are female with 10% of the female employees in management and 60% in administration.

5% of the male employees are in management and 80% are in production.

(a) Complete the following table.

(3)

Grade\Gender	Male	Female	Total
Management			
Production			
Administration			
Total		20	80

An employee is chosen at random to discuss health and safety issues within the company.

(b) Calculate, using your completed table from (a), the probability that the employee is:

(i) a female in production

(2)

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(ii) in management

(2)

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(iii) in administration given that the employee is male.

(2)

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Two employees are chosen at random from the workforce.

(c) Calculate the probability that both work in production.

(3)

After taking advice about the health and safety issues within the company, Sunbrite Tiles plc decides to replace its old fire kilns with new gas-fired kilns, which can be bought from any one of eight UK suppliers. The suppliers are to be scored out of 20 on their suitability, with a score of 20 representing the best possible score.

Two senior employees (Sam and Pritesh) have both been asked to provide their scores on the eight suppliers. The results are shown in the following table.

Employee	**Supplier**							
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Sam	12	15	10	6	13	9	4	18
Pritesh	18	12	14	5	12	11	7	15

(d) (i) Rank the scores given by Sam and Pritesh.

(3)

(ii) Calculate Spearman's rank correlation coefficient between the scores given by Sam and Pritesh.

(4)

(iii) Interpret, in context, the Spearman's rank correlation coefficient.

(1)

(Total for Question 3 = 20 marks)

4 Billings plc manufactures a range of bricks for the building of new houses. The sales manager at Billings plc monitors the total amount spent on housing as an indicator of the general trend in sales of housing materials. The following table gives the total amount spent on private housing each quarter over the years 2012 to 2014.

Year	Spend on private housing ($m)			
	Quarter 1	**Quarter 2**	**Quarter 3**	**Quarter 4**
2012	3870	4140	4000	4220
2013	3690	4590	4730	5110
2014	4900	5920	6260	6320

(a) Plot the data as a time series graph.

(4)

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(b) (i) Calculate appropriate centred moving averages to find the trend of the data.

(5)

(ii) Give **one** comment on the trend of the data.

(1)

Using the additive model, the seasonal components ($m) for each of the four quarters are given in the following table.

Quarter 1	Quarter 2	Quarter 3	Quarter 4
–491	+196	+7	+131

(c) Give **two** comments on what the seasonal components show.

(2)

1 .....

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2 .....

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The average annual salary of employees working for Billings plc, together with the Index of Retail Prices for the period 2012 to 2014, is given in the table below.

Year	Average annual salary ($)	Index of Retail Prices (1987 = 100)
2012	21 500	238.0
2013	22 100	245.8
2014	22 450	256.0

(d) (i) Rebase the Index of Retail Prices using a base year of 2012.

(2)

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(ii) Calculate, in real terms, the average annual salaries for each year 2012 to 2014 using 2012 prices.

(2)

(iii) Give **one** comment on the real value of the average annual salaries over the period 2012 to 2014.

(1)

(e) (i) State what is meant by a secondary source of data.

(1)

(ii) Give **one** example of a secondary source of data.

(1)

(iii) Describe **one** advantage of using a secondary source of data compared with using a primary source.

(1)

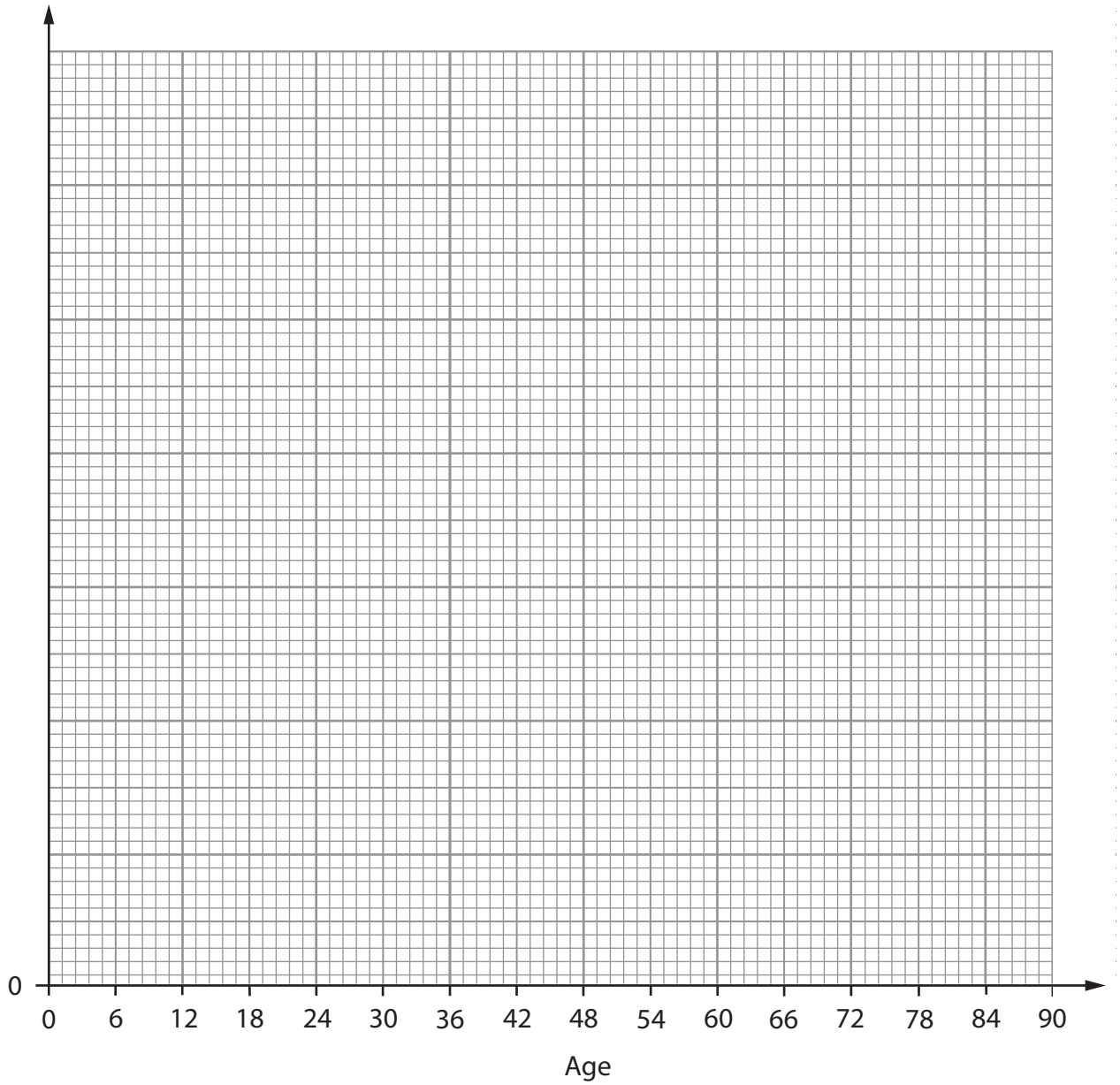
(Total for Question 4 = 20 marks)

5 Retrieval plc is a market research company with offices in two UK cities, London and Cardiff. The IT manager at the Cardiff office records the ages of its computers in use at its 420 workstations. At the end of the financial year in 2015 he records the ages, in months, as summarised in the following table.

Age of computer (months)	Number of computers
0 up to 6	30
6 up to 12	72
12 up to 24	120
24 up to 36	96
36 up to 60	72
60 up to 90	30

(a) (i) Draw a histogram to represent the data on the grid opposite.

(6)



(ii) Estimate the mode using the histogram in (a)(i).

(2)

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(iii) Explain why the mode is a useful measure of location in this case.

(1)

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Age of computer (months)	Number of computers (f)	Midpoint (x)	fx	fx^2
0 up to 6	30			
6 up to 12	72			
12 up to 24	120			
24 up to 36	96			
36 up to 60	72			
60 up to 90	30			
Total				

(b) Calculate, for the ages of the computers at the Cardiff office, an estimate of:

(i) the mean

(4)

(ii) the standard deviation.

(4)

The calculations for the mean and standard deviation of the computer ages at the London office gave a mean of 20 months and a standard deviation of 12 months.

(c) Use these results, together with your answers in (b), to compare the ages of the computers at the two offices.

(3)

(Total for Question 5 = 20 marks)

TOTAL FOR PAPER = 100 MARKS

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