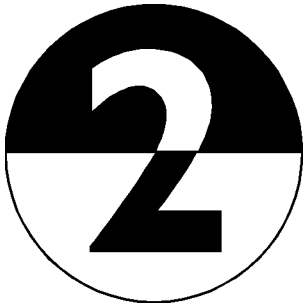
LCCI EXAMINATIONS BOARD

Business Statistics



Level 2

Series 2 2003

(Code 2009)

Model Answers

ASP M 1414

Business Statistics Level 2
Series 2 2003

How to use this booklet

Model Answers have been developed by LCCIEB to offer additional information and guidance to Centres, teachers and candidates as they prepare for LCCIEB examinations. The contents of this booklet are divided into 3 elements:

(1) Questions – reproduced from the printed examination paper

(2) Model Answers – summary of the main points that the Chief Examiner expected to see in the answers to each question in the examination paper, plus a fully worked example or sample answer (where applicable)

(3) Helpful Hints – where appropriate, additional guidance relating to individual questions or to examination technique

Teachers and candidates should find this booklet an invaluable teaching tool and an aid to success.

The London Chamber of Commerce and Industry Examinations Board provides Model Answers to help candidates gain a general understanding of the standard required. The Board accepts that candidates may offer other answers that could be equally valid.

Business Statistics Level 2
Series 2 2003

QUESTION 1

(a) Briefly explain why it is necessary to update the base of index numbers periodically.

(4 marks)

The following data show **5** of the main groups that make up the components of the Index of Retail Prices together with their weights and price relatives.

Group	Weights	Price relative Sept 2001 (Jan 1995 = 100)
Food and catering	213	136.0
Alcohol and tobacco	125	144.7
Housing and household expenditure	305	197.5
Personal expenditure	112	121.2
Travel and leisure	245	136.1

Source: Monthly Digest of Statistics.

(b) Calculate the Index of Retail Prices for September 2001 with January 1995 = 100:

(i) for all items shown (6 marks)

(ii) for all items except housing and household expenditure. (4 marks)

(c) Comment on your results.

(4 marks)

The average weekly wage in a particular industry and a Retail Price Index are shown in the following table for the years 1997 to 1999:

Year	Average weekly wage (£)	Retail Price Index
1997	204.50	100
1998	235.00	108.4
1999	248.00	119.1

(d) Calculate the annual percentage increase in both the average weekly wage and the Retail Price Index and interpret your results.

(7 marks)

(Total 25 marks)

Model Answer to Question 1

(a)
- To update the series
- For comparative purposes

(b) (i)

Wt x PR1
28,968
18,087.5
60,237.5
13,574.4
33,344.5
154,211.9

$$\text{All items } \frac{\Sigma(\text{Wt x PR})}{\Sigma(\text{Wts})} = \frac{154{,}211.9}{1{,}000}$$

$$= 154.2$$

(ii) All items except Housing

$$\frac{\Sigma(\text{Wt x PR})}{\Sigma(\text{Wts})} = \frac{93{,}974.4}{695}$$

$$= 135.2$$

(c) Price Index reduced due to

- high weight
- high PR

(d) Percentage increase in wages

1997/98 $\quad \frac{30.5}{204.5} \times \frac{100}{1} = 14.9\%$

1998/99 $\quad \frac{13.0}{235} \times \frac{100}{1} = 5.5\%$

Changes in RPI

1997/98 $\quad \frac{8.4}{100} \times \frac{100}{1} = 8.4\%$

1998/99 $\quad \frac{10.7}{108.4} \times \frac{100}{1} = 9.9\%$

1997/98 Average Wage greater increase than RPI
1998/99 Average Wage smaller increase than RPI

QUESTION 2

The following table shows the number of quotations issued and the number of sales made by a sample of 8 salesmen.

The figures all refer to the same time period:

Salesman	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Number of quotations	120	200	90	160	110	100	240	180
Number of sales	80	105	60	80	50	60	140	100

(a) Plot the data on a scatter diagram and comment.

(5 marks)

(b) Find the equation of the regression line of the form $y = a + bx$ which would enable you to estimate the number of sales for a given number of quotations.

(13 marks)

(c) Use your regression equation to forecast the number of sales made by a salesman issuing:

(i) 150 quotations

(ii) 250 quotations.

(4 marks)

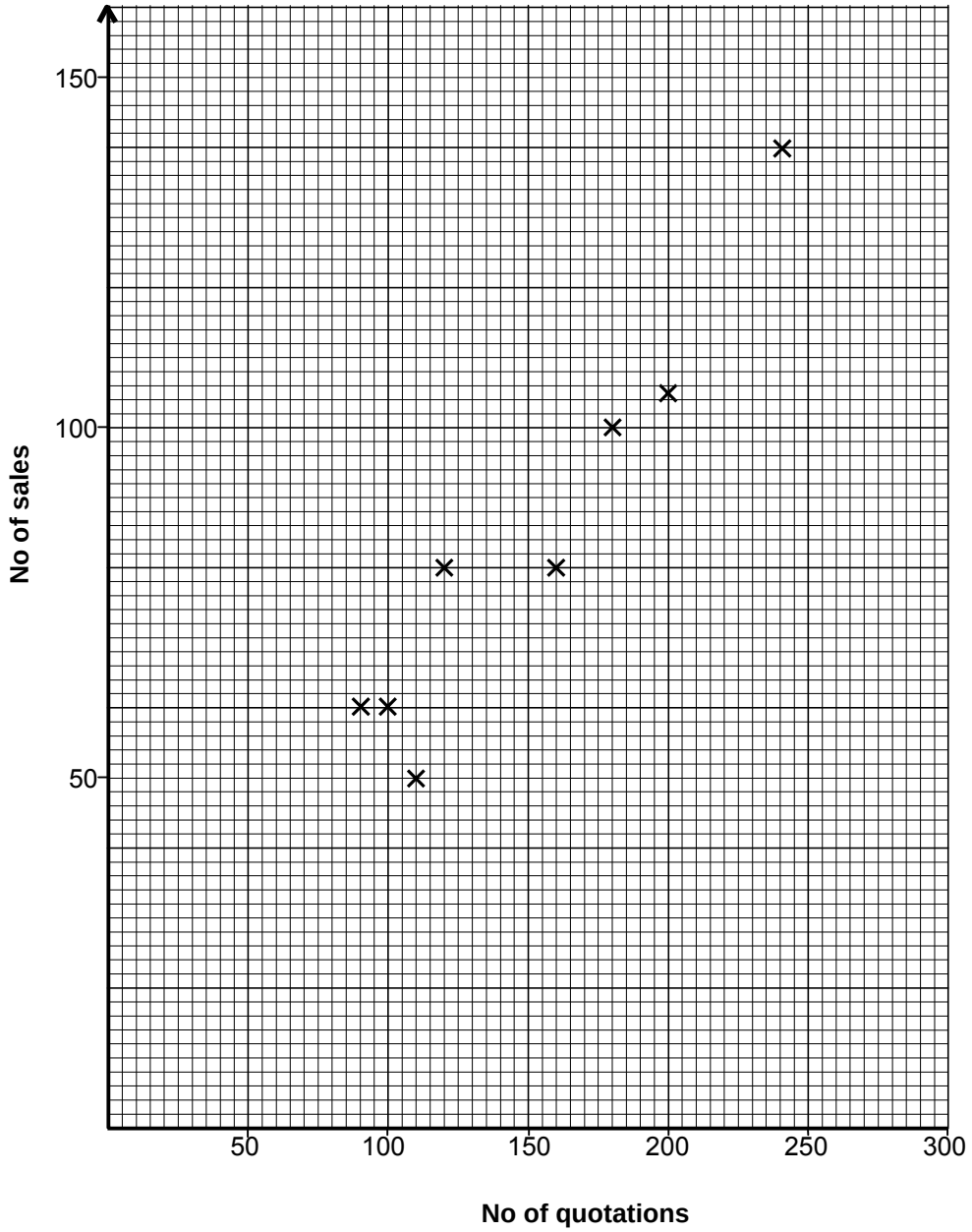
(d) Comment on the relative accuracy of your forecasts given in (c) above.

(3 marks)

(Total 25 marks)

Model Answer to Question 2

(a) **Scatter Diagram**



Comment: positive or linear

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Model Answer to Question 2 continued

(b) $\Sigma x = 1{,}200$ $\Sigma y = 675$
$\Sigma xy = 111{,}900$ $\Sigma x^2 = 200{,}200$
$n = 8$

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

$$= \frac{85{,}200}{161{,}600}$$

$$= 0.527$$

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

$$a = \frac{675}{8} - \frac{(0.527)(1{,}200)}{8}$$

$$= 5.29$$

equation $y = 5.29 + 0.527\,x$

(c) (i) When $x = 150$ $y = 84$ sales

(ii) $x = 250$ $y = 137$ sales

(d) • Data may not be linear

QUESTION 3

In an aptitude test 200 staff were timed to see how long they took to clean and reassemble a piece of machinery. The results were as follows:

Time (minutes)	Frequency
0 but less than 10	14
10 but less than 15	42
15 but less than 30	70
30 but less than 40	48
40 but less than 60	18
60 but less than 70	8

(a) Construct a cumulative frequency graph (ogive) for these figures.

(6 marks)

(b) Using your graph, or otherwise, find the values of the median and the quartile deviation.

(8 marks)

(c) Estimate the percentage of staff who take between 8 and 25 minutes to complete the aptitude test.

(4 marks)

(d) Estimate the mean time taken by each member of staff.

(5 marks)

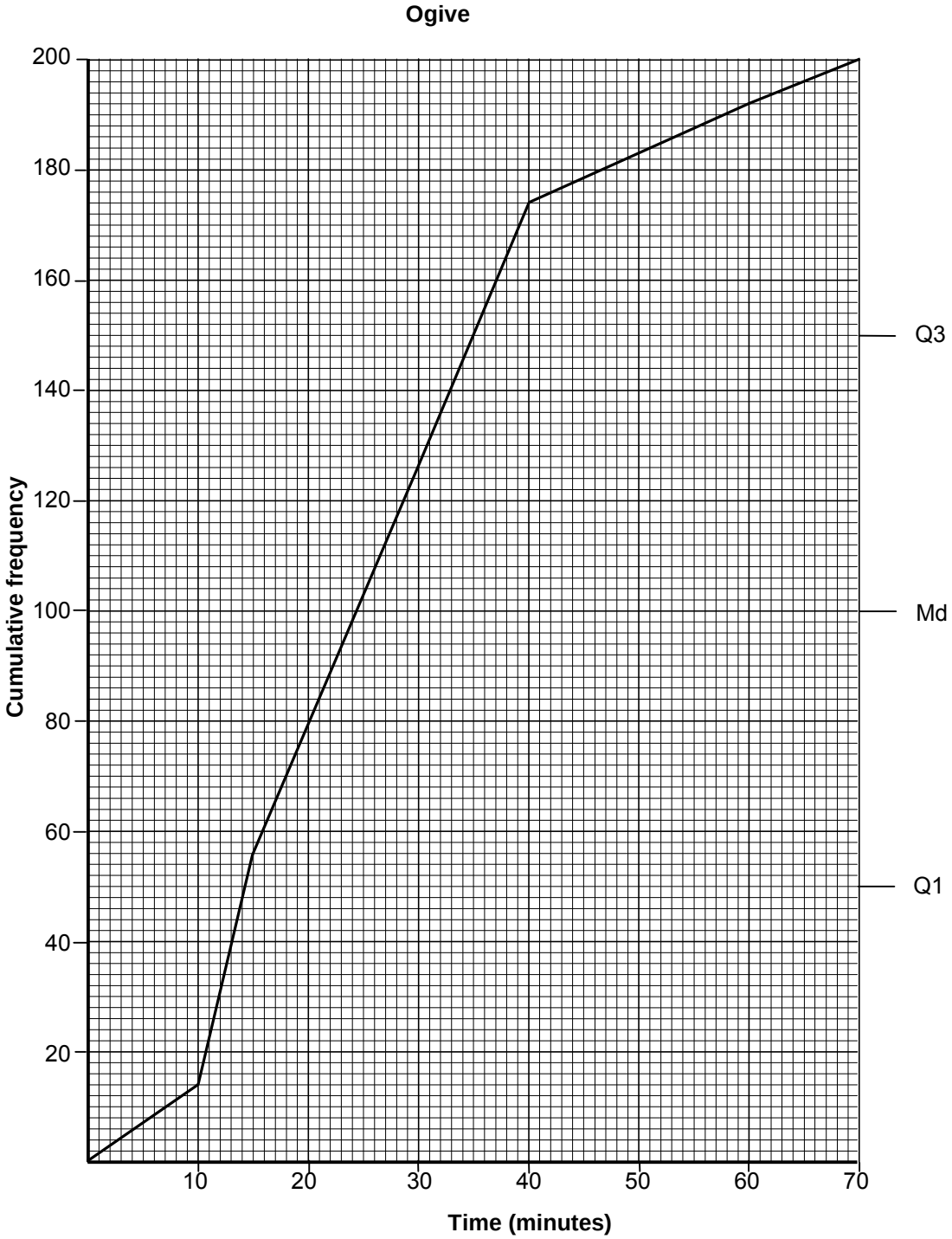
(e) What assumption is made when estimating the mean time?

(2 marks)

(Total 25 marks)

Model Answer to Question 3

(a) cf 14, 56, 126, 174, 192, 200



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Model Answer to Question 3 continued

(b) Median = 24
$Q_3 = 35$
$Q_1 = 14$

$$\frac{Q_3 - Q_1}{2} = \frac{21}{2} = 10.5$$

(c) $102 - 11 = \frac{91}{200} \times 100 = 45.5\%$

(d) Mid pts

5, 12.5, 22.5 35, 50, 65

$\Sigma fx = 5{,}270$

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{5{,}270}{200} = 26.35$$

(e) Mid points representative of class

QUESTION 4

A manufacturing company employing 90 staff has decided to undertake a survey of the workforce to find their views on the introduction of a new bonus payment scheme.

Random Number Table		
29764	45692	65555
86193	46243	44779
58142	79482	02718
82390	87177	64325

(a) Using the random number table above, explain how you would select:

(i) a simple random sample of 10 members of the workforce (6 marks)

(ii) a systematic sample of 10 from the workforce. (5 marks)

(b) Explain why it would be preferable to introduce stratification into the sampling procedure. (2 marks)

(c) The company will undertake the survey using direct interviewing. Give **2** advantages and **2** disadvantages of using this method of data collection.

(4 marks)

The company is also planning to introduce a new range of packaging for their products. Two members of staff (X and Y) are asked to rank **10** different designs in order of their suitability. The results are as follows:

Staff Member	**Package Design**									
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
X	9	6	3	1	10	4	2	8	5	7
Y	7	3	4	2	9	5.5	1	10	5.5	8

(d) Calculate Spearman's rank correlation coefficient between the two sets of rankings given above and interpret the value obtained.

(8 marks)

(Total 25 marks)

Model Answer to Question 4

(a) (i) Listing
Number population
2 digit random numbers
Illustration
Duplicates
Match to population

(ii) Population numbering
Sample fraction 1 in 9
Random choice 1 → 9
then every 9th

(b) Increase representativeness

(c) Advantages – response rate
– more detailed questioning

Disadvantages – cost, time
– interviewer bias

(d) $\Sigma d^2 = 24.5$

$$1 - \frac{6\,\Sigma d^2}{n(n^2 - 1)}$$

$$1 - \frac{147}{990} = +.85$$

Positive agreement

QUESTION 5

(a) **Trend**, **seasonal variation** and **random variation** are three terms used in the analysis of a time series. Explain what they mean.

(6 marks)

A local cinema opens 5 nights a week, Tuesday to Saturday. The daily attendances at this cinema during a 3 week period were recorded as follows:

	Tuesday	**Wednesday**	**Thursday**	**Friday**	**Saturday**
Week 1	55	92	101	75	68
Week 2	117	174	172	150	131
Week 3	163	230	251	212	191

(b) (i) Find, using the method of moving averages, the trend values. (6 marks)

(ii) Calculate the average daily variations using the additive model. (7 marks)

(iii) Seasonally adjust the data for Week 3. What does this show? (6 marks)

(Total 25 marks)

Model Answer to Question 5

(a) Trend – long-term movement

Seasonal variation – short-term oscillations

Random variation – unpredictable changes

(b) (i)

	Sum of 5s	(Trend) Average	Y – T
55			
92			
101	391	78.2	22.8
75	453	90.6	–15.6
68	535	107.0	–39.0
117	606	121.2	–4.2
174	681	136.2	37.8
172	744	148.8	23.2
150	790	158.0	–8
131	846	169.2	–38.2
163	925	185	–22
230	987	197.4	32.6
251	1,047	209.4	41.6
212			
191			

(ii)

	T	**W**	**T**	**F**	**S**
			22.8	–15.6	–39
	–4.2	37.8	23.2	–8	–38.2
	–22	32.6	41.6		
Mean	–13.1	35.2	29.2	–11.8	–38.6

Correction (not necessary) –.18

	–13.28	35.02	29.02	–11.98	–38.78

(iii)

	T	**W**	**T**	**F**	**S**
	163	230	251	212	191
Subtract	–13.28	35.02	29.02	–11.98	–38.78
Adjusted	176.28	194.98	221.98	223.98	229.78

Attendances with daily variation removed ie shows in general attendances increasing

QUESTION 6

A company produces electronic components on one of 2 machines, X or Y. Of the total output 20% is produced on Machine X and the remainder on Machine Y. Experience shows that 1% of the output from Machine X is defective, whilst 3% of that produced by Machine Y is defective.

(a) Calculate the probability that a randomly selected item leaving the process:

(i) is produced by Machine X and not defective (2 marks)

(ii) is defective. (3 marks)

(b) If **2** items are selected at random from the process, what is the probability:

(i) both are produced by Machine X (2 marks)

(ii) both are **not** defective. (4 marks)

The company exports its components to **4** different areas of the world. Sales, in units, for **each** area during 1998 and 2002 are given in the following table:

	Sales (units)	
Area	**1998**	**2002**
South Africa	70	144
Western Europe	125	108
Australia	170	252
North America	135	216

(c) (i) Represent these data in the form of a percentage component bar chart, showing **2** bars, one for **each** of the 2 years 1998 and 2002.

(10 marks)

(ii) Comment on the differences shown by the two bars. (4 marks)

(Total 25 marks)

Model Answer to Question 6

(a) (i) .2 x .99 = .198

(ii) .2 x .01 = .002

.8 x .03 = .024

.026

(b) (i) .2 x .2 = .04

(ii) $(1 - 0.026)^2$ = .9487

(c) (i)

	1998		2002	
	%	cum %	%	cum %
S Africa	14	14	20	20
W Europe	25	39	15	35
Australia	34	73	35	70
N America	27	100	30	100

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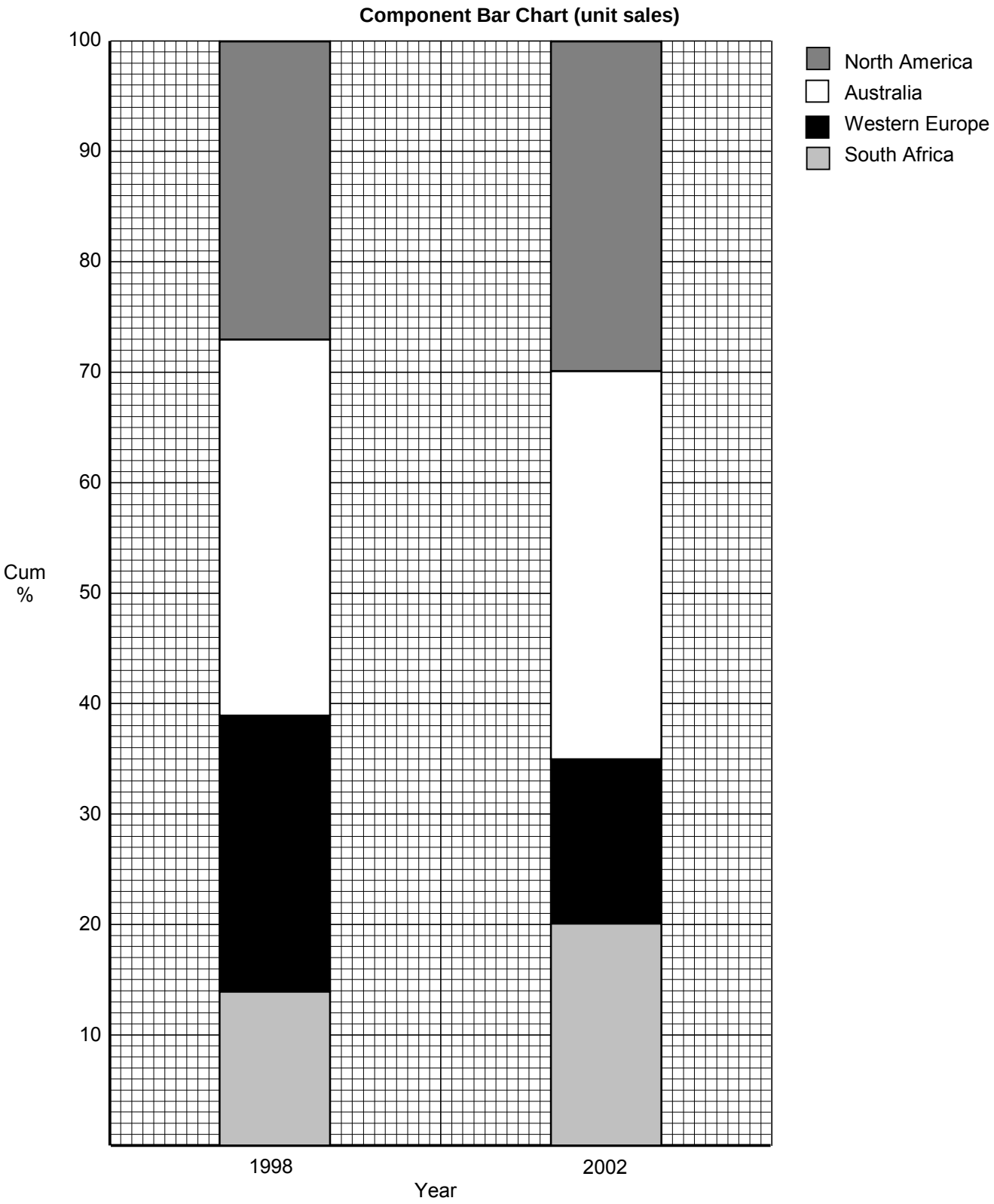
Model Answer to Question 6 continued

(i)



(ii) South African sales greater proportion in 2002

Western Europe less significant in 2002

FORMULAE

Median

$$l_m + \frac{c_m}{f_m}\left(\frac{n}{2} - F_{m-1}\right)$$

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

$$\bar{x} = \frac{\Sigma fx}{\Sigma f}$$

Standard deviation

$$s = \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f}\right)^2}$$

Quartile deviation

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

Mean deviation

$$\frac{\Sigma f\,|x - \text{mean}|}{\Sigma f}$$

Coefficient of variation

$$\frac{s}{\bar{x}} \times 100$$

Product moment correlation coefficient

$$r = \frac{n\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{\left(n\Sigma x^2 - (\Sigma x)^2\right)\left(n\Sigma y^2 - (\Sigma y)^2\right)}}$$

Spearman's rank correlation coefficient

$$r_s = 1 - \frac{6\Sigma d^2}{n(n^2 - 1)}$$

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

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

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

Weighted index number

$$\frac{\Sigma WI}{\Sigma W}$$

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