LCCI EXAMINATIONS BOARD

Business Statistics

3

Level 3

Series 4 2003

(Code 3009)

Model Answers

ASP M 1586

Business Statistics Level 3
Series 4 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 3
Series 4 2003

QUESTION 1

(a) Describe **2** uses of the normal distribution.

(4 marks)

A company employs a team of technicians to keep the machines it uses operating. The repair time taken for repairing machine type X follows a normal distribution with mean time of 17 minutes and standard deviation of 3 minutes. Whilst the machine is not working it is taken out of service.

(b) Calculate the probability that the time to repair a machine of type X is:

(i) less than 12.5 minutes

(ii) between 14 and 18.5 minutes.

(6 marks)

(c) The technicians wish to establish a benchmark time within which 95% of repairs are completed. What will be the benchmark time?

(4 marks)

(d) On some occasions when the machine needs to be repaired the tool on the machine is also changed. The mean time to change the tool is 10 minutes with a standard deviation of 5 minutes. The tool replacement time also follows a normal distribution and is independent of the repair time. The repair and tool replacement have to be carried out consecutively.

Find the probability that a repair and tool replacement take

(i) less than 20 minutes

(ii) over 30 minutes.

(6 marks)

(Total 20 marks)

Model Answer to Question 1

(a) The normal distribution can be used to determine the warning and action limits for **quality control charts**, **confidence intervals**, **hypothesis testing**, **determining probabilities**.

(b) (i) $z = \frac{x - \bar{x}}{s} = \frac{12.5 - 17}{3} = -1.5$

Probability (<12.5) = 1 – 0.933 = 0.067

(ii) $z = \frac{x - \bar{x}}{s} = \frac{14 - 17}{3} = -1$

Probability (14 to 17) = 0.841 – 0.5 = 0.341

$z = \frac{x - \bar{x}}{s} = \frac{18.5 - 17}{3} = 0.5$

Probability (17 to 18.5) = 0.692 – 0.5 = 0.192

∴ Probability (14 to 18.5) = 0.533

(c) $z = \frac{x - \bar{x}}{s}$ Z = 1.64/1.65

$1.64 = \frac{x - 17}{3}$ $\qquad$ $4.92 + 17 = x$

$21.92 = x$

(d) Joint mean $\bar{x}_J = \overline{x_1} + \bar{x}_2$ = 17 + 10 = 27 minutes

Joint $SD_J = \sqrt{SD_1^2 + SD_2^2} = \sqrt{3^2 + 5^2}$

$= \sqrt{34}$ $\qquad$ = 5.83

(i) $z = \frac{x - \bar{x}_J}{s_J} = \frac{20 - 27}{5.83}$

= 1.2

Probability (< 20) = 1 – 0.885 = 0.115

(ii) $z = \frac{x - \bar{x}_J}{s_J} = \frac{30 - 27}{5.83}$

= 0.51 (use 0.5)

∴ Probability (> 30) = 1 – 0.692 = 0.308

QUESTION 2

The table below shows information from a random sample of 10 workers. Their ages and the times taken to complete a standard assembly job are given.

Worker No	Age (years)	Time (minutes)
1	23	5.3
2	45	6.3
3	54	4.9
4	65	5.2
5	19	5.9
6	52	5.2
7	45	6.1
8	32	4.9
9	29	5.8
10	25	5.9

(a) Draw a scatter graph and comment on the pattern of the data.

(4 marks)

(b) Calculate the correlation coefficient between age and time.

(10 marks)

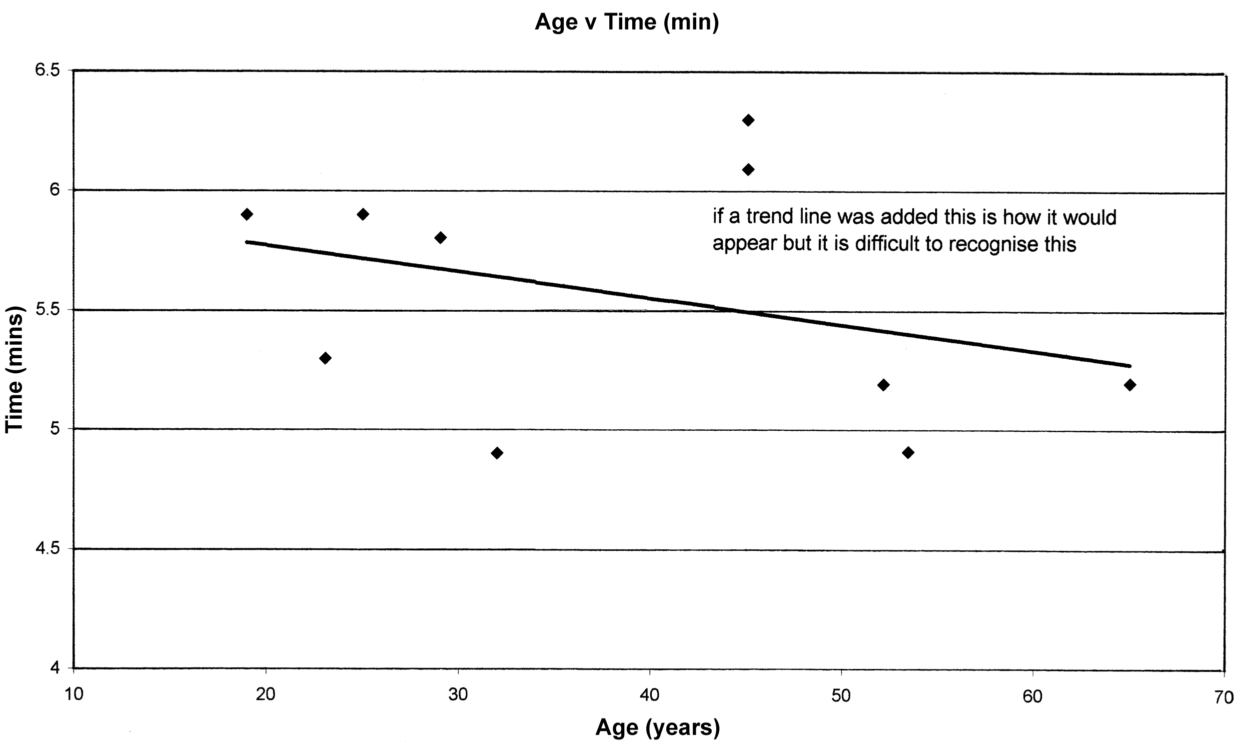
(c) Test if the correlation coefficient differs significantly from zero.

(6 marks)

(Total 20 marks)

Model Answer to Question 2

(a)



Comment: Difficult to discern a pattern, perhaps some weak negative correlation.

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Model Answer to Question 2 continued

(b) Let Age = x, Time = y

$\sum x = 389$ $\sum y = 55.5$ $\sum x^2 = 17275$

$\sum y^2 = 310.35$ $\sum x\, y = 2137.5$ N = 10

$$r = \frac{N\Sigma xy - \Sigma x\, \Sigma y}{\sqrt{(N\Sigma x^2 - (\Sigma x)^2)\,.\,(N\Sigma y^2 - (\Sigma y)^2)}}$$

$$= \frac{10 \text{ x } 2137.5 - 389 \text{ x } 55.5}{\sqrt{(10 \text{ x } 17275 - 389^2) \text{ x } (10 \text{ x } 310.35 - 55.5^2)}}$$

$$= \frac{-214.5}{\sqrt{21429 \text{ x } 23.25}}$$

$= -0.304$

(c) Null hypothesis: the correlation coefficient does not differ from zero p = o

Alternative hypothesis the correlation coefficient does differ from zero p ≠o

Degrees of freedom = n – 2 = 10 – 2 = 8

Critical t 0.05 = 2.31

$$t = \frac{r}{\sqrt{\frac{1-r^2}{n-2}}}$$

$$= \frac{-\ 0.304 \text{ x } 8}{\sqrt{1-(-0.304)^2}}$$

= 0.91

Conclusion calculated t < critical t

Therefore accept the null hypothesis r does not differ from zero

QUESTION 3

(a) Explain the circumstances, in time series analysis, in which the multiplicative model should be used in preference to the additive model.

(4 marks)

The table below shows the quarterly production figures for a company in thousands:

Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4
1999	-	-	53	61
2000	35	45	58	78
2001	40	58	71	93
2002	51	67	80	

(b) Calculate the centred moving average for the quarterly production and estimate the average seasonal variations.

(10 marks)

(c) Forecast the production levels for the next four quarters and comment on the accuracy of your answer.

(6 marks)

(Total 20 marks)

Model Answer to Question 3

(a) The multiplicative model is more appropriate when the seasonal differences are proportional to the trend rather than constant relative to trend.

(b)

	Additive model									
1										
2		m total 1	m total 2	trend	differences	Q1	Q2	Q3	Q4	
3	53									
4	61									
1	35	194	393	49.125	–14.125	–14.125	–6.875	3.375	21.125	
2	45	199	415	51.875	–6.875	–20.125	–5.625	4.125	23.625	
3	58	216	437	54.625	3.375	–20.625				
4	78	221	455	56.875	21.125					
1	40	234	481	60.125	–20.125	–54.875	–12.5	7.5	44.75	total
2	58	247	509	63.625	–5.625	–18.29167	–6.25	3.75	22.375	ASV
3	71	262	535	66.875	4.125					
4	93	273	555	69.375	23.625	–18.6875	–6.6458	3.35417	21.97917	0.395833 adjustment
1	51	282	573	71.625	–20.625					
2	67	291								
3	80									
4										
1										
2										
3										

Multiplicative model

53									
61									
35	194	393	49.125	0.712468	0.712468	0.867470	1.061785	1.371429	
45	199	415	51.875	0.867470	0.665281	0.911591	1.061682	1.340541	
58	216	437	54.625	1.061785	0.712042				
78	221	455	56.875	1.371429					
40	234	481	60.125	0.665281	2.089791	1.77906	2.123467	2.711970	
58	247	509	63.625	0.911591	0.696597	0.88953	1.061734	1.355985	Avg Sv
71	262	535	66.875	1.061682					4.003847
93	273	555	69.375	1.340541	0.695635	0.888569	1.060772	1.355023	0.000962 adjustment
51	282	573	71.625	0.712042					
67	291								
80									

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Model Answer to Question 3 continued

(c) Trend growth rate $= \dfrac{71.625 - 49.125}{9 - 1} = 2.8125$

Additive method

	Estimated trend values			Additive seasonal variation		Forecast	
Qtr 4	71.625	+ (3 x 2.8125)	= 80.0625	+ 21.9792	=	102.0417	(102.0)
Qtr 1		(4 x 2.8125)	= 82.875	– 18.6875	=	64.1875	(64.2)
Qtr 2		(5 x 2.8125)	= 85.6875	– 6.6458	=	79.0417	(79.0)
Qtr 3		(6 x 2.8125)	= 88.5	+ 3.3542	=	91.8542	(91.9)

Multiplicative method

	Estimated trend values	Multiplicative seasonal variation		Forecast	
Qtr 4	80.0625	1.355023	=	108.4865	(108.5)
Qtr 1	82.875	0.695635	=	57.6508	(57.7)
Qtr 2	85.6875	0.888569	=	76.1393	(76.1)
Qtr 3	88.5	1.060772	=	93.8783	(93.9)

Comment: Data is extrapolated; therefore some danger in the forecast, unknown size of residuals, unexpected changes in the economy.

QUESTION 4

(a) The data below relate to the value of a savings fund for a number of years. The retail price index for the country is also given.

Year	Savings Fund £000	Retail Price Index
1994	9.4	103.5
1995	9.8	106.8
1996	10.6	108.6
1997	11.8	109.1
1998	10.9	118.9
1999	11.4	123.4
2000	12.3	129.3
2001	13.2	133.9
2002	13.5	140.1

(i) Rebase the Retail Price Index to 1994. (2 marks)

(ii) Create an index for the Savings Fund based on 1994 = 100. (2 marks)

(iii) Calculate and comment upon the changes in the real value of the fund. (4 marks)

(iv) In 1994 the owner of the savings fund required the fund to be worth £12,000 in real terms (ie measured at 1994 prices) by 2002. By how much, in 2002, is the fund (in real terms) short of the required amount? (4 marks)

(b) (i) Explain the meaning of the term **simple random sampling**. (2 marks)

(ii) 250 patients in a hospital have identity numbers in the range 001 to 250. Using the table of random numbers below and starting from the top left, number 163, draw a random sample of 10 patients.

163	106	058	108	101	489	163	428	177	503
640	944	669	677	323	641	054	580	275	443
439	915	133	141	389	334	712	778	705	188

(6 marks)

(Total 20 marks)

Model Answer to Question 4

(a)

Year	Fund	Fund index	rpi	Rebased rpi	Real value
1994	9.4	100	103.5	100	100
1995	9.8	104.3	106.8	103.2	101.0
1996	10.6	112.8	108.6	104.9	107.5
1997	11.8	125.5	109.1	105.4	119.1
1998	10.9	116.0	118.9	114.9	100.9
1999	11.4	121.3	123.4	119.2	101.7
2000	12.3	130.9	129.3	124.9	104.8
2001	13.2	140.4	133.9	129.4	108.5
2002	13.5	143.6	140.1	135.4	106.1
		(ii)		(i)	(iii)

(iii) Comment: Real value has risen by 6.1%
Real value rose, fell, rose again to 2001 and fell in 2002.

(iv) Real value of the fund 2002

$$= 9.4 \times \frac{106.1}{100} = 9.9734$$

Deficit = 12 – 9.9734 = £2.0266 (000)

(b) (i) In a single random sample all members of the population have an equal chance of being chosen.

(ii) 163, 106, 58, 108, 101, 177, 54, 133, 141 and 188

QUESTION 5

A random sample from a company's personnel records shows the ages and number of days of absence for members of staff over the past year.

	Ages		
Absence	Under 25	25 and under 50	50 and over
0 days	110	120	70
1 to 10 days	30	50	40
11 and over	40	30	10

(a) Test for an association between age and absence.

(12 marks)

The company also records the daily absence numbers for one week. The data are shown in the table below:

	Monday	Tuesday	Wednesday	Thursday	Friday
Staff absent	7	9	6	7	6

(b) Test the hypothesis that daily absence is uniform throughout the week.

(8 marks)

(Total 20 marks)

Model Answer to Question 5

(a) Null hypothesis: there is no association between age and absence.

Alternative hypothesis: there is association between age and absence.

Degrees of freedom = (R – 1) x (C – 1) = (3 – 1)(3 – 1) = 4

Critical x^2 = 9.49/13.28

Expected values

108	120	72
43.2	48	28.8
28.8	32	19.2

Contributions to x^2

0.0370	0	0.0555
4.0333	0.0833	4.3555
4.3555	0.125	4.4083

x^2 = 17.4524

Conclusion: Calculate x^2 > critical x^2 therefore reject the null hypothesis.
There is association between age and absence.

Need reference to 1% or very significant.

(b) Null hypothesis: there is no difference in the daily number absent.

Alternative hypothesis: there is a difference in the daily numbers absent.

(Degrees of freedom = (n – 1) = (5 – 1) = 4
critical x^2 = 9.49 13.28)

Expected values = 35/5 = 7 per day

Contribution to x^2 = 0 + 0.6 + 0.1 + 0 + 0.1

x^2 = 0.8

Conclusions: Calculated x^2 < critical x^2 therefore accept the null hypothesis.
There is no difference in the daily numbers absent.

QUESTION 6

(a) Explain the meaning of the term the sampling distribution of the mean.

(6 marks)

Random samples were taken of the price of petrol in urban areas and rural areas.

Urban area £	**Rural area £**
0.749	0.799
0.759	0.759
0.741	0.749
0.765	0.759
0.789	0.809
0.739	0.789
0.749	0.799
0.789	0.819
0.809	

(b) Does the price of petrol differ significantly between urban and rural areas?

(14 marks)

(Total 20 marks)

Model Answer to Question 6

(a) When a large number of samples of a given size are taken, the mean values of the individual samples vary. The sampling distribution of the means is the record of these variations.

For large samples these are normally distributed with the mean of the sample means equal to the population mean $\bar{\bar{x}} = \mu$

(b) Null hypothesis: There is no difference in the price of petrol between urban and rural areas.

Alternative hypothesis: There is a difference in the price of petrol between urban and rural areas.

Degrees of freedom ($n_u + n_r - 2$) = 9 + 8 – 2 = 15

Critical t = 2.13/2.95

Σx_u = 6.889 , Σx_r = 6.282

$\bar{x}_u$ = 0.7654 , $\bar{x}_r$ = 0.7853

S_u = 0.0247 , s_r = 0.0262

or $\Sigma(x_u - \bar{x}_u)^2$ = 0.004886 , $\Sigma(x_r - \bar{x}_r)^2$ = 0.004788

$$s = \sqrt{\frac{\Sigma (x_u - \bar{x}_u)^2 \;\; \Sigma (x_r - \overline{x_r})^2}{n_u + n_r - 2}}$$

s = 0.0254

$$t = \frac{\bar{x}_u - \bar{x}_r}{S\sqrt{\frac{1}{n_u} + \frac{1}{n_r}}}$$

$$= \frac{0.7654 - 0.7853}{0.0254\sqrt{\frac{1}{9} + \frac{1}{8}}}$$

$$= \frac{0.0199}{0.0123} = 1.61$$

Conclusions: The calculated t value is less than the critical t value therefore accept the null hypothesis. There is no difference in the price of petrol between urban and rural areas.

QUESTION 7

(a) Explain how the mean chart and range chart are used in quality control procedures.
(4 marks)

(b) A company in its quality control procedures sets the warning limit at the 0.025 probability point and the action limit at the 0.001 probability point. This means, for example, that the upper action limit is set so that the probability of the mean exceeding the limit is 0.001.

The weight of a product is normally distributed with a mean weight of 300 grams and a known standard deviation of 1.5 grams. To check the process samples of 9 are taken from the production line.

(i) Draw a control chart to monitor the process.
(8 marks)

(ii) The first 8 samples taken had the following mean weights (in grams):

299.6	299.5	299.8	299.6	299.4	299.6	299.3	299.8

Plot these data on your control chart and comment appropriately.
(3 marks)

(iii) If the mean value had been wrongly set at 299.7 grams, what is the probability that a sample mean lies outside the lower warning limit?
(5 marks)

(Total 20 marks)

Model Answer to Question 7

(a) The mean chart is used to check that the process is working satisfactorily by producing items whose mean value are close to the specified value.

A range charge is used to ensure that the variability within the sample is acceptable, otherwise individual items may exceed the limits.

(b) (i) Warning limits $= \bar{x} \pm 1.96 \frac{s}{\sqrt{n}}$

$= 300 \pm 1.96 \times \frac{1.5}{\sqrt{9}}$

$= 300 \pm 0.98$

= 299.02 to 300.98 (299 to 301)

Action limits $= \bar{x} \pm 3.09 \quad s/\sqrt{n}$

$= 300 \pm 1.545$

= 298.45 to 301.55

Axes, titles, scale

Plot of chart lines

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Model Answer to Question 7 continued

(ii) Plot of points

Comment: All means below 300 grams

and ∴ set up is incorrect

(iii) $z = \dfrac{x - \overline{x}}{s/\sqrt{n}} = \dfrac{299.02 - 299.7}{0.5}$

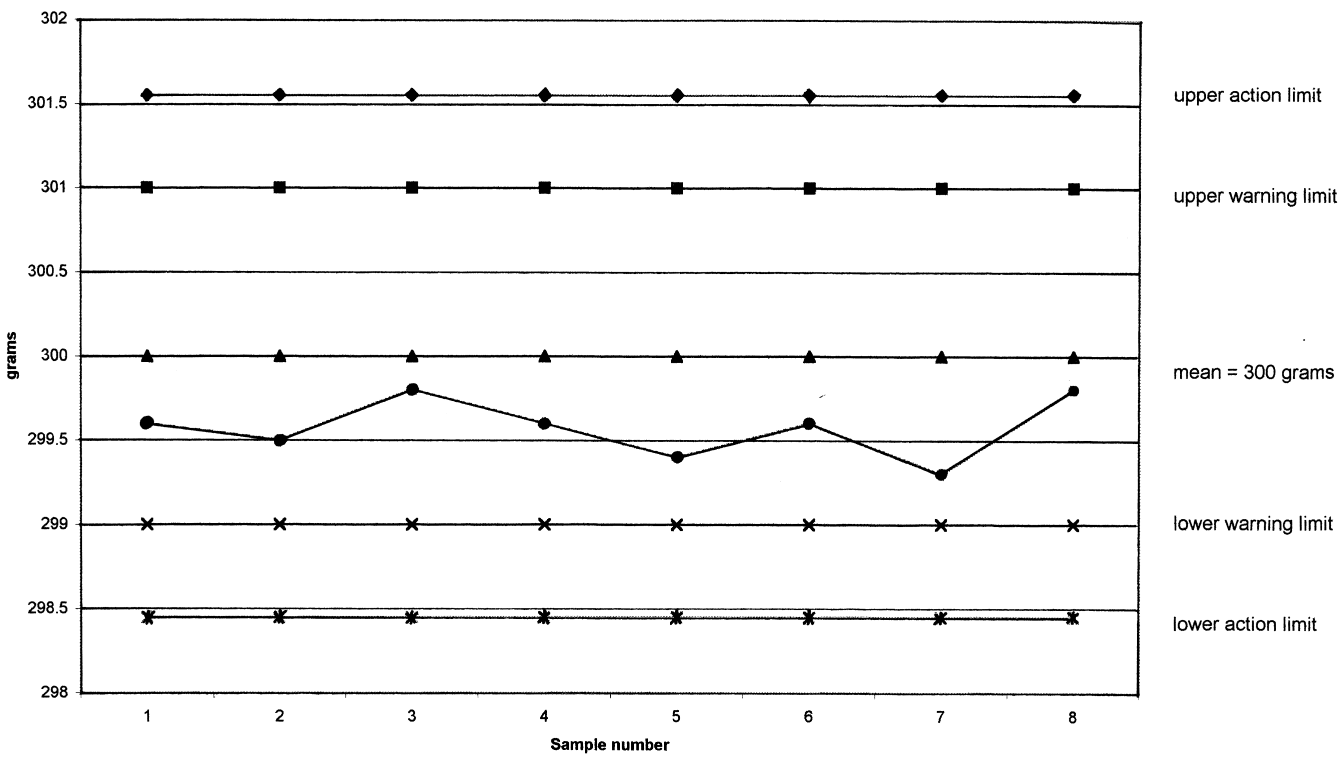
= 1.36 (1.4)

Probability (<299.02) = 1 – 0.919

= 0.081

(b) (i)

QC chart



QUESTION 8

(a) Explain the difference between one-tailed and two-tailed tests.

(4 marks)

The records of a company contain the following production data for the last two weeks:

	Week 1	**Week 2**
Mean output per worker	295	308
Standard deviation	7.5	8.6
Sample size	50	65

(b) Has there been an increase in the mean output per worker between the two weeks?

(8 marks)

(c) In the previous year a proportion 0.03 of the production was rejected as faulty. In the past week a random sample from 250 items showed that a proportion of 0.012 of the production was faulty.

(i) Test to find if there has been a significant fall in the proportion of items that are faulty.

(6 marks)

(ii) What would be the effect if a two-tail test was used? (2 marks)

(Total 20 marks)

Model Answer to Question 8

(a) A one-tail test tests if a difference exists that is either greater than or less than the stated parameter.

A two-tail test tests if there is a difference from a stated parameter irrespective of the direction.

(b) Null hypothesis: there is no difference in the mean output.

Alternative hypothesis: there is an increase in the mean output.

Critical z = 1.64/2.33

$$z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$$= \frac{295 - 308}{\sqrt{\frac{7.5^2}{50} + \frac{8.6^2}{65}}}$$

$$= \frac{13}{\sqrt{1.125 + 1.138}} = \frac{13}{\sqrt{2.2}} = 8.64$$

Conclusion. The calculated value of z exceeds the critical value of z of the 0.01 level therefore reject the null hypothesis. There has been an increase in output.

(c) (i) Null hypothesis: There has not been a change in the proportion faulty

Alt hypothesis: The proportion faulty has fallen

Critical z value 1.64/2.33

$$z = \frac{p - \pi}{\sqrt{\frac{\pi(1-\pi)}{n}}} = \frac{0.012 - 0.03}{\sqrt{\frac{0.03 \times 0.97}{250}}}$$

= 1.67

Conclusion: Reject the null hypothesis at the 0.05 level. There is evidence to suggest the proportion faulty has fallen but at the 0.01 level there is insufficient evidence to reject the null hypothesis.

(ii) The conclusion drawn would be the same at the 0.01 level but at the 0.05 level there is insufficient evidence to suggest the proportion faulty has fallen.

FORMULAE

Mean $\bar{x} = \dfrac{\Sigma fx}{\Sigma f}$

Standard deviation

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

Pearson measure of skewness

$$\frac{3(\bar{x} - \text{Median})}{s}$$

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 $\hat{y} = a + bx$

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

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

One sample *z* test

Mean

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

Proportion

$$z = \frac{p - \pi}{\sqrt{\dfrac{\pi(1 - \pi)}{n}}}$$

Two sample *z* test

Mean

$$z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}}}$$

Proportion

$$z = \frac{p_1 - p_2}{\sqrt{p(1 - p)\left(\dfrac{1}{n_1} + \dfrac{1}{n_2}\right)}}$$

where $p = \dfrac{n_1p_1 + n_2p_2}{n_1 + n_2}$

	Price	Quantity
Laspeyres index	$\dfrac{\Sigma p_1q_0}{\Sigma p_0q_0} \times 100$	$\dfrac{\Sigma p_0q_1}{\Sigma p_0q_0} \times 100$
Paasche index	$\dfrac{\Sigma p_1q_1}{\Sigma p_0q_1} \times 100$	$\dfrac{\Sigma p_1q_1}{\Sigma p_1q_0} \times 100$

Weighted index $\dfrac{\Sigma WI}{\Sigma W}$

One sample t test

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}} \quad \text{where} \quad s = \sqrt{\frac{\Sigma(x - \bar{x})^2}{n - 1}}$$

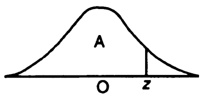
Independent samples t test

$$t = \frac{\bar{x} - \bar{y}}{s\sqrt{\dfrac{1}{n} + \dfrac{1}{m}}} \quad \text{where} \quad s = \sqrt{\frac{\Sigma(x - \bar{x})^2 + \Sigma(y - \bar{y})^2}{n + m - 2}}$$

Chi-square test $\chi^2 = \Sigma \dfrac{(O - E)^2}{E}$

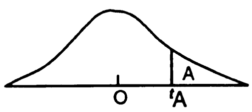
Test for $\rho = 0$ $\quad t = \dfrac{r\sqrt{n - 2}}{\sqrt{1 - r^2}}$

TABLE 1 – NORMAL DISTRIBUTION
A is the area to the left of the given value of *z*



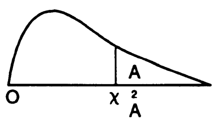
z	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	
A	.500	.540	.580	.618	.655	.692	.726	.758	.788	.816	
z	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	
A	.841	.864	.885	.903	.919	.933	.945	.955	.964	.971	
z	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
A	.977	.982	.986	.989	.992	.994	.995	.996	.997	.998	.999

TABLE 2 – t DISTRIBUTION
t_A is the value of the t statistic with ν degrees of freedom with area A to the right of it



ν	1	2	3	4	5	6	7	8
$t_{0.05}$	6.31	2.92	2.35	2.13	2.02	1.94	1.90	1.86
$t_{0.025}$	12.71	4.30	3.18	2.78	2.57	2.45	2.37	2.31
$t_{0.01}$	31.82	6.97	4.54	3.75	3.37	3.14	3.00	2.90
$t_{0.005}$	63.66	9.93	5.84	4.60	4.03	3.71	3.50	3.36
ν	9	10	11	12	13	14	15	16
$t_{0.05}$	1.83	1.81	1.80	1.78	1.77	1.76	1.75	1.75
$t_{0.025}$	2.26	2.23	2.20	2.18	2.16	2.15	2.13	2.12
$t_{0.01}$	2.82	2.76	2.72	2.68	2.65	2.62	2.60	2.58
$t_{0.005}$	3.25	3.17	3.11	3.05	3.01	2.98	2.95	2.92
ν	17	18	19	20	21	22	23	24
$t_{0.05}$	1.74	1.73	1.73	1.73	1.72	1.72	1.71	1.71
$t_{0.025}$	2.11	2.10	2.09	2.09	2.08	2.07	2.07	2.06
$t_{0.01}$	2.57	2.55	2.54	2.53	2.52	2.51	2.50	2.49
$t_{0.005}$	2.90	2.88	2.86	2.85	2.83	2.82	2.81	2.80

TABLE 3 – CHI SQUARED DISTRIBUTION
χ^2_A is the value of the χ^2 statistic with ν degrees of freedom with area A to the right of it



ν	1	2	3	4	5	6
$\chi^2_{0.05}$	3.84	5.99	7.81	9.49	11.07	12.59
$\chi^2_{0.01}$	6.63	9.21	11.34	13.28	15.09	16.81
ν	7	8	9	10	11	12
$\chi^2_{0.05}$	14.07	15.51	16.92	18.31	19.68	21.03
$\chi^2_{0.01}$	18.48	20.09	21.67	23.21	24.73	26.22

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