THE INSTITUTE OF CHARTERED ACCOUNTANTS OF SRI LANKA

SUGGESTED SOLUTIONS

02104 – Business Mathematics and Statistics

Certificate in Accounting and Business I Examination
September 2012

THE INSTITUTE OF CHARTERED ACCOUNTANTS OF SRI LANKA

PAPER 'A'

ANSWERS FOR MULTIPLE CHOICE QUESTIONS

1.	**2**	11.	**3**
2.	**1**	12.	**1**
3.	**4**	13.	**3**
4.	**4**	14.	**2**
5.	**4**	15.	**2**
6.	**1**	16.	**1**
7.	**3**	17.	**4**
8.	**2**	18.	**1**
9.	**1**	19.	**3**
10.	**2**	20.	**4**

Answer No. 01

(a) $V = \frac{P}{i}\left(1 - \frac{1}{(1+i)^n}\right)$

$1{,}000{,}000 = \frac{P}{0.01}\left(1 - \frac{1}{(1.01)^{180}}\right)$

= Rs. 12,001.68

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(4 marks)

(b)

Year	Estimated saving on electricity cost (Rs.)	Estimated O & M cost saving (Rs.)	DCF	PV
0				
1	480,000	200,000	0.909	618,120
2	640,000	200,000	0.826	693,840
3	680,000	200,000	0.751	660,880
4	600,000	200,000	0.683	546,400
5	720,000	200,000	0.621	571,320
				3,090,560

Since the PV of saving during the first five years is more than the PV of the proposed investment, the management should proceed with the investment.

(6 marks)

(c) The IRR is the rate of interest at which NPV of the project becomes zero.

(2 marks)

(Total 12 marks)

Answer No. 02

(a) Assume the number of passengers on board is x then the total cost function is given by,

TC = a + bx

When x = 300, total other operational cost is Rs. 5.7 million.

5,700,000 = a + 300b _____ (1)

When x = 180, total other operational cost is Rs. 3.9 million

3,900,000 = a + 180b _____ (2)

Solving (1) & (2)

b = 15,000
a = 1,200,000

Total fixed cost = 1,200,000 + 1,800,000

= Rs. 3,000,000

Total variable cost = Rs. 15,000 per passenger (3 marks)

(b) (i) Total cost function Y = 3,000,000 + 15,000 x

Total revenue function Y = 30,000 x

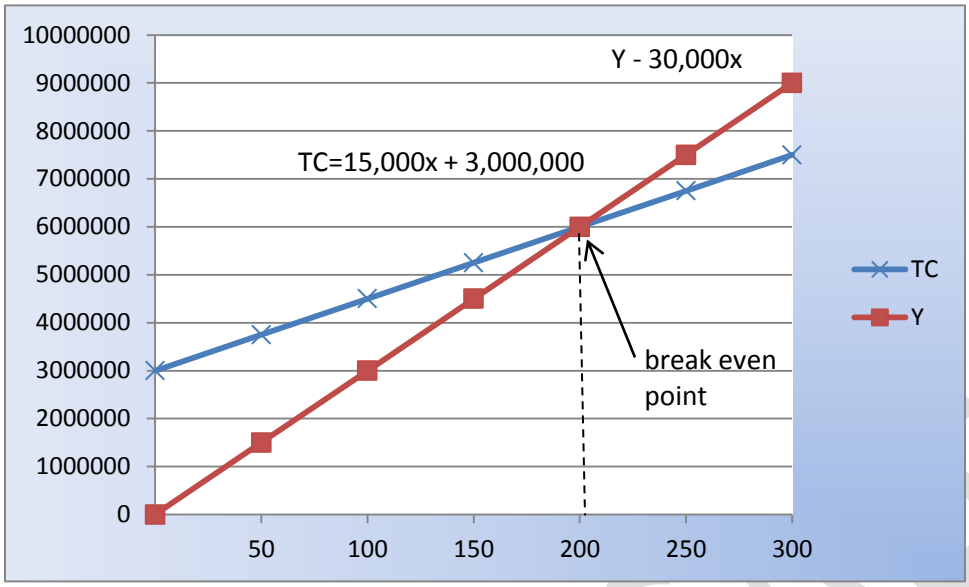
x – number of passengers on board

(ii)

X	Sales Revenue fy Y = 30,000x	Total cost fy Y = 15,000x + 3,000,000
0	0	3,000,000
50	1,500,000	3,750,000
100	3,000,000	4,500,000
150	4,500,000	5,250,000
200	6,000,000	6,000,000
250	7,500,000	6,750,000
300	9,000,000	7,500,000

Alternate answer

30,000x = 3,000,000 + 15,000x
15,000x = 3,000,000
x = 200



Break even No of passengers = 200

(6 marks)

(c) Total cost of fuel after price hike = 20 x 10,000 +1,800,000 + 1,200,000

= Rs. 3,200,000

Total variable cost = 15,000 x (300 x 75%)

= Rs. 3,375,000

Total cost = Rs. 6,575,000

Total revenue = Rs. 6,750,000 (300 x 75% x Rs. 30,000)

Net profit = Rs. 175,000

(3 marks)

(Total 12 marks)

Answer No. 03

(a) (i) Modal class = 15 - 19

(ii) Mean = $\frac{2 \times 3 + 7 \times 8 + 12 \times 10 + 17 \times 13 + 24.5 \times 6}{40}$

= $\frac{550}{40}$

= 13.75

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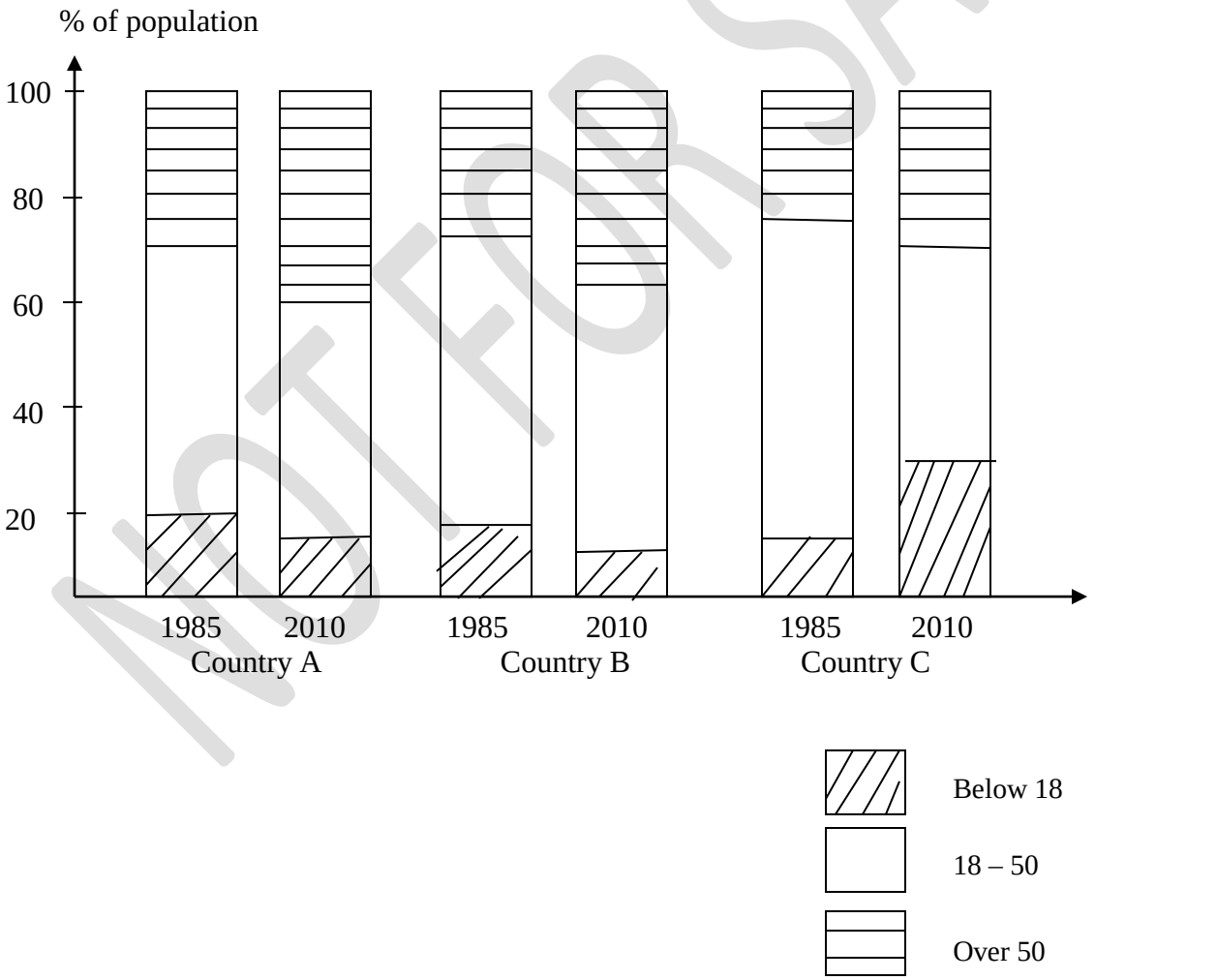
(3 marks)

(b)

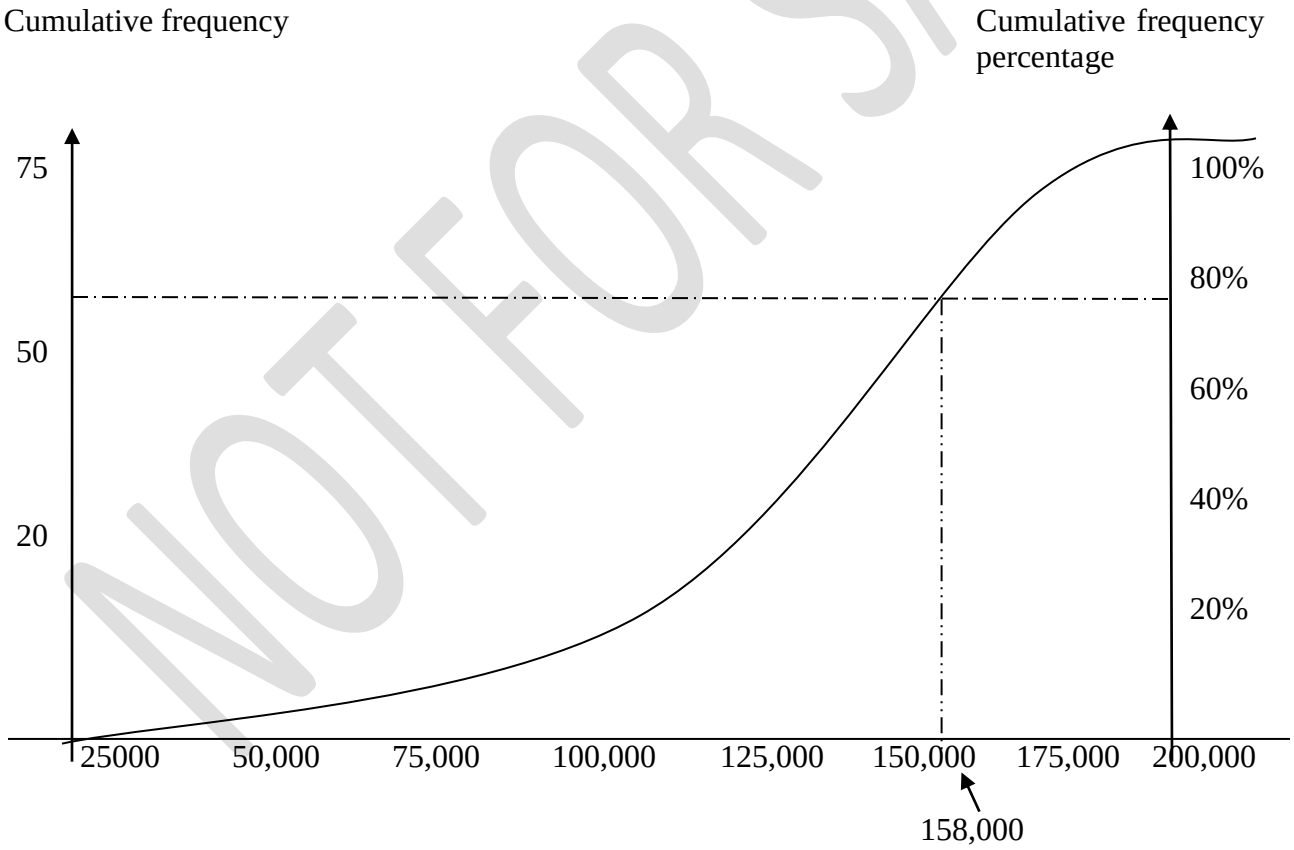


(4 marks)

(c)

Distance driven by cars x (km)	Number of vehicles	Cum. frequency
$0 < x \leq 25{,}000$	1	1
$25{,}000 < x \leq 50{,}000$	5	6
$50{,}000 < x \leq 75{,}000$	6	12
$75{,}000 < x \leq 100{,}000$	9	21
$100{,}000 < x \leq 125{,}000$	14	35
$125{,}000 < x \leq 150{,}000$	20	55
$150{,}000 < x \leq 175{,}000$	15	70
$175{,}000 < x \leq 200{,}000$	5	75

(i)



(ii) Reference to the cumulative frequency curve, over 158,000 km driven vehicles will be replaced.

(5 marks)

(Total 12 marks)

Answer No. 04

(a) Curve in symmetrical. It is bell shaped.

Mean median & mode has the same values.

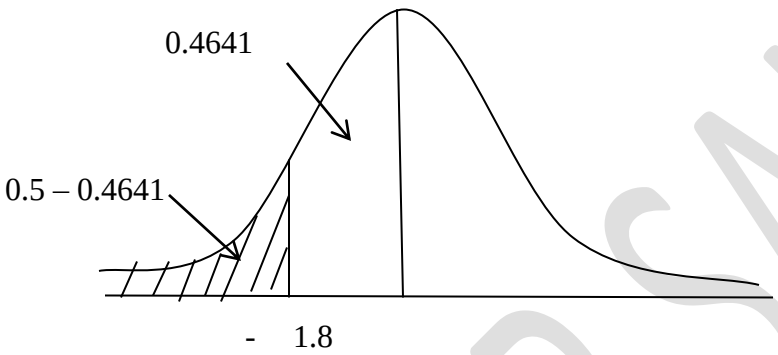
Total area under the curve is one

Two tails of the curve come closer and closer and closer to x but will never touch x axis.

(3 marks)

(b)

(i)



$\mu = 5.25$

$\sigma = 1.25$

using $Z = \frac{x - \mu}{\sigma}$

when $x = 3$

$Z = \frac{3 - 5.25}{1.25}$

$= -1.8$

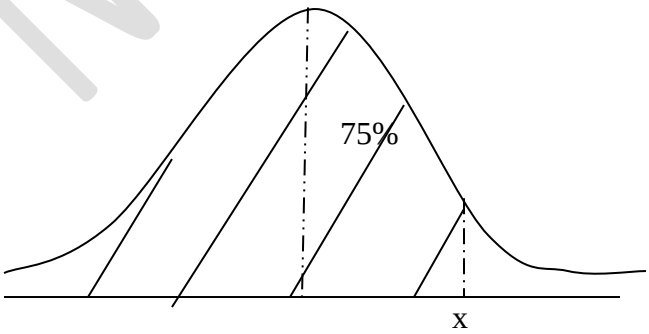
Percentage of customer pay in less than 3 minutes

= Area to the left of Z = -1.8

= 0.5 - 0.4641 = 0.0359

= 3.59% (3 marks)

(ii)



$Z = \frac{x - \mu}{\sigma}$

Value of Z when are = 0.25 $\Rightarrow$ Z = 0.67

Finding x when Z = 0.67 $\Rightarrow$ $Z = \frac{x - \mu}{\sigma}$

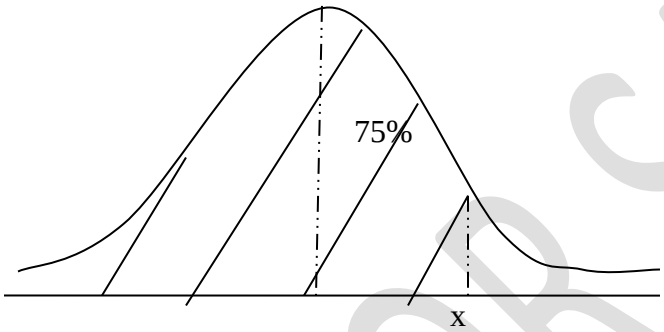
$$0.67 = \frac{x - 5.25}{1.25}$$

$$x = 6.07 \text{ minutes}$$

Since the standard cannot be maintained with existing number of counters, a new counter need to be added.

(3 marks)

(iii)



$\mu = 4.25$

$\sigma = 0.9$

$$Z = \frac{x - \mu}{\sigma}$$

$$0.67 = \frac{x - 4.25}{0.90}$$

$$x = 4.85 \text{ minutes}$$

Addition of one billing counter is sufficient to maintain the service standard

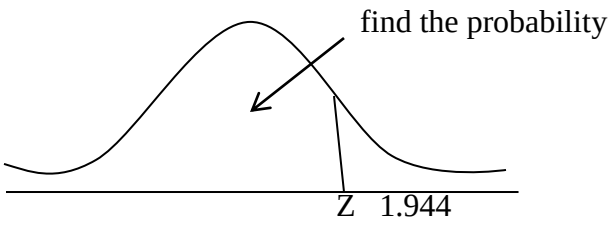
(3 marks)

Alternate answer

If students have substituted x = 6, and extrapolated the probability

If the probability is $Z = \frac{6 - 4.25}{0.90} = 1.944$

>0.75, then 6 counters are sufficient to maintain the series standard



(Total 12 marks)

Answer No. 05

(a) The power of test is the probability that a false hypothesis in correctly rejected.

Hypothesis in correctly rejected

Power of test = $1 - \beta$ = Pr (rejected H_o when false)

(3 marks)

(b) (i) The Null and Alternative hypothesis for the problem can be stated as two tail test

H_o : μ = 2,500 mm σ = 256 mm n = 40

H_1 : $\mu \neq$ 2,500 mm $\bar{x}$ = 2659 mm

(2 marks)

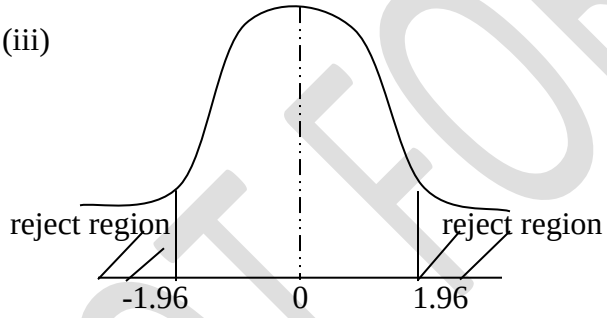
(ii) Standard error of mean = $\frac{\sigma}{\sqrt{n}}$

$= \frac{256}{\sqrt{40}}$

$= 40.48$

(3 marks)

(iii)



Note: Assuming that the sampling distribution of x is a normal distribution

$$Z = \frac{\bar{x} - \mu}{\left(\frac{\sigma}{\sqrt{n}}\right)} = \frac{2,659 - 2,500}{40.48} = 3.92$$

The value of z exceeds 1.96 and falls in the rejection region.

$\therefore$ Null hypothesis H_o should be rejected.

i.e. The average annual rainfall in Watawala area is not 2,500mm.

(4 marks)

(Total 12 marks)

Answer No. 06

(a) (i) In 1ml of liquid we expect to find 4 particles, so in 3ml of liquid we expect to find 12 particles.

Let Υ be the r.v. 'number of particles in 3ml of liquid.

So, $\Upsilon \sim Po(12)$ and $P(\Upsilon = y) = \frac{e^{-12}\, 12^{y}}{y!}$

$y = 0, 1, 2, \ldots\ldots$

Now we require $P(\Upsilon < 2)$

$= P(\Upsilon = 0) + P(\Upsilon = 1)$

$= (e^{-12} * 12^{0})/ 0! + (e^{-12} * 12^{1})/1!$

$= 13e^{-12}$

$= 7.99 \times 10^{-5}$

(2 marks)

(ii) In 1ml of liquid we expect 4 particles, so in ½ ml of liquid we 'expect' 2 particles. Let R be the r.v. 'the number of particles in ½ ml of liquid'.

We require

$P(R > 2) = 1 - [P(R = 0) + P(R = 1) + P(R = 2)]$

$= 1 - [(e^{-2} * 2^{0})/0! + (e^{-2} * 2^{1})/1! + (e^{-2} * 2^{2})/2!$

$= 1 - [e^{-2} + 2e^{-2} + 2e^{-2}]$

$= 1 - 5e^{-2}$

$= 0.323$

(2 marks)

(b) (i) Average number of misprints per page $= \frac{750}{500}$

$= 1.5$ (1 marks)

(ii) Let x be the r.v. 'the number of misprints per page'.

Then, assuming that misprints occur at random, $x \sim Po(1.5)$

$P(x = 0) = e^{-1.5}$

$= 0.2231$

$\therefore$ P (there will be no misprints on page 427) = 0.223

$P(x = 4) = \frac{e^{-1.5} * (1.5)^{4}}{4!}$

$= 0.0470$

The average number of misprints per page = 1.5

$P(x > 1.5) = P(x = 2) + P(x = 3) + \ldots\ldots$

$= 1 - (P(x = 0) + P(x = 1))$

$= 1 - (e^{-1.5} + e^{-1.5}(1.5))$

$= 1 - 2.5\, e^{-1.5}$

$= 0.4421$

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(5 marks)

(iii) On one page all expect 1.5 misprints, so on two pages we expect 3 misprints. Let Υ be the random variable.

'the number of misprints on two pages'.

$\Upsilon \sim Po(3)$, So $P(\Upsilon = 0) = (e^{-3} \times 3^{o})/ 0!$

$= 0.0497$

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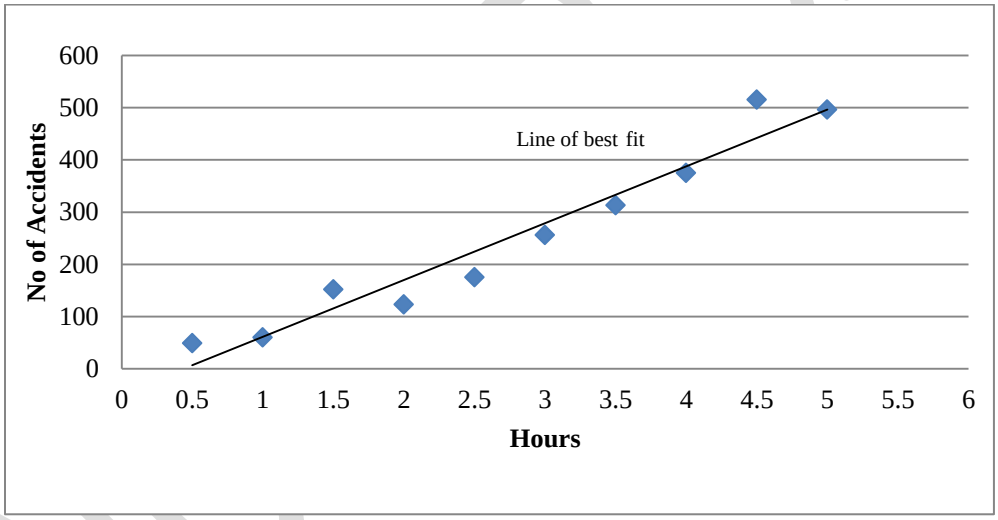
(2 marks)

(Total 12 marks)

Answer No. 07

(a)

Day	Duration of continuous driving at the time of the accident occurred (nearest 30 minutes)	Number of accident in 2011
1	0.5 Min	49
2	1.0 Hour	60
3	1.5 Hours	152
4	2.0 Hours	123
5	2.5 Hours	175
6	3.0 Hours	256
7	3.5 Hours	313
8	4.0 Hours	375
9	4.5 Hours	515
10	5.0 Hours	496



(3 marks)

(b) According to the diagram, possible number of accidents will be around 550.

(2 marks)

(c) Correlation

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

$$= \frac{10 \times 9157 - 27.5 \times 2514}{\sqrt{\left\{10 \times 96.25 - (27.5)^2\right\}\left\{10 \times 890230 - (2514)^2\right\}}}$$

$$= 0.97$$

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Two variables have a strong positive correlation

(5 marks)

(d) Multi Correlation Analysis

(2 marks)

(Total 12 marks)

Answer No. 08

(a) (i) All item price index for 1980

= 339.7 x 61.9% + 239.9 x 9.4% + 563.9 x 4.3% + 109.8 x 5.7% + 293.8 x 18.7%

= **318.27**

(3 marks)

(ii) Salary of the person to maintain the same living standard

$$= \frac{8{,}000}{203.2} \times 318.27$$

= **Rs. 12,530**

(3 marks)

(b)

Year	Quarter	Y	T	Y – T
2008	Q1	99		
	Q2	72		
	Q3	118	106.63	11.375
	Q4	136	107.50	28.5
2009	Q1	102	107.75	-5.75
	Q2	76	108.00	-32
	Q3	116	108.75	7.25
	Q4	140	109.75	30.25
2010	Q1	104	111.00	-7
	Q2	82	112.00	-30
	Q3	120	112.13	7.875
	Q4	144	112.25	31.75
2011	Q1	101	113.13	-12.125
	Q2	86	113.88	-27.875
	Q3	123		
	Q4	147		

YEAR	Q1	Q2	Q3	Q4	
2008	0	0	11.375	28.5	
2009	-5.75	-32	7.25	30.25	
2010	-7	-30	7.875	31.75	
2011	-12.125	-27.875			
Unadjusted Mean	-8.29167	-29.9583	8.833333	30.16667	$=\sum + 0.75$
Adjustment 0.75/4	-0.1875	-0.1875	-0.1875	-0.1875	
Adjusted Mean	-8.47917	-30.1458	8.645833	29.97917	
Seasonal fluctuation	-8.48	-30.15	8.65	29.98	

(6 marks)

(Total 12 marks)

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