SOLVED PAPER 2010

QUESTION NO. 1

Weekly Wages	No.of Works f	x	fx	fx^2	f/x
117-124	13	120.5	1566.5	188763.25	0.1078
124-131	17	127.5	2167.5	276356.25	0.1333
131-138	33	134.5	4438.5	596978.25	0.2453
138-145	47	141.5	6650.5	941045.75	0.3321
145-152	56	148.5	8316	1234926	0.3771
152-159	73	155.5	11351.5	1765158.25	0.4694
159-166	81	162.5	13162.5	2138906.25	0.4985
166-173	65	169.5	11017.5	1867466.25	0.3835
173-180	55	176.5	9707.5	1713373.75	0.3116
180-187	40	183.5	7340	1346890	0.2180
187-194	20	190.5	3810	725805	0.1050
	$\sum f = 500$		$\sum fx = 79528$	$\sum fx^2 = 12795669$	$\sum(f/x) = 3.1816$

$$\text{A.M.} = \bar{x} = \frac{\sum fx}{\sum f}$$

$$= \frac{79528}{500}$$

$$\boxed{\text{A.M.} = 159.056}$$

$$\text{H.M.} = \frac{\sum fx}{\sum\left(\frac{f}{x}\right)}$$

$$= \frac{500}{3.1816}$$

$$\boxed{\text{H.M.} = 157.154}$$

$$\text{S.D} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

$$= \sqrt{\frac{12795669}{500} - (159.056)^2}$$

$= \sqrt{25591.338 - 25298.81}$

$= \sqrt{292.528}$

S.D $= 117.10$

Coefficient of variation:

C.V. $= \frac{S.D}{\bar{x}}$ x 100%

$= \frac{17.10}{159.056}$ x 100%

C.V. $= 10.75\%$

Hence

Arithmetic mean = 159.05

Harmonic mean = 157.154

Standard Deviation = 17.10

Coefficient of variation = 10.75%

QUESTION NO. 2.

x	y	xy	x^2	y^2
16	40	640	256	1600
72	52	3744	5184	2704
73	43	3139	5329	1849
63	49	3087	3969	2401
83	61	5063	6889	3721
80	58	4640	6400	3364
66	44	2904	4356	1936
66	58	3828	4356	3364
74	50	3700	5476	2500
62	45	2790	3844	2025
$\sum x = 655$	$\sum y = 500$	$\sum xy = 33535$	$\sum x^2 = 46059$	$\sum y^2 = 25464$

Correlation Coefficient = $r = \frac{n\sum xy - \sum x \sum y}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$

$$= \frac{10(33535)-(656)(500)}{\sqrt{[10(460590)-(655)^2][10(25464)-(500)^2]}}$$

$$= \frac{335350-327500}{\sqrt{[460590-429025][254640-250000]}}$$

$$= \frac{7850}{\sqrt{[31565][4640]}}$$

$$= \frac{7850}{12102.13204}$$

r = 0.65

r = 0.6486 = 0.65

Interpretation: There exists a fair positive correlation between two variables.

QUESTION NO. 3.

Hypothesis

H_o: Attributes are independent

H_1: Attributes are associated

Level of Significance:

$\alpha = 0.05$

Test Statistic:

$$x^2 = \sum\left[\frac{(O-E)^2}{E}\right]$$

With (r – 1)(e – 1) degrees of freedom under the assumption that H_o is true.

Critical Region:

$$x^2_{cal} \geq x^2_{tab}$$

$$x^2_{cal} \geq x^2_{(0.05,4)}$$

$$x^2_{cal} \geq 9.488$$

We reject H_o if calculated values of x^2 is greater than 9.488.

Computations:

Tables of observed frequencies:

Attribute	A_1	A_2	A_3	Total
B_1	20	15	30	65
B_2	30	18	35	83
B_3	35	20	40	95
Total	85	53	105	243

Expected Frequency $= \frac{(Row\ total)(Column\ totsl)}{Grand\ total}$

Tables of expected frequencies:

Attribute	A_1	A_2	A_3	Total
B_1	$\frac{65x85}{243} = 22.74$	14.18	28.08	165
B_2	29.03	18.10	35.86	83
B_3	33.23	20.72	41.05	95
Total	85	53	105	243

Let O = Observed Frequency

E = Expected Frequency

Now we have:

O	E	$\frac{(O-E)^2}{E}$
20	22.74	0.3301
15	14.18	0.0474
30	28.08	0.0335
30	29.03	0.03136
18	18.10	0.000552
35	35.86	0.0206
35	33.23	0.09427
20	20.72	0.02502
40	41.05	0.02685
		0.609652

$$x^2 = \sum\left[\frac{(O-E)^2}{E}\right]$$

x^2 = 0.609652

x^2 = 0.61

Conclusion:

Since x^2_{cal}= 0.61 ≤ 9.488, so it does not fall in the critical region. So we do not reject H_o at 5% level of significance and conclude that attributes are independent.

QUESTION NO. 4

Commodity	2000		20002		p_nq_o	p_oq_o	p_nq_n	p_oq_n
	p_o	q_o	p_n	q_n				
A	3	100	6	120	600	500	720	600
B	7	120	10	80	1200	840	800	560
C	10	80	12	80	960	800	960	800
D	4	50	5	60	250	200	300	240
E	8	70	8	60	560	560	640	`640
Total					3570	2900	3420	2840

Laspeyr's Price index = $P_{on} = \frac{\sum p_n q_o}{\sum p_o q_o}$ x 100

$= \frac{3570}{2900}$ x 100

P_{on} = 123.10

Paasche's Price index = $P_{on} = \frac{\sum p_n q_n}{\sum p_o q_n}$ x 100

$= \frac{3420}{2840}$ x 100

P_{on} = 120.42

Fisher's Price index = $P_{on} = \sqrt{Laspeyre's\ index \times Paasche's\ index}$

$= \sqrt{123.10 \times 120.48}$

$$= \sqrt{14823.702}$$

$$\boxed{P_{on} = 121.75}$$

QUESTION NO. 5

$$A = \begin{bmatrix} 1 & 4 & 3 \\ 2 & 1 & 8 \\ 1 & 1 & 2 \end{bmatrix} \text{ and } B = \begin{bmatrix} 2 & 1 & 2 \\ 0 & -4 & 8 \\ 6 & 1 & 4 \end{bmatrix}$$

(i) $$A + B = \begin{bmatrix} 1 & 4 & 3 \\ 2 & 1 & 8 \\ 1 & 1 & 2 \end{bmatrix} + \begin{bmatrix} 2 & 1 & 2 \\ 0 & -4 & 8 \\ 6 & 1 & 4 \end{bmatrix}$$

$$= \begin{bmatrix} 1+2 & 4+1 & 3+2 \\ 2+0 & 1-4 & 8+8 \\ 1+6 & 1+1 & 2+4 \end{bmatrix} = \begin{bmatrix} 3 & 4 & 5 \\ 2 & -3 & 16 \\ 7 & 2 & 6 \end{bmatrix}$$

(ii) $$2A = 2\begin{bmatrix} 1 & 4 & 3 \\ 2 & 1 & 8 \\ 1 & 1 & 2 \end{bmatrix} \qquad 2B = 3\begin{bmatrix} 2 & 1 & 2 \\ 0 & -4 & 8 \\ 6 & 1 & 4 \end{bmatrix}$$

$$2A = \begin{bmatrix} 2 & 8 & 6 \\ 4 & 2 & 16 \\ 2 & 2 & 4 \end{bmatrix} \qquad 2B = \begin{bmatrix} 6 & 3 & 6 \\ 0 & -12 & 24 \\ 18 & 3 & 12 \end{bmatrix}$$

$$2A - 3B = \begin{bmatrix} 2 & 8 & 6 \\ 4 & 2 & 16 \\ 2 & 2 & 4 \end{bmatrix} - \begin{bmatrix} 6 & 3 & 6 \\ 0 & -12 & 24 \\ 18 & 3 & 12 \end{bmatrix}$$

$$= \begin{bmatrix} 2-6 & 8-3 & 6-6 \\ 4-0 & 2+12 & 16-24 \\ 2-18 & 2-3 & 4-12 \end{bmatrix}$$

$$2A - 3B = \begin{bmatrix} -4 & 5 & 0 \\ 4 & 14 & -8 \\ -16 & -1 & -8 \end{bmatrix}$$

(ii) $$AB = \begin{bmatrix} 1 & 4 & 3 \\ 2 & 1 & 8 \\ 1 & 1 & 2 \end{bmatrix} \begin{bmatrix} 2 & 1 & 2 \\ 0 & -4 & 8 \\ 6 & 1 & 4 \end{bmatrix}$$

$$= \begin{bmatrix} (1)(2)+(4)(0)+(3)(6) & (1)(1)+(4)(4)+(3)(1) & (1)(2)+(4)(8)+(3)(4) \\ (2)(2)+(1)(0)+(8)(6) & (2)(2)+(1)(-4)+(8)(1) & (1)(2)+(1)(8)+(2)(4) \\ (1)(2)+(1)(0)+(2)(6) & (1)(1)+(1)(-4)+(2)(1) & (1)(2)+(1)(8)+(2)(4) \end{bmatrix}$$

$$= \begin{bmatrix} 2+0+18 & 1-16+3 & 2+32+12 \\ 4+0+48 & 2-4+8 & 2+8+8 \\ 2+0+12 & 1-4+2 & 2+8+8 \end{bmatrix}$$

$$= \begin{bmatrix} 20 & -12 & 46 \\ 52 & 6 & 18 \\ 14 & -1 & 18 \end{bmatrix}$$

$$AB = \begin{bmatrix} 20 & -12 & 46 \\ 52 & 6 & 18 \\ 14 & -1 & 18 \end{bmatrix}$$

QUESTION NO. 6

(a) $2x + y = -7$ .....(1)

$3x + 2y = -12$ .....(2)

Multiplying eq. (1) by 3 and equation (2) by 2 and subtracting:

$6x + 3y = -21$

$6x \pm 4y = \bar{+}24$

$-y = 3$

$\boxed{y = -3}$

Putting $y = -3$ in eq. (1):

$2x + (-3) = -7$

$2x = -7 + 3$

$2x = -4$

$x = \frac{-4}{2}$

$\boxed{x = -2}$

Hence S.S. $= [(-2, -3)]$

(b) $6x^2 - 5x - 6 = 0$

$6x^2 - 9x + 4x - 6 = 0$

$3x(2x - 3) + 2(2x - 3) = 0$

$(2x - 3)(3x + 2) = 0$

$2x - 3 = 0 \quad , \quad 3x + 2 = 0$

$2x = 3 \quad , \quad 3x = -2$

$x = \frac{3}{2} \quad , \quad x = \frac{-2}{3}$

S.S. $= \left\{\frac{3}{2}, \frac{-2}{3}\right\}$

QUESTION NO. 7

Principal = P = Rs. 20,000

i = 6% = 0.06

n = 3 years

$= 20000(1 + 0.06)^2$

$= 20000(1.06)^2$

$= 20000(1.1910)$

Compound amount= Rs. 23820

Compound interest= S – P

= 23820 – 20000

Compound interest= Rs. 3820