Solved Paper 2014

QUESTION NO. 1

Week & Wage's	f	x	fx	D	fD	fD2	C.F
0 – 40	6	20	120	-120	-720	86400	6
40 – 80	15	60	900	-80	-1200	96000	21
80 – 120	22	100	2200	-40	-880	35200	43
120 – 160	30	140	4200	0	0	0	73
160 – 200	45	180	8100	40	1800	7200	118
200 – 240	27	320	5940	80	2160	172800	145
240 – 280	16	260	3380	120	1560	187200	158
280 – 320	6	300	1800	160	960	153600	168
	164		**26640**		**3680**	**803200**	

$$\bar{x} = \frac{\sum FX}{\sum F} = \frac{26640}{164} = 162.439$$

Median

$$\widetilde{X} = l + \frac{h}{f}\left(\frac{n}{2} - c\right)$$

$$= 160 + \frac{40}{45}(82 - 73) \quad = 160 + \frac{8}{9} \times 9 \quad = 160 + 8 = 168$$

$$= \frac{n}{2} = \frac{164}{2} = 82$$

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

$$= \sqrt{\frac{803200}{164} - \left(\frac{3680}{164}\right)^2}$$

$$= \sqrt{4897.571 - 503.51} = \sqrt{4394.051}$$

$$= 66.288$$

$$C = \frac{S.D}{\bar{x}} = \frac{66.288}{162.439} \times 100 = 40.808\%$$

QUESTION NO. 2

x	y	xy	X^2	Y^2
5	9	45	25	81
6	7	42	36	49
7	10	70	49	100
8	3	24	64	9
9	13	117	81	169
10	11	110	100	121
11	14	154	121	196
12	10	120	144	100
13	14	182	169	196
14	12	168	196	144
15	18	270	225	324
110	**121**	**1302**	**1210**	**1489**

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

$$r = \frac{1302 - \frac{110 \times 121}{11}}{\sqrt{\left\{1210 - \frac{(110)^2}{11}\right\}\left\{14889 - \frac{(121)^2}{11}\right\}}}$$

$$r = \frac{92}{\sqrt{110 \times 158}}$$

$$r = \frac{92}{\sqrt{17380}}$$

$$r = \frac{92}{131.833}$$

$$r = 0.698$$

$$\bar{x} = \frac{\sum x}{n} = \frac{110}{11} = 10$$

$$\bar{y} = \frac{\sum y}{n} = \frac{121}{11} = 11$$

$$\sigma_x = \sqrt{\frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2}$$

$$\sigma_x = \sqrt{\frac{1210}{11} - \left(\frac{110}{11}\right)^2}$$

$$\sigma_x = \sqrt{110 - 100}$$

$$\sigma_x = \sqrt{10}$$

$$\sigma_x = 3.162$$

$$\sigma_y = \sqrt{\frac{\sum y^2}{n} - \left(\frac{\sum y}{n}\right)^2}$$

$$\sigma_y = \sqrt{\frac{1489}{11} - \left(\frac{121}{11}\right)^2}$$

$$\sigma_y = \sqrt{135.364 - 121}$$

$$\sigma_y = \sqrt{14.364}$$

$$\sigma_y = 3.79$$

Line if regression y on x:

$$y - \bar{y} = r\frac{\sigma_x}{\sigma_y}(x - \bar{x})$$

$$y - 11 = 0.698\ \frac{3.79}{3.10}(x - 10)$$

$$y = 0.837x - 8.37 + 11$$

$$y = 0.837x + 2.63$$

QUESTION NO. 3

Commodity	2000		2001		p_nq_o	p_oq_o	p_nq_n	p_oq_n
	p_o	q_o	p_n	q_n				
Wheat	30	110	32	112	3300	3360	3520	3584
Rice	40	100	38	110	4000	4400	3800	4180
Jawar	25	50	22	80	1250	2000	1100	1760
Maize	10	40	15	50	400	500	600	750
Total					8950	10260	9020	10274

Laspreyr's Index Number $= \frac{\sum p_n q_o}{\sum p_o q_o} \times 100$

$= \frac{9020}{8950} \times 100$

$= 100.78$

Paasche's Index Number $= \frac{\sum p_n q_n}{\sum p_o q_n} \times 100$

$= \frac{10274}{10260} \times 100$

$= 100.14$

Fisher's Index Number $= \sqrt{Laspeyre's \times Paasche's} \times 100$

$= \sqrt{100.78 \times 100.14}$

$= 100.92$

Marshall's Index Number $= \frac{\sum p_n q_o + \sum p_n q_n}{\sum p_o q_o + \sum p_o q_n} \times 100$

$= \frac{9020+10274}{8950+10260}$

$= \frac{1000}{930}$

$= 100.44$

QUESTION NO. 4

Observed Frequency (f_e)

Eye Color	Light Blue	Dark Black	Brown	Total
Blue	26	21	13	60
Black	22	42	21	88
Brown	19	18	15	52
Total	70	81	49	200

Expected Frequency (f_e)

Eye Color	Light Blue	Dark Black	Brown	Total
Blue	21	24.3	14.7	60
Black	30.8	35.6	21.6	88
Brown	18.2	21.1	12.7	52
Total	70	81	49	200

f_o	f_e	$F_o - f_e$	$\frac{(Fo - fe)2}{fe}$
26	21	5	1.1905
21	24.3	-3.3	0.4481
13	14.7	-1.7	0.1966
25	30.8	-5.8	1.0922
42	35.6	6.4	1.1506
21	21.6	-0.6	0.0167
19	18.2	0.8	0.0352
18	21.1	-3.1	0.4555
15	12.7	2.3	0.4165
			5.0019

Chi-Square = $\sum \frac{(Fo - fe)2}{fe}$ = 5.0019

The computed value of chi-square 4.95 is smaller than the table value (i.e., 9.49 so we accept the null hypothesis that the hair colour and the eye colour are independent.

QUESTION NO. 5

$$A = \begin{bmatrix} 2 & -3 & 4 \\ 1 & 5 & -2 \\ 4 & 2 & 6 \end{bmatrix} \text{ and } B = \begin{bmatrix} 1 & -2 & 3 \\ 4 & -5 & -6 \\ 7 & 8 & 9 \end{bmatrix}$$

(i) $A + B = \begin{bmatrix} 2 & -3 & 4 \\ 1 & 5 & -2 \\ 4 & 2 & 6 \end{bmatrix} + \begin{bmatrix} 1 & -2 & 3 \\ 4 & -5 & -6 \\ 7 & 8 & 9 \end{bmatrix}$

$$= \begin{bmatrix} 3 & -5 & 7 \\ 5 & 0 & -8 \\ 11 & 10 & 15 \end{bmatrix}$$

(ii) $2A - 3B = \begin{bmatrix} -4 & -6 & 8 \\ 2 & 10 & -4 \\ 8 & 4 & 12 \end{bmatrix} - \begin{bmatrix} 3 & -6 & 9 \\ 12 & -15 & -18 \\ 21 & 34 & 27 \end{bmatrix}$

$$= \begin{bmatrix} 1 & 0 & -1 \\ -10 & 25 & 14 \\ -13 & -20 & -15 \end{bmatrix}$$

(iii) $AB = \begin{bmatrix} 2-12+28 & -4+15+32 & 6+18-36 \\ 1+20-14 & -2-25-16 & 3-30-18 \\ 4+8+42 & -8-10+48 & 12-12+54 \end{bmatrix}$

$$= \begin{bmatrix} 18 & 43 & 60 \\ 7 & -43 & -45 \\ 54 & 30 & 54 \end{bmatrix}$$

QUESTION NO. 6

(a) $2x^2 + 15x + 18 = 0$
$2x^2 + 12x + 3x + 18 = 0$
$2x(x+6) + 3(x+6) = 0$
$(x+6)(2x+3) = 0$
$(x+6) = 0$ or $(2x+3) = 0$
$X = -6$ or $x = \frac{-3}{2}$

(b) Suppose small number = x then larger = 3x+1
$(3x+1)-x = 33$ or $3x+1-x = 33$

$2x = 33-1 = 32$ or $x = \frac{32}{2} = 16$

$3x + 1 = 3 \times 16 + 1 = 49$

So 1st number = 16 and the larger number = 49

QUESTION NO. 7

$S_n = \frac{n}{2}(a+L)$

$145 = \frac{10}{2}(a+28) = 5a+140$

$5a = 145-140 = 5$

$A = \frac{5}{5} = 1$

$L = a + (n-1)d$

$28 = 1 + (10-1)d$

$28 = 1+9d$

$9d = 28 - 1 = 27$

$D = \frac{27}{9} = 3$

So 1st term = a = 1 and common difference = d = 3

(c) $S_\infty = \frac{a}{1-4}$

$= \frac{1}{1-1/2}$

$= \frac{1}{1/2}$

$= 1 \times \frac{2}{1} = 2$

$S_\infty = 2$ Proved

QUESTION NO. 8

Let x represents the effective rate of interest:

So,

$$X = (1 + \frac{0.08}{4})^2 - 1$$

$$X = (1 + 0.02\ 4)^4 - 1$$

$$X = (1.02)^4 - 1$$

$$X = 1.08243216 - 1$$

$$X = 0.08243216 \text{ or } 8.243216\ \%$$

Effective rate = 8.243216 %