

Solved Paper 2017

QUESTION NO. 1

Groups	f	x	fx	fx ²	C.f
0-7	5	3.5	17.5	61.25	5
7-14	13	10.5	136.5	1433.25	18
14-21	18	17.5	315.0	5512.50	36
21-28	28	24.5	686.0	16807.0	64
28-35	18	31.5	567.0	17860.50	82
35-42	13	38.5	500.5	19269.25	95
42-49	5	45.5	227.5	10351.25	100
	100		2450.0	71295.00	

$$\bar{x} = \frac{\sum fx}{\sum f} = \frac{2450}{100} = 24.5$$

$$\begin{aligned} \text{Median} &= l + \frac{i}{f} \left(\frac{n}{2} - c \right) \\ &= 21 + \frac{7}{28} (50 - 36) \\ &= 24.5 \end{aligned}$$

$$\begin{aligned} \text{Mode} &= l + \frac{f_m - f_1}{(f_m - f_1) + (f_m - f_2)} \times c \\ &= 21 + \frac{28 - 18}{(28 - 18) + (28 - 18)} \times 7 \\ &= 24.5 \end{aligned}$$

$$\begin{aligned} \sigma &= \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2} \\ &= \sqrt{\frac{71295}{100} - \left(\frac{2450}{100} \right)^2} \\ &= \sqrt{712.95 - 600.25} \\ &= \sqrt{112.7} = 10.616 \end{aligned}$$

QUESTION NO. 2

x	y	x ²	y ²	xy
18	17	306	324	289
19	17	323	361	259
20	18	360	400	324
21	18	378	441	324
22	18	396	484	324
23	19	437	529	361
24	19	456	576	361
25	20	500	625	400
26	21	546	676	441
27	22	594	729	484
225	189	4296	5145	3597

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

$$r = \frac{4296 - \frac{225 \times 189}{10}}{\sqrt{\left\{ 5145 - \frac{(225)^2}{10} \right\} \left\{ 3597 - \frac{(189)^2}{10} \right\}}}$$

$$r = \frac{43.5}{\sqrt{(5145 - 5062.5)(3597 - 3572.1)}}$$

$$r = \frac{43.5}{\sqrt{82.5 \times 24.9}}$$

$$r = \frac{43.5}{45.324}$$

$$r = 0.96$$

$$\bar{x} = \frac{\sum x}{n} = \frac{225}{10} = 22.5$$

$$\bar{y} = \frac{\sum y}{n} = \frac{189}{10} = 18.9$$

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

$$\sigma_x = \sqrt{\frac{5145}{10} - \left(\frac{225}{10} \right)^2}$$

$$\sigma_x = \sqrt{514.5 - 506.25}$$

$$\sigma_x = \sqrt{8.25}$$

$$\sigma_x = 2.872$$

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

$$\sigma_y = \sqrt{\frac{3597}{10} - \left(\frac{189}{10}\right)^2}$$

$$\sigma_y = \sqrt{359.7 - 357.21}$$

$$\sigma_y = \sqrt{2.49}$$

$$\sigma_y = 1.578$$

Line of regression y on x:

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

$$y - 18.9 = 0.96 \times \frac{1.578}{2.872} (x - 22.5)$$

$$y = 18.9 - 11.858 + 0.527x$$

$$y = 7.042 + 0.527x$$

QUESTION NO. 3

Commodity	2000		2001		$p_n q_o$	$p_o q_o$	$p_n q_n$	$p_o q_n$
	p_o	q_o	p_n	q_n				
Wheat	12	10	15	12	150	120	180	144
Rice	15	7	20	5	140	105	100	75
Jawar	24	5	20	9	100	120	180	216
Maize	5	16	5	14	80	80	70	70
Total					470	425	530	506

$$\begin{aligned} \text{Laspeyr's Index Number} &= \frac{\sum p_n q_o}{\sum p_o q_o} \times 100 \\ &= \frac{470}{425} \times 100 \\ &= 110.59 \end{aligned}$$

$$\begin{aligned} \text{Paasche's Index Number} &= \frac{\sum p_n q_n}{\sum p_o q_n} \times 100 \\ &= \frac{530}{505} \times 100 \\ &= 104.95 \end{aligned}$$

$$\begin{aligned} \text{Fisher's Index Number} &= \sqrt{\text{Laspeyre's} \times \text{Paasche's}} \times 100 \\ &= \sqrt{110.59 \times 104.95} \\ &= 107.73 \end{aligned}$$

$$\begin{aligned} \text{Marshall's Index Number} &= \frac{\sum p_n q_o + \sum p_n q_n}{\sum p_o q_o + \sum p_o q_n} \times 100 \\ &= \frac{470 + 530}{425 + 505} \times 100 \\ &= \frac{1000}{930} \times 100 \\ &= 107.53 \end{aligned}$$

QUESTION NO. 4

Observed Frequency (f_o)

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	$f_o - f_e$	$\frac{(f_o - f_e)^2}{f_e}$
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

$$\text{Chi-Square} = \sum \frac{(f_o - f_e)^2}{f_e} = 5.0019$$

Table value is much greater than the calculated value. We accept H_0 . So that hair colour and the eye colour are independent.

QUESTION NO. 5

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

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

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

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

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

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

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

QUESTION NO. 6

(a) $2x^2 + 15x + 18 = 0$

$$2x^2 + 12x + 3x + 18 = 0$$

$$2x(x+6) + 3(x+6) = 0$$

$$(x+6)(2x+3) = 0$$

$$(x+6) = 0 \text{ or } (2x+3) = 0$$

$$X = -6 \text{ or } x = \frac{-3}{2}$$

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

$$(3x+1)-x = 33 \text{ or } 3x+1-x = 33$$

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

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

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

$$(c) S_{\infty} = \frac{a}{1-r}$$
$$= \frac{1}{1-1/2}$$

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

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

$$S_{\infty} = 2 \text{ Proved}$$

QUESTION NO. 8

Let x represents the effective rate of interest:

So,

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

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

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

$$X = 1.08243216 - 1$$

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

$$\text{Effective rate} = 8.243216 \%$$