

Solved Paper 2018

QUESTION NO. 1

Ages	No.ofmen f	C.F	x	fx	C.B.
15-19	29	29	17	493	14.5-19.5
20-24	176 f ₁	20	22	3872	19.5-24.5
25-29	208f _m	413	27	5616	24.5-29.5
30-34	173 f ₂	386	32	5536	29.5-34.5
35-39	82	668	37	3034	34.5-39.5
40-44	40	708	42	1680	39.5-44.5
45-49	15	723	47	705	44.5-49.5
50-54	3	726	52	156	49.5-54.5
Total	$\Sigma f = 726$			$\Sigma fx = 21092$	

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{21092}{726} = 29.05$$

$$\hat{x} = l + \frac{(f_m - f_1)}{(f_m - f_1) + (f_m - f_2)} \times h$$

$$\hat{x} = 24.5 + \frac{(208 - 176)}{(208 - 176) + (208 - 173)} \times 5$$

$$\hat{x} = 24.5 + \frac{32}{32 + 35} \times 5 = 26.88$$

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

$$= 24.5 + \frac{5}{208} \left(\frac{726}{2} - 205 \right) = 28.298$$

$$Q_1 = l + \frac{h}{f} \left(\frac{n}{4} - c \right)$$

$$= 19.5 + \frac{5}{176} (181.5 - 29) = 23.832$$

$$Q_3 = l + \frac{h}{f} \left(\frac{3n}{4} - c \right)$$

$$= 19.5 + \frac{5}{176} (544.5 - 413) = 33.30$$

$$S.K = \frac{Q_3 + Q_1 - 2Q_2}{Q_3 + Q_1}$$

$$S.K = \frac{33.30+23.83-2(28.296)}{33.30-23.83}$$

$$S.K = \frac{0.534}{9.47} = 0.0564$$

QUESTION NO. 2.

x	y	xy	x ²	y ²
3	25	75	9	625
4	24	96	16	576
5	20	100	25	400
6	20	120	36	400
7	19	133	49	361
8	17	136	64	289
9	16	144	81	256
10	13	130	100	169
11	10	110	121	100
12	6	72	144	36
$\Sigma x = 75$	$\Sigma y = 170$	$\Sigma xy = 1116$	$\Sigma x^2 = 645$	$\Sigma y^2 = 3212$

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

$$= \frac{(10)(1116) - (75)(170)}{\sqrt{[(10)(645) - (75)^2][(10)(3212) - (170)^2]}} = -0.975$$

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

$$= \frac{(10)(1116) - (75)(170)}{(10)(645) - (75)^2}$$

$$= \frac{11160 - 12750}{6450 - 5625}$$

$$= \frac{-1590}{825} = -1.927$$

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

$$= \frac{(10)(1116) - (75)(170)}{(10)(3212) - (170)^2}$$

$$= \frac{11160 - 12750}{32120 - 28900}$$

$$= \frac{-1590}{3220} = -0.494$$

$$a = \bar{y} - b\bar{x} = 31.4525$$

$$c = \bar{x} - d\bar{y} = 15.894$$

$$\hat{y} = 31.452 - 1.927x$$

QUESTION NO. 3

Population (N) = 2, 4, 6, 8, 10, 12, 14, 16

Sample size (n) = 2

$${}^N C_n = {}^8 C_2 = 28 \text{ samples}$$

x	X ²
2	4
4	16
6	36
8	64
10	100
12	144
14	196
16	256
$\sum x = 72$	$\sum x^2 = 818$

$$\mu = \frac{\sum x}{N} = \frac{72}{8} = 9$$

$$\begin{aligned} \sigma^2 &= \frac{\sum x^2}{n} - \left(\frac{\sum x}{N}\right)^2 \\ &= \frac{816}{8} - \left(\frac{72}{8}\right)^2 \\ &= 102 - 81 = 21 \end{aligned}$$

Samples	(2, 4)	(2, 6)	(2, 8)	(2, 10)	(2, 12)	(2, 14)	(2, 16)
\bar{x}	3	4	5	6	7	8	9
Samples	(4, 6)	(4, 8)	(4, 10)	(4, 12)	(4, 14)	(4, 16)	(6, 8)
\bar{x}	5	6	7	8	9	10	7
Samples	(6, 10)	(6, 12)	(6, 14)	(6, 16)	(8, 10)	(8, 12)	(8, 14)
\bar{x}	8	9	10	11	9	10	11
Samples	(8, 16)	(10, 12)	(10, 14)	(10, 16)	(12, 14)	(12, 16)	(14, 16)

\bar{x}	12	11	12	13	13	14	15
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Sampling Distribution:

\bar{x}	$f \bar{x}$	$\bar{x} f(\bar{x})$	$\bar{x}^2 f(\bar{x})$
3	1/28	3/28	9/28
4	1/28	4/28	16/28
5	2/28	10/28	50/28
6	2/28	12/28	72/28
7	3/28	21/28	147/28
8	3/28	24/28	192/28
9	4/28	36/28	324/28
10	3/28	30/28	300/28
11	3/28	33/28	363/28
12	2/28	24/28	288/28
13	2/28	26/28	338/28
14	1/28	14/28	196/28
15	1/28	15/28	225/28
		252/28	2520/28

Mean and variance of sampling distribution of means:

$$\mu_{\bar{x}} = \sum \bar{x} f(\bar{x}) = \frac{2520}{28} = 9$$

$$\sigma_{\bar{x}}^2 = \sum \bar{x}^2 f(\bar{x}) - [\sum \bar{x} f(\bar{x})]^2$$

$$= 90 - (9)^2$$

$$= 90 - 81$$

$$= 9$$

$$\sigma_{\bar{x}}^2 = \frac{\sigma^2 N-n}{n \cdot N-1}$$

$$= \frac{21 \cdot 8-1}{2 \cdot 8-1}$$

$$= 9$$

QUESTION NO. 4

(a) Possible Outcomes:

HH, HT, TH, TT

x (Head)	P(x)	xP(x)
0	$\frac{1}{4}$	0
1	$\frac{2}{4}$	$\frac{2}{4}$
2	$\frac{1}{4}$	$\frac{2}{4}$
		$\sum x P(x) = 4/4 = 1$

$$E(x) = \sum x P(x) = 1$$

(b)

p_o	q_o	p_n	q_n	$p_n q_o$	$p_o q_o$	$p_n q_n$	$p_o q_n$
35	71	32	80	2272	2485	2560	2800
20	107	18	138	1926	2140	2484	2760
26	62	20	57	1240	1612	1140	1482
				5438	6237	6184	7042

$$P_{on} = \sqrt{\frac{5438}{6237} \times \frac{6184}{7042}} \times 100 = 87.50$$

QUESTION NO. 5

(a) $x^2 + 5x = 50$

$$x^2 + 10x - 5x - 50 = 0$$

$$x(x + 10) - 5(x + 10) = 0$$

$$(x + 10)(x - 5) = 0$$

$$\{10, -5\}$$

(b) Let 1st consecutive even integer is = x

Let 1st consecutive even integer is = x + 2

$$x + x + 2 = 66$$

$$2x = 66 - 2$$

$$2x = 64$$

$$x = \frac{64}{2} = 32$$

$$x + 2 = 32 + 2 = 34$$

1st number is 32 and 2nd is 34.

QUESTION NO. 6

Find inverse:

$$A = \begin{bmatrix} 1 & 2 & 1/2 \\ 4 & 5 & 6 \\ 1 & 3 & -2 \end{bmatrix}$$

$$|A| = (1) \begin{vmatrix} 5 & 6 \\ 3 & -2 \end{vmatrix} - (2) \begin{vmatrix} 4 & 6 \\ 1 & -2 \end{vmatrix} + (1/2) \begin{vmatrix} 4 & 5 \\ 1 & 3 \end{vmatrix}$$

$$= -28 + 28 + \frac{1}{2}(7) = \frac{7}{2}$$

$$A_{\text{cof}} = \begin{bmatrix} \begin{vmatrix} 5 & 6 \\ 3 & -2 \end{vmatrix} & \begin{vmatrix} 4 & 6 \\ 1 & -2 \end{vmatrix} & \begin{vmatrix} 4 & 5 \\ 1 & 3 \end{vmatrix} \\ \begin{vmatrix} 2 & 1/2 \\ 3 & 2 \end{vmatrix} & \begin{vmatrix} 1 & 1/2 \\ 1 & -2 \end{vmatrix} & \begin{vmatrix} 1 & 2 \\ 1 & 3 \end{vmatrix} \\ \begin{vmatrix} 2 & 1/2 \\ 5 & 6 \end{vmatrix} & -\begin{vmatrix} 1 & 1/2 \\ 4 & 6 \end{vmatrix} & -\begin{vmatrix} 1 & 2 \\ 4 & 5 \end{vmatrix} \end{bmatrix}$$

$$= \begin{bmatrix} -28 & 14 & 7 \\ 11/2 & -5/2 & -1 \\ 19/2 & -4 & -3 \end{bmatrix}$$

$$(A_{\text{cof}})^t = \begin{bmatrix} -28 & 11/2 & 19/2 \\ 14 & -5/2 & -4 \\ 7 & -1 & -3 \end{bmatrix}$$

$$A^{-1} = \begin{bmatrix} -28 & 11/2 & 19/2 \\ 14 & -5/2 & -4 \\ 7 & -1 & -3 \end{bmatrix}$$

$$= \begin{bmatrix} -8 & 11/7 & 19/7 \\ 4 & -5/7 & -8/7 \\ 2 & -2/7 & -6/7 \end{bmatrix}$$

QUESTION NO. 7

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

$a_5 = a + (5 - 1)d$, $a_5 = a + 4d$

$5 = a + 4d$ (i)

$a_{13} = a + (13 - 1)d$, $a_{13} = a + 12d$

$-3 = a + 12d$ (ii)

Subtracting (i) from (ii);

$$\begin{array}{r} 5 = a + 4d \\ +3 = -a + 12d \\ \hline 8 = -8d \\ d = \frac{8}{-8} = -1 \\ 5 = a + 4(-1) \\ a = 9 \\ a_n = 9 + (n - 1)(-1) \\ a_n = 9 + 1 - n \\ a_n = 10 - n \\ a_{16} = 9 + (16 - 1)(-1) \\ a_{16} = 9 - 15 = -6 \end{array}$$

(b) $S = 100 + 200 + 400 + \dots$ Upto 12 terms

$$a = 100, \quad r = \frac{200}{100} = 2, \quad n = 12$$
$$S_n = \frac{a(r^n - 1)}{r - 1}$$
$$S_n = \frac{100(2^{12} - 1)}{2 - 1} = 409,500$$

QUESTION NO. 8

$$n = 10$$

$$P = 200,000$$

Option A $\rightarrow i = 1.5\%$ (3 months compounded)

Option B $\rightarrow i = 3.2\%$ (6 months compounded)

$$n = 10 \times 4 = 40$$

$$n = 10 \times 2 = 20$$

$$\text{A option C.I} = P[(1+i)^n - 1]$$

$$= 200,000 \left[\left(1 + \frac{0.015}{4} \right)^{40} - 1 \right]$$

$$= 32,301.67$$

$$\text{B option C.I} = 200,000 \left[\left(1 + \frac{0.032}{4} \right)^{40} - 1 \right]$$

$$= 74,728.78$$