# Solved Paper 2015

## QUESTION NO. 1

| Monthly Income | f | x | D | fD | $fD^2$ | C.f | Regrouping C – B |
|---|---|---|---|---|---|---|---|
| 110-119 | 2 | 114.5 | -40 | -80 | 3200 | 2 | 109.5-119.5 |
| 120-129 | 4 | 124.5 | -30 | -120 | 3600 | 6 | 119.5-129.5 |
| 130-139 | 17 | 134.5 | -20 | -340 | 6800 | 23 | 129.5-139.5 |
| 140-149 | 28 | 144.5 | -10 | -280 | 2800 | 51 | 139.5-149.5 |
| 150-159 | 25 | 154.5 | 0 | 0 | 0 | 76 | 149.5-159.5 |
| 160-169 | 18 | 164.5 | 10 | 180 | 1800 | 94 | 159.5-169.5 |
| 170-179 | 13 | 174.5 | 20 | 260 | 5200 | 107 | 169.5-179.5 |
| 180-189 | 6 | 184.5 | 30 | 180 | 5400 | 113 | 179.5-159.5 |
| 190-199 | 5 | 194.5 | 40 | 200 | 8000 | 118 | 189.5-199.5 |
| 200-209 | 2 | 204.5 | 50 | 100 | 5000 | 120 | 199.5-209.5 |
| | 120 | | 100 | 41800 | | | |

$$\bar{x} = P.M + \frac{\Sigma fD}{\Sigma f}$$

$$= 154.5 + \frac{100}{120}$$

$$= 154.5 + 0.8333$$

$$= 155.333$$

$$\sigma^2 = \frac{\Sigma f D^2}{\Sigma f} - \left(\frac{\Sigma f}{\Sigma f}\right)^2$$

$$= \frac{41800}{120} - \left(\frac{100}{120}\right)^2$$

$$= 348.3333 - (0.833)^2$$

$$= 348.3333 - 0.6944$$

$$= 347.639$$

$$\sigma = \sqrt{347.639} = 18.645$$

$$\text{Median} = l + \frac{c}{f}\left(\frac{n}{2} - c\right) \qquad \frac{n}{2} = \frac{120}{2} = 60$$

$$=149.5 + \frac{10}{25}(60 - 51)$$

$$= 149.5 + 3.6 = 153.1$$

Pearson's coefficient of S.K:

$$\text{S.K.} = \frac{3(Mean - Median)}{S.D}$$

$$= \frac{3(155.333 - 153.1)}{18.645}$$

$$= \frac{3(2.233)}{18.645} = \frac{6.699}{18.645} = 0.359$$

## QUESTION NO. 2

(a) S = HH, HT, TH, TT and A = HH, HT, TH

Probability of getting at least one head = $\frac{n(A)}{n(S)} = \frac{3}{4}$

(b) Chi-square = $\sum \frac{(f_o - f_e)^2}{f_e}$

| $f_o$ | $f_e$ | $f_o - f_e$ | $(f_o - f_e)^2$ | $(f_o - f_e)^2/f_e$ |
|---|---|---|---|---|
| 40 | 46.67 | -6.67 | 44.4889 | 0.953 |
| 18 | 13.48 | 4.52 | 20.4304 | 1.516 |
| 12 | 9.85 | 2.15 | 4.6225 | 0.469 |
| 50 | 43.33 | 6.67 | 44.4889 | 1.027 |
| 8 | 12.52 | -4.52 | 20.4304 | 1.632 |
| 7 | 9.15 | -2.15 | 4.6225 | 0.502 |
| | | | | 6.102 |

| $f_o$ | | | | |
|---|---|---|---|---|
| | **Recovered** | **No Change** | **Died** | **Total** |
| Drug A | 40 | 18 | 12 | 70 |
| Drug B | 50 | 8 | 7 | 65 |
| Total | 90 | 26 | 19 | 135 |

| $f_o$ |
|---|

| | Recovered | No Change | Died | Total |
|---|---|---|---|---|
| Drug A | 46.67 | 13.48 | 9.85 | 70 |
| Drug B | 43.33 | 12.52 | 9.15 | 65 |
| Total | 90 | 26 | 19 | 135 |

Chi-square $= \sum \frac{(f_o - f_e)^2}{f_e} = 6.102$

$x^2_{cal} = 6.099 > 5.99$ table value so we reject $H_o$.

## QUESTION NO. 3

| | Base year | | Current year | | $p_1q_o$ | $p_oq_o$ | $p_1q_1$ | $p_oq_1$ |
|---|---|---|---|---|---|---|---|---|
| | $p_o$ | $q_o$ | $p_1$ | $q_1$ | | | | |
| A | 9 | 10 | 11 | 5 | 110 | 90 | 55 | 45 |
| B | 6 | 80 | 9 | 100 | 720 | 480 | 900 | 600 |
| C | 3 | 17 | 2 | 20 | 34 | 51 | 40 | 60 |
| D | 9 | 20 | 7 | 15 | 140 | 180 | 105 | 135 |
| E | 6 | 30 | 8 | 40 | 240 | 180 | 320 | 240 |
| Total | - | - | - | - | 1244 | 981 | 1420 | 1080 |

Laspeyr's $= \frac{\sum p_1q_o}{\sum p_oq_o} \times 100 = \frac{1244}{981} \times 100 = 126.81$

Paasche's $= \frac{\sum p_1q_1}{\sum p_oq_1} \times 100 = \frac{1420}{1080} \times 100 = 131.48$

Marahall $= \frac{\sum p_1q_o + \sum p_1q_1}{\sum p_oq_o + \sum p_oq_1} \times 100$

$= \frac{1244+1420}{981+1080} \times 100$

$= \frac{2664}{2061} \times 100 = 129.26$

Fisher's $= \sqrt{\frac{\sum p_1q_0}{\sum p_oq_0} \times \frac{\sum p_1q_1}{\sum p_oq_1}} \times 100$

$= \sqrt{\frac{1244}{981} \times \frac{1420}{1080}} \times 100$

$= \sqrt{1.667308491}$ x 100

$= 129.12$

## QUESTION NO. 3

$x = 3 + 6 + 9 + 12 + 15 + 18 = 63\ (\sum x)$

$x^2 = 9 + 36 + 81 + 144 + 225 + 324 = 819\ (\sum x^2)$

(i) $\mu = \frac{\sum x}{n} = \frac{63}{6} = 10.5$

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

$= \sqrt{\frac{819}{6} - \left(\frac{63}{6}\right)^2} = \sqrt{136.5 - 110.5}$

$= \sqrt{26.25} = 5.123$

| Samples | Samples Mean | $\bar{x}$ | f | $f\bar{x}$ | $f(\bar{x})^2$ |
|---|---|---|---|---|---|
| 3, 6 | 4.5 | 4.5 | 1 | 4.5 | 20.25 |
| 3, 9 | 6.0 | 6.0 | 1 | 6.0 | 36.00 |
| 3, 12 | 7.5 | 7.5 | 2 | 15.0 | 112.50 |
| 3, 15 | 9.0 | 9.0 | 2 | 18.0 | 162.00 |
| 3, 18 | 10.5 | 10.5 | 3 | 31.5 | 300.75 |
| 6, 9 | 7.5 | 12.0 | 2 | 24.0 | 288.00 |
| 6, 12 | 9.0 | 13.5 | 2 | 27.0 | 364.50 |
| 6, 15 | 10.5 | 15.0 | 1 | 15.0 | 225.0 |
| 6, 18 | 12.0 | 16.5 | 1 | 16.5 | 272.25 |
| 9, 12 | 10.5 | | | | |
| 9, 15 | 12.0 | | | | |
| 9, 18 | 13.5 | | | | |
| 12, 15 | 13.5 | | | | |
| 12, 18 | 15.0 | | | | |
| 15, 18 | 16.5 | | | | |
| | | | | 157.5 | 1811.25 |

$\mu_{\bar{x}} = \frac{\sum f\bar{x}}{\sum f} = \frac{63}{6} = 10.5$

$$\sigma_{\bar{x}} = \sqrt{\frac{\sum f(\bar{x})^2}{\sum f} - \frac{\sum f\bar{x}}{\sum f}}$$

$$= \sqrt{\frac{181.25}{15} - \frac{157.5}{15}}$$

$$= \sqrt{120.75 - 110.25}$$

$$= \sqrt{10.5} = 3.24$$

## QUESTION NO. 5

$$A = \begin{bmatrix} 13 & 2 & -6 \\ -3 & 9 & 0 \\ 8 & 4 & -1 \end{bmatrix} \text{ and } B = \begin{bmatrix} 11 & -2 & 6 \\ 9 & -14 & 3 \\ -4 & 8 & 5 \end{bmatrix}$$

(i) $A + 2B = \begin{bmatrix} 13 & 2 & -6 \\ -3 & 9 & 0 \\ 8 & 4 & -1 \end{bmatrix} + 2\begin{bmatrix} 11 & -2 & 6 \\ 9 & -14 & 3 \\ -4 & 8 & 5 \end{bmatrix}$

$$= \begin{bmatrix} 35 & -2 & 6 \\ 15 & -19 & 6 \\ 0 & 20 & 9 \end{bmatrix}$$

(ii) $3A - 4B = \begin{bmatrix} 39 & 6 & -18 \\ -9 & 27 & 0 \\ 24 & 12 & -3 \end{bmatrix} - \begin{bmatrix} 44 & -8 & 24 \\ 36 & -56 & 12 \\ -16 & 32 & 20 \end{bmatrix}$

$$= \begin{bmatrix} -5 & 14 & -42 \\ -45 & 83 & -12 \\ 40 & -20 & -23 \end{bmatrix}$$

(iii) $AB = \begin{bmatrix} 43+18+24 & -26-28-48 & 78+6-30 \\ -33+81+0 & 6-126+0 & -18+27+ \\ 88+36+4 & -16-56-8 & 48+12-5 \end{bmatrix}$

$$= \begin{bmatrix} 185 & -102 & 54 \\ 48 & -120 & 9 \\ 128 & -80 & 55 \end{bmatrix}$$

## QUESTION NO. 6

(a) $\frac{2}{x} + \frac{3}{y} = 2$ .....(i) $\frac{8}{x} + \frac{9}{y} = 7$ .....(ii)

Putting value if y in (i);

$\frac{2}{x} + \frac{3}{y} = 2$

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

$x = 2 \times 1 = 2$

S.S. = {x=2, y=3}

$\frac{8}{x} + \frac{9}{y} = 8$

$-\frac{3}{y} = -1$

$y = \frac{-3}{-1} = 3$

(b) Suppose speed of car = x, then

$\frac{210}{x} - \frac{210}{x-5} = 1$

$210(x + 5) - 210x = 1[x(x + 5)]$

$210x + 1050 - 210x = x^2 + 5x$

$x^2 + 5x - 1050 = 0$

$x^2 + 35x - 30x - 1050 = 0$

$x(x + 35) - 30(x + 35) = 0$

$(x + 35)(x - 30) = 0$

$x - 30 = 0$ or $x + 35 = 0$

$x = 30$ or $x = -35$ (not possible)

$x = 30$ km per hour (Speed of the car)

Time taken $= \frac{210km}{30km} = 7$ hours

## QUESTION NO. 7

The A.P is 30, 35, 40, ….n terms

$S = 30 + 35 + 40 + \ldots. +$ upto n terms

$a = 30$

$d = 35 - 30 = 5$

$S_n = 3075$

$S_n = \frac{n}{2}[2a + (n-1)d]$

$3075 = \frac{n}{2}[2 \times 30 + (n-1)5]$

$= \frac{n}{2}[60 + 5n - 5]$

$3075 \times 2 = (60n + 5n^2 - 5n)$

$6150 = 5n^2 + 55n$

$5n^2 + 55n - 6150 = 0$

$n^2 + 11n - 1230 = 0$

$n^2 + 11n - 30n - 1230 = 0$

$n(n + 11) - 30(n + 41) = 0$

$(n + 41)(n - 30) = 0$

$n - 30 = 0$ or $n + 41 = 0$

$n = 30$ or $n = -41$ (not possible)

Thus (the well can be drilled upto 30 feet deep for Rs. 3075)



## QUESTION NO. 8

$R$ = Rs. 500 (at the end of each quarter, it is ordinary annuity)

$S$ = Sum of annuity = Rs. 10,000

$I$ = Rate of interest = $\frac{0.05}{4}$ = 0.0125 per quarter

Now, $S = R\left[\frac{(1+i)^n - 1}{i}\right]$

$$10{,}000 = 500\left[\frac{(1+0.0125)^n-1}{0.0125}\right]$$

$$\frac{10{,}000}{500} = \frac{(1.0125)^n-1}{0.0125}$$

$$0.0125 \times 20 = \frac{(1.0125)^n-1}{1}$$

$$(1.0125)^n = 1.25$$

$$n \log (1.0125) = \log 1.25$$

$$n = \frac{\log 1.25}{\log 1.0125}$$

$$= 17.96 \text{ or } 18$$

$$= 18 \text{ deposits approx.}$$