1

SET – 2 Q.P. Code : 33885

Q-1(a) 2 MKs each

i) False
Rank correlation coefficient was developed by Spearman.

ii) False
Regression coefficients are independent of change origin and not of scale.

iii) True

iv) False
Splicing is a technique of linking two or more index number series.

v) False
Fisher's Index is known as Ideal Index.

Q-1(b) 2 MKs each

i) The coefficient of determination is defined as the ratio of the explained variance to the total variance & it lies betn 0 and 1.

ii) $b_{xy} = r \cdot \frac{\sigma_x}{\sigma_y}$ & $b_{yx} = r \cdot \frac{\sigma_y}{\sigma_x}$

Regression Coeff. of X on Y — Regression Coeff. of Y on X

iii) Models of Time Series
Additive Model $Y = T + S + C + I$
Multiplicative Model $Y = T \times S \times C \times I$

iv) Dorbish and Bowley index is arithmetic mean of laspeyre's and Paasche's index is

v) Circular test is an extension of Time Reversal Test.

Q-2 a) 2 + 2 + 6 Mks

b) 6 + 4

c) $2x - y - 15 = 0$

$3x - 4y + 25 = 0$

ie $6x - 3y - 45 = 0$

$6x - 8y + 50 = 0$

$5y - 95 = 0$

$y = \frac{95}{5} = 19$

$2x = 15 + 19$

$x = \frac{34}{2} = 17$

$\therefore \bar{x} = 17$ & $\bar{y} = 19$ — 4 Mks

Let $2x - y - 15 = 0$ be regression $eq^n$ of $y$ on $x$

$y = 2x - 15 = -15 + 2x \Rightarrow b_{yx} = 2$

& $3x - 4y + 25 = 0$ be regression $eq^n$ of $x$ on $y$

$3x = -25 + 4y \Rightarrow x = \frac{-25}{3} + \frac{4}{3}y \Rightarrow b_{xy} = \frac{4}{3}$

$r = +\sqrt{b_{yx} \cdot b_{xy}} = +\sqrt{2 \times \frac{4}{3}} = \sqrt{\frac{8}{3}} = 1.6329$

$\because r$ lies $bet^n$ $-1$ & $+1$.

$\therefore 2x - y - 15 = 0$ be regression $eq^n$ of $x$ on $y$

$\Rightarrow 2x = y + 15 \Rightarrow x = \frac{15}{2} + \frac{y}{2} \Rightarrow b_{xy} = \frac{1}{2}$

& $3x - 4y + 25 = 0$ be regression $eq^n$ of $y$ on $x$

$4y = 25 + 3x$

$y = \frac{25}{4} + \frac{3}{4}x \quad \therefore b_{yx} = \frac{3}{4}$

$r = +\sqrt{b_{yx} \times b_{xy}} = 0.6124 =$ Coeff. of Correlation

$\rightarrow$ 6 Mks

Q-2 d) 4 + 6 MKs

* Curve fitting → 4 MKs

* To fit Power Curve $y = ax^b$

| $x$ | $y$ | $X = \log_e x$ | $Y = \log_e y$ | $X^2$ | $XY$ |
|---|---|---|---|---|---|
| 1 | 0.7 | 0 | −0.3567 | 0 | 0 |
| 2 | 0.86 | 0.6931 | −0.1508 | 0.4804 | −0.1045 |
| 3 | 0.97 | 1.0986 | −0.0305 | 1.2069 | −0.0335 |
| 4 | 1.06 | 1.3863 | 0.0583 | 1.9218 | 0.0808 |
| | | 3.1780 | −0.4797 | 3.6091 | −0.0572 |

↳ 2 MKs

~~A = −0.3573~~

$$\log_e y = \log_e a + b \log_e x$$

$$Y = A + bX$$

The normal eqⁿs are

$$\Sigma Y = nA + b\Sigma X$$

$$\Sigma XY = A\Sigma X + b\Sigma X^2$$

— 2 MKs

$\Rightarrow A = -0.3573$ ; $b = 0.2988$

$a = \text{Antilog}_e A = 0.6996$

$\therefore$ The curve is $y = 0.6996\, x^{0.2988}$ ↳ 2 MKs

Note: Full Credit can be given to the final answer by using $\log_{10}$.

Q-3 a) 12 + 2 + 6 MKs

b) i) 6 MKs

ii) Next Page

$$S.I. = \frac{\text{Average}}{\text{Grand Average}} \times 100$$

Computation of Seasonal Indices: (5)

| Year | 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter | |
|---|---|---|---|---|---|
| 2001 | 72 | 68 | 80 | 70 | |
| 2002 | 76 | 70 | 82 | 74 | |
| 2003 | 74 | 66 | 84 | 80 | |
| 2004 | 76 | 74 | 84 | 78 | |
| 2005 | 78 | 74 | 86 | 82 | |
| Total | 376 | 352 | 416 | 384 | Grand |
| 2MKs → Average | 75.2 | 70.4 | 83.2 | 76.8 | Average = 76.40 |
| 2MKs → S.I. | 98.43 | 92.15 | 108.9 | 100.52 | 400 |

c) 

| Year | Values(y) | 5-yearly moving totals | 5-yearly moving average |
|---|---|---|---|
| 1999 | 105 | – | – |
| 2000 | 107 | – | – |
| 2001 | 109 | 547 | 109.4 |
| 2002 | 112 | 558 | 111.6 |
| 2003 | 114 | 569 | 113.8 |
| 2004 | 116 | 581 | 116.2 |
| 2005 | 118 | 592 | 118.4 |
| 2006 | 121 | 602 | 120.4 |
| 2007 | 123 | 611 | 122.2 |
| 2008 | 124 | 620 | 124.0 |
| 2009 | 125 | 628 | 125.6 |
| 2010 | 127 | – | – |
| 2011 | 129 | – | – |

← 5MKs

Advantages & disadvantages — 5 MKs

d) $2\frac{1}{2}$ MKs each

Q-4

a) 3 + 7 Mks

b) 3+3+4 Mks

c)

| Commodity | $P_0$ | $P_1$ | W | $WP_0$ | $WP_1$ | $I=\frac{P_1}{P_0}\times 100$ | IW |
|---|---|---|---|---|---|---|---|
| A | 25 | 40 | 10 | 250 | 400 | 160 | 1600 |
| B | 10 | 12 | 3 | 30 | 36 | 120 | 360 |
| C | 12 | 15 | 3 | 36 | 45 | 125 | 375 |
| D | 13 | 20 | 2 | 26 | 40 | 153.8462 | 307.6924 |
| E | 20 | 25 | 2 | 40 | 50 | 125 | 250 |
| | | | 20 | 382 | 571 | | 2892.6924 |

i) Price Index No. using weighted aggregate method $= I_{01} = \frac{\Sigma WP_1}{\Sigma WP_0} \times 100 = \frac{571}{382} \times 100$

$= \underline{149.4764}$ — 3 Mks

ii) Price Index No. using weighted av. of price relative $= \frac{\Sigma IW}{\Sigma W} = \frac{2892.6924}{20} = \underline{144.6346}$ → 3 Mks

- shifting of base → 4 Mks

d)

| Commodity | $P_0$ | $q_0$ | $P_1$ | $q_1$ | $P_0q_0$ | $P_1q_0$ | $P_0q_1$ | $P_1q_1$ |
|---|---|---|---|---|---|---|---|---|
| A | 2 | 40 | 5 | 75 | 80 | 200 | 150 | 375 |
| B | 4 | 16 | 6 | 40 | 64 | 96 | 160 | 240 |
| C | 1 | 10 | 2 | 24 | 10 | 20 | 24 | 48 |
| D | 5 | 25 | 7 | 60 | 125 | 175 | 300 | 420 |
| E | 6 | 15 | 10 | 20 | 90 | 150 | 120 | 200 |
| | | | | | 369 | 641 | 754 | 1283 |

→ 2 Mks

i) Laspayre's Price I.N. $= \frac{\Sigma P_1q_0}{\Sigma P_0q_0} \times 100 = \frac{641}{369} \times 100$

$I_{01}^{L} = \underline{173.7127}$ → 1 Mks

ii) Paasche's Price I.N. $= \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1} \times 100 = \frac{1283}{754} \times 100$

$I_{01}^{P} = \underline{\underline{170.1591}} \longrightarrow$ 1-MK

iii) Fisher's Price I.N. $= \sqrt{I_{01}^{L} \times I_{01}^{P}}$

$I_{01}^{F} = \sqrt{173.7127 \times 170.1591} = \underline{171.9267}$ ← 1-MK

iv) Marshal Edgeworth Price I.N.

$I_{01}^{ME} = \frac{\Sigma p_1 q_0 + \Sigma p_1 q_1}{\Sigma p_0 q_0 + \Sigma p_0 q_1} \times 100 = \frac{641 + 1283}{369 + 754} \times 100$

$= \frac{1924}{1123} \times 100 = \underline{\underline{171.3268}}$ ← $\boxed{\text{1-MK}}$

$Q_{10}^{F} = \sqrt{\frac{\Sigma p_0 q_1}{\Sigma p_0 q_0} \times \frac{\Sigma p_1 q_1}{\Sigma p_1 q_0}} \times 100 = \sqrt{\frac{754}{369} \times \frac{1283}{641}} \times 100 = \underline{\underline{202.2352}}$

$V_{01} = \frac{\Sigma p_1 q_1}{\Sigma p_0 q_0} \times 100 = \frac{1283}{369} \times 100 = 347.6965$

$I_{10}^{F} = \sqrt{\frac{\Sigma p_0 q_1}{\Sigma p_1 q_1} \times \frac{\Sigma p_0 q_0}{\Sigma p_1 q_0}} \times 100 = \sqrt{\frac{754}{1283} \times \frac{369}{641}} \times 100 = \underline{\underline{58.1643}}$

* Time Reversal Test for Fisher

$\frac{I_{01}^{F}}{100} \times \frac{I_{10}^{F}}{100} = \frac{171.9267}{100} \times \frac{58.1643}{100} = 0.9999 \simeq 1$

$\Rightarrow$ Fisher's I.N. satisfy time reversal test. ← 2Mks

* Factor Reversal Test for Fisher

$\frac{P_{01}^{F}}{100} \times \frac{Q_{01}^{F}}{100} = \frac{171.9267}{100} \times \frac{202.2352}{100} = 3.4769 = \frac{V_{01}}{100}$

$\Rightarrow$ Fisher's I.N. satisfy Factor Reversal Test. ← 2Mks

Q-5 a) Spearman Rank Correlation Coeff. is $R = 1 - \frac{6\sum d_i^2}{n(n^2-1)}$

$$0.8 = 1 - \frac{6 \times 33}{n(n^2-1)}$$

$$\Rightarrow 0.2 = \frac{198}{n(n^2-1)}$$

$$\Rightarrow n(n^2-1) = \frac{198}{0.2} = 990$$

By trial & error

$$990 = 10(10^2-1)$$

$$\Rightarrow n = 10$$

— 5 MKS

b) i) — $2\frac{1}{2}$ MKS

ii) — $2\frac{1}{2}$ MKS

c)

| Year | Price I. No. | Index No. Base 1990 | Index No. (Base 1994) |
|---|---|---|---|
| 1990 | 70 | $\frac{70}{70} \times 100 = 100$ | $\frac{70}{120} \times 100 = 58.33$ |
| 1991 | 82 | $\frac{82}{70} \times 100 = 117.14$ | $\frac{82}{120} \times 100 = 68.33$ |
| 1992 | 90 | $\frac{90}{70} \times 100 = 128.57$ | $\frac{90}{120} \times 100 = 75.00$ |
| 1993 | 104 | $\frac{104}{70} \times 100 = 148.57$ | $\frac{104}{120} \times 100 = 86.67$ |
| 1994 | 120 | $\frac{120}{70} \times 100 = 171.43$ | $\frac{120}{120} \times 100 = 100$ |
| 1995 | 131 | $\frac{131}{70} \times 100 = 187.14$ | $\frac{131}{120} \times 100 = 109.17$ |
| 1996 | 146 | $\frac{146}{70} \times 100 = 208.57$ | $\frac{146}{120} \times 100 = 121.67$ |
| 1997 | 160 | $\frac{160}{70} \times 100 = 228.57$ | $\frac{160}{120} \times 100 = 133.33$ |
| 1998 | 180 | $\frac{180}{70} \times 100 = 257.14$ | $\frac{180}{120} \times 100 = 150$ |

↳ $2\frac{1}{2}$ MKS    ↳ $2\frac{1}{2}$ MKS

d) 5 MKs

e)

| Year | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|
| Sales (thousand units) | 100 | 105 | 109 | 96 | 102 | 108 | 112 | 114 |
| Semi Average | | 102.5 | | | | 109 | | |

— 2MKs

Graph - 1MK

From graph, sales for the year 2011 = 116 thousand units

↳ 2MKS

f) $r = 1 - \frac{6\Sigma d_i^2}{n(n^2-1)}$ ⟶ 1 MK

$0.5 = 1 - \frac{6\Sigma d_i^2}{10 \times 99}$

$\frac{6\Sigma d_i^2}{990} = 0.5 \Rightarrow \Sigma d_i^2 = 82.5$ — 1 MK

Correct $\Sigma d_i^2 = 82.5 - 3^2 + 7^2 = 122.5$ — 1 MK

$r = 1 - \frac{6(\text{Correct } \Sigma d_i^2)}{990}$

$= 1 - \frac{6 \times 122.5}{990} = 0.2576$ — 2MKs

g) 5 MKs