(1)

Q. P. Code : 33889 Set-6

Duration: Three Hours

Maximum Marks: 100

N.B.: 1 All questions are compulsory.

2 Use of simple calculator is allowed.

| | | | |
|---|---|---|---|
| Q.1 | (a) | Correct the following if necessary | 10 |
| | | i) The given statement is incorrect. The coefficient of determination is the ratio of explained variation to the total variation. | 02 |
| | | ii) The given statement is incorrect. Any relevent statement to correct it. | 02 |
| | | iii) The given statement is incorrect. Any relevent statement to correct it. | 02 |
| | | iv) The given statement is incorrect. Any relevent statement to correct it | 02 |
| | | v) The given statement is incorrect. Marshall-Edgeworth's index number does not satisfies factor reversal test. | 02 |
| | (b) | Answer in one sentence: | 10 |
| | | i) w.k.t, $r^2 = b_{xy} * b_{yx} = 0.28 * 2.8 = 0.784$ <br> $r = \sqrt{b_{xy} * b_{yx}} = \sqrt{0.784} = 0.8854$ | 02 |
| | | ii) - Perfect correlation / Perfect negative correlation. <br> - Two regression line coincide and same <br> (Any one point) | 02 |
| | | iii) Time Series is the arragement of statistical data in chronological order. —— (01 Mark) <br> Any one example of time series —— (01 Mark) | 02 |
| | | iv) These are the price relatives and are obtained by dividing the price in a given year $P_i$ by base year price $P_0$. <br> $P_{0i} = \frac{P_i}{P_0} \times 100$ | 02 |
| | | v) Fisher's index number is ideal index number since it satisfies time reversal test and factor reversal test. | 02 |

2

| Q.2 | Attempt any Two | | 20 |
|---|---|---|---|
| | (a) | Description of scatter diagram —— (03 Marks)<br>Interpretation of relationship from scatter diagram —— (05 Marks)<br>Merits of scatter diagram —— (02 Marks) | 10 |
| | (b) | Defination of Karl Pearson's product moment correlation coefficient —— (02 Marks) [with formula]<br>Properties of correlation coefficient (any four properties) —— (04 marks)<br>Merits of correlation coefficient —— (02 Marks)<br>Demerits of $r$ —— (02 Marks) | 10 |
| | (c) | i) Proof of<br>$Corr\left(\frac{X-a}{c}, \frac{Y-b}{d}\right) = Corr(X,Y)$ -- if $c$ & $d$ have same sign<br>$Corr\left(\frac{X-a}{c}, \frac{Y-b}{d}\right) = -Corr(X,Y)$ -- if $c$ & $d$ have different sign | 05 |
| | | ii) $r = \frac{n\sum xy - \sum x \sum y}{\sqrt{\left(n\sum x^2-(\sum x)^2\right)\left(n\sum y^2-(\sum y)^2\right)}}$<br>$r = 0.8507$ —— (04 Marks)<br>There is strong positive correlation betn mark in math & stats —— (01 Mark) | 05 |
| | (d) | Procedure for fitting power curve ($y=ax^b$) by least square method —— (04 Marks)<br>$y = ax^b$<br>take $\log_{10}$ or $\log_e$<br>$\log y = \log a + b \log x$<br>$w = A + bz$<br>So normal eqn are<br>$\sum w = nA + b\sum z$<br>$\sum wz = A\sum z + b\sum z^2$<br>**By using $\log_{10}$ :-**<br>$\sum w = 5.08379, \sum z = 1.6531$<br>$\sum wz = 4.2654, \sum z^2 = 1.3988$<br>By solving normal eqn<br>$b = 3.008$, $A = 0.0410$<br>So $a = 1.0990$<br>Eqn is<br>$y = 1.099\, x^{3.008}$<br>**By using $\log_e$ :**<br>$\sum w = 11.7059, \sum z = 3.8067$<br>$\sum wz = 22.6171, \sum z^2 = 7.4181$<br>By solving normal eqn<br>$b = 3.000057$, $A = 0.095193$<br>So $a = 1.0998721$<br>So eqn is<br>$y = 1.0998\, x^{3.0005}$<br>**Perfect eqn is $y = 1.1x^3$** | 10 |

error may be due to the rounding credit full marks

Note: Solve by any one $\log_e$ or $\log_{10}$ —— (06 marks)

(3)

| Q.3 | Attempt any Two | | 20 |
|---|---|---|---|
| | (a) | Components of time series<br>Trend, Seasonal, Cyclical & Random — (02 marks each)<br>Any two uses of time series —— (02 marks) | 10 |
| | (b) | See the table and seasonal indices below (07 marks) | 10 |
| | (c) | i) See the working below | 06 |
| | | ii) Any two merits of least square method for determining trend — (02)<br>Any two demerits or — (02) | 04 |
| | (d) | Method of simple average for estimation of seasonal variation<br>Method — (03 marks)<br>Any two merits —— (02 marks)<br>Method of ratio to trend method for estimation of seasonal variation<br>Method —— (03 Marks)<br>Any two merits ——(02 marks) | 10 |

**(b)**

| Year | Quarter | Prod^n | 4 period MA | 2 Point MA | Ratio to MA |
|---|---|---|---|---|---|
| 2010 | I | 75 | — | — | — |
| | II | 60 | 62 | — | — |
| | III | 54 | 64.75 | 63.375 | 85.2071 |
| | IV | 59 | 66 | 65.375 | 90.2485 |
| 2011 | I | 86 | 68.25 | 67.125 | 128.119 |
| | II | 65 | 73.5 | 70.875 | 91.710 |
| | III | 63 | 74.5 | 74.015 | 85.135 |
| | IV | 80 | 76.25 | 75.375 | 106.135 |
| 2012 | I | 90 | 77 | 76.625 | 117.455 |
| | II | 72 | 78.25 | 77.625 | 92.7536 |
| | III | 66 | 80.75 | 79.5 | 83.0188 |
| | IV | 85 | 82.25 | 81.5 | 104.2944 |
| 2013 | I | 100 | 83.75 | 83 | 120.4819 |
| | II | 78 | 85.75 | 84.5 | 92.3076 |
| | III | 72 | — | — | — |
| | IV | 93 | — | — | — |

(07 marks)

Seasonal Indices

| I | II | III | IV |
|---|---|---|---|
| 122.0186 | 92.2571 | 84.4536 | 100.2259 |

— (02)

Adjusted seasonal indices

| I | II | III | IV |
|---|---|---|---|
| 122.3381 | 92.4987 | 84.6748 | 100.8484 |

— (01)

**(c) i)** Eq^n of line : Prod : Y & Year : X

$Y = a + bX$

so normal eq^n are

$\Sigma y = na + b\Sigma x$

$\Sigma xy = a\Sigma x + b\Sigma x^2$ — (01)

So $\Sigma x = 14105$, $\Sigma x^2 = 28421603$

$\Sigma y = 652$, $\Sigma xy = 1313968$ — (01)

By solving eq^n we get

$a = -13436.14286$

$b = 6.714285$ — (02)

so straight line eq^n is

$y = -13436.14286 + 6.714285x$

Trend values : 72.99851, 79.7128, 86.42713, 93.141415, 99.8557, 106.5699, 113.2843 — (02)

| Q.4 | Attempt any Two | | | 20 |
|---|---|---|---|---|
| | (a) | i) | Defination of Index Number —— (01 mark)<br>Any ~~three~~ 4 uses of index number —— (04 marks) | 05 |
| | | ii) | Def^n of chain base index number (CBIN) —— (01)<br>Advantages & disadvantage — (any two) —— (04 marks) | 05 |
| | (b) | i) | Method for calculating index number by<br>• simple aggregate method<br>• simple average of price relatives<br>• weighted aggregate method<br>} (02 marks each) | 06 |
| | | ii) | Formula's for backward and forward splicing —— (02 marks) | 04 |

| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|
| Series A | 100 | 105 | 122 | 130 | 136.5 | 143 | 158.6 |
| Series B | 76.9230 | 80.7692 | 93.8461 | 100 | 105 | 110 | 122 |

—(½ mark for each value)

**(c) i)** (06)

$$P_{01}^{La} = \frac{\Sigma P_1 q_0}{\Sigma P_0 q_0} \times 100 = \frac{725}{510} \times 100 = 142.1568 \quad \text{—— (02)}$$

$$P_{01}^{Pa} = \frac{\Sigma P_1 q_1}{\Sigma P_0 q_1} \times 100 = \frac{935}{660} \times 100 = 141.6667 \quad \text{—— (02)}$$

$$P_{01}^{F} = \sqrt{P_{01}^{L} \cdot P_{01}^{Pa}} = 141.91148 \quad \text{—— (02)}$$

**ii)** (04)

Index number by simple aggregate method -

$$= \frac{\Sigma P_1}{\Sigma P_0} \times 100$$

so,

$$160 = \frac{\Sigma P_1}{\Sigma P_0} \times 100$$

$$160 = \frac{192}{84 + x} \times 100$$

It gives

$$\boxed{x = 36}$$

So price of commodity A in base year is 36.

**(d)** (10)

Index number is said to be satisfies time reversal test if

$$P_{01} \times P_{10} = (100)^2$$

Fisher's IN :

$$P_{01}^{F} = \sqrt{\frac{\Sigma P_1 q_0}{\Sigma P_0 q_0} \times \frac{\Sigma P_1 q_1}{\Sigma P_0 q_1}} \times 100$$

$$P_{10}^{F} = \sqrt{\frac{\Sigma P_0 q_1}{\Sigma P_1 q_1} \times \frac{\Sigma P_0 q_0}{\Sigma P_1 q_0}} \times 100$$

So, $P_{01}^{F} \times P_{10}^{F} = (100)^2$

So, Fisher's IN satisfies time reversal test —— (05)

Marshall - Edgeworth's IN :

$$P_{01}^{ME} = \frac{\Sigma P_1 q_1 + \Sigma P_1 q_0}{\Sigma P_0 q_1 + \Sigma P_0 q_0} \times 100$$

$$P_{10}^{ME} = \frac{\Sigma P_0 q_0 + \Sigma P_0 q_1}{\Sigma P_1 q_0 + \Sigma P_1 q_1} \times 100$$

So, $P_{01}^{ME} \times P_{10}^{ME} = (100)^2$

So, Marshall Edgeworth's IN satisfies time reversal test. —— (05)

5

| Q.5 | Attempt any Four | | 20 |
|---|---|---|---|
| | (a) | Correct values : $\Sigma x = 172$, $\Sigma y = 186$, $\Sigma xy = 5219$, $\Sigma x^2 = 5182$, $\Sigma y^2 = 5886$ — (03)<br>$r = \dfrac{n\Sigma xy - \Sigma x \Sigma y}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]}} = -0.65067$<br>— (02) | 05 |
| | (b) | ~~Distin~~ Discussion about Spearman's Rank Correlation Def^n, formula with repeated obs^ns & not repeated obs^s — (05 Marks) | 05 |
| | (c) | Any three point for distinguish betn correlation & regression. | 05 |
| | (d) | Addeditive model of time series } (03 marks)<br>Multiplicative model of time series }<br>Multiplicative model is more popular. — (01 Mark)<br>Reason — (01 Mark) | 05 |
| | (e) | Def^n secular trend. — (01)<br>Any one method for determining trend — (04) | 05 |
| | (f) | Let $x$ be a group index for A.<br>Cost of living index number $= \dfrac{\Sigma wI}{\Sigma w}$<br>$215 = \dfrac{17648 + 18x}{98}$<br>$\Rightarrow \boxed{x = 190.1111}$ | 05 |
| | (g) | Real wages : $\dfrac{\text{monthly wages}}{CLI} \times 100$<br>Year : 2006 \| 2007 \| 2008 \| 2009<br>Real wages : 15000 \| 20000 \| 15000 \| 12500 (04)<br>Any reliable comment — (01) | 05 |

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