

OR iii. Explain the four components of time series.

6

Total No. of Questions: 6

Total No. of Printed Pages: 4

Q.6 Attempt any two:

- For the data given below, calculate the Index number by taking:
 a.) 1995 as the base year
 b.) 2002 as the base year
 c.) 1995 to 1997 as the base period

| Year | Price of Commodity (X) |
|------|------------------------|
| 1995 | 4 |
| 1996 | 5 |
| 1997 | 6 |
| 1998 | 7 |
| 1999 | 8 |
| 2000 | 10 |
| 2001 | 9 |
| 2002 | 10 |
| 2003 | 11 |

- Explain the definition of Index Number. Also write its advantages.

5

- Prepare Index numbers of price for three years with average price as base year from the data given:

| | Rate per rupee commodities | | |
|------|----------------------------|-------|-------|
| | A | B | C |
| 2001 | 10kg | 4kg | 3kg |
| 2002 | 9kg | 3.5kg | 3kg |
| 2003 | 9kg | 3kg | 2.5kg |

5

5

Enrollment No.....

Faculty of Commerce

End Sem Examination Dec-2023

CM3CO19 Business Statistics

Programme: B.Com.(Hons.) Branch/Specialisation: Commerce



Knowledge is Power

Duration: 3 Hrs.

Maximum Marks: 60

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

- Q.1 i. Which of the following is the example of Qualitative data? **1**
- (a) Total no. of student in a classroom (b) Age of 10 students
 (c) Clever student in a class (d) None of these
- ii. A Pie diagram is also known as- **1**
- (a) Pictogram (b) Angular diagram
 (c) Bar diagram (d) None of these
- iii. What is the maximum value if the Range is 38 & the minimum value is 82? **1**
- (a) 60 (b) 76 (c) 120 (d) None of these
- iv. If Mean and Mode of some data are 4 and 10 respectively, its Median will be- **1**
- (a) 16 (b) 6 (c) 5 (d) None of these
- v. If Coefficient of Correlation between two variables is given by $r = 0$ then, **1**
 which one is true for variables-
 (a) Positive Correlation (b) No Correlation
 (c) Negative Correlation (d) None of these
- vi. In the Equation of Regression Line $y = a + bx$, "b" indicates- **1**
 (a) Slope (b) Intercept
 (c) Variable (d) None of these
- vii. In Time series Seasonal Variation can occur within a period of- **1**
 (a) Four year (b) Three year
 (c) One year (d) None of these
- viii. A complete cycle consists of a period of- **1**
 (a) Prosperity and depression (b) Prosperity and recovery
 (c) Prosperity and recession (d) None of these
- ix. Cost of living Index is also known as- **1**
 (a) Consumer Price Index (b) Consumer Quantity Index
 (c) Industrial Quantity Index (d) None of these
- x. The time period for which an Index number is determined is known as: **1**
 (a) Base Period (b) Normal Period
 (c) Current Period (d) None of these

- Q.2 i. Write the definition of Pie chart with example. **2**

[2]

- ii. Draw histogram for the following table:

| Class | Frequency |
|-------|-----------|
| 2-4 | 3 |
| 4-8 | 50 |
| 8-14 | 44 |
| 14-16 | 34 |
| 16-20 | 25 |
| 20-24 | 32 |
| 24-26 | 12 |

Also find class width of each class.

- iii. Explain the scope of statistics in management and economy.

3

- OR iv. What is population and sample? Write difference between population & sample.

5

Q.3 Attempt any two:

- i. Find the median of the following frequency distribution-

| Class | Frequency |
|-------|-----------|
| 0-10 | 15 |
| 10-20 | 20 |
| 20-30 | 25 |
| 30-40 | 24 |
| 40-50 | 22 |
| 50-60 | 14 |
| 60-70 | 5 |

- ii. Find the missing frequencies from the following table:

| Wages (Rs.) | No. of workers |
|-------------|----------------|
| 0-20 | 10 |
| 20-40 | ? |
| 40-60 | 30 |
| 60-80 | ? |
| 80-100 | 14 |

Total no. of workers=94 and Value of Mode=54.

- iii. Find the Standard deviation of the following series:

| Class | Frequency |
|-------|-----------|
| 0-10 | 10 |
| 10-20 | 15 |
| 20-30 | 25 |
| 30-40 | 25 |
| 40-50 | 10 |
| 50-60 | 10 |
| 60-70 | 5 |

- Q.4 i. Show that the coefficient of correlation is the geometric mean of the coefficient of regression.

5

[3]

- ii. Calculate the Karl Pearson's coefficient of correlation between X and Y series: 7

| X | Y |
|-----|-----|
| 17 | 12 |
| 18 | 16 |
| 19 | 14 |
| 19 | 11 |
| 20 | 15 |
| 20 | 19 |
| 21 | 22 |
| 21 | 16 |
| 22 | 15 |
| 23 | 20 |

- OR iii. The following marks have been obtained by a class of students in statistics (Out of 20):

| Paper I (x) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---------------------|---|---|----|----|----|----|----|----|----|
| Paper II (y) | 9 | 8 | 10 | 12 | 11 | 13 | 14 | 16 | 15 |

Then obtain the equation of Regression Line x on y .

- Q.5 i. Give any two definitions of Time Series with examples. 4
ii. Calculate 5-yearly moving average of the data given below and also draw the graph to represent the moving averages. 6

| Year | Sales ('000 Rs) |
|------|-----------------|
| 2002 | 40 |
| 2003 | 45 |
| 2004 | 55 |
| 2005 | 50 |
| 2006 | 60 |
| 2007 | 90 |
| 2008 | 95 |
| 2009 | 105 |
| 2010 | 100 |
| 2011 | 110 |
| 2012 | 140 |
| 2013 | 145 |
| 2014 | 155 |

Faculty of Commerce
End Sem Examination Dec-2023

Date :
P. No. : 01

CM3C019

Business Statistics

Programme : B.Com. (Hons.)

Branch : Commerce

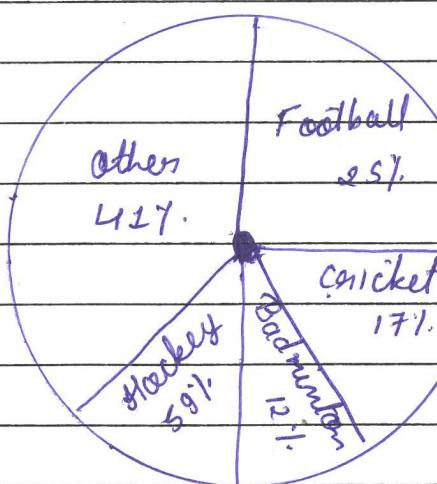
Q. 1. MCA -

- | | | |
|-------|--|----|
| i) | clever Student in a class (c) | +1 |
| ii) | Angular diagram Pictogram (a) | +1 |
| iii) | 120 (c) | +1 |
| iv) | # 6 (d) | +1 |
| v) | No Correlation (b) | +1 |
| vi) | slope (a) | +1 |
| vii) | One year (c) | +1 |
| viii) | Prosperity and recession (c) | +1 |
| ix) | Consumer Price Index (a) | +1 |
| x) | Current Period (c) | +1 |

)

(Q1) A pie chart is a graphical representation technique that displays data in a circular shaped graph. It is a composite static chart that works best with few variables. Pie charts are often used to represent sample data with data points belonging to a combination of different categories. Each of these categories is represented as a "slice of the pie". The size of each slice is directly proportional to the number of data points that belong to a particular category.

Example: In a class of 200 students, a survey was done to collect each student's favorite sports



Since the pie chart is provided and the total number of students is given, we can easily take the original data out for each sport.

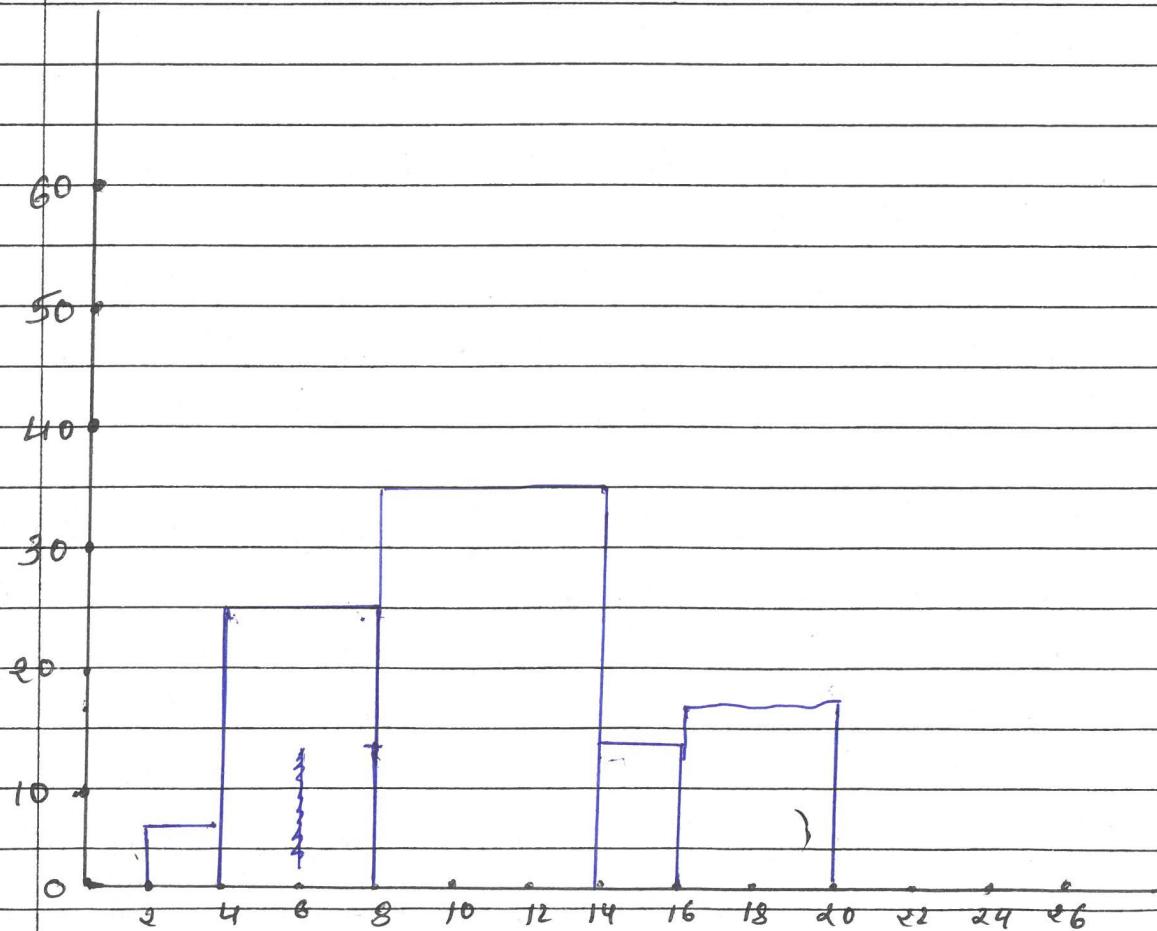
- Cricket = $17/100 \times 200 = 34$
- Football = $25/100 \times 200 = 50$
- Badminton = $12/100 \times 200 = 24$
- Hockey = $5/100 \times 200 = 10$
- Others = $41/100 \times 200 = 82$

(ii)

~~def~~

| Class | Frequency | class width | D.F |
|-------|-----------|------------------|-----------------------|
| 2-4 | 3 | $2 = 2 \times 1$ | $\frac{3}{1} = 3$ |
| 4-8 | 50 | $4 = 2 \times 2$ | $\frac{50}{2} = 25$ |
| 8-14 | 44 | $6 = 2 \times 3$ | $\frac{44}{3} = 14.6$ |
| 14-16 | 34 | $2 = 2 \times 1$ | 34 |
| 16-20 | 25 | $4 = 2 \times 2$ | 12.5 |
| 20-24 | 32 | $4 = 2 \times 2$ | 16 |
| 24-26 | 12 | $2 = 2 \times 1$ | 12 |

Histogram



iii

Ans. Scope of Statistics in Management :-

Statistical method are widely used in business and trade solutions such as financial analysis, market research and manpower planning. Every business establishment irrespective of the type has to adopt statistical techniques for its growth. They estimate the trend of prices, buying and selling, importing and exporting of goods using statistical methods and past data.

Scope of Statistics in Economics.

Statistical techniques have proved to be extremely useful in the study of all branches of economics, such as:

- (i) Financial statistics are basic in the field of money and banking, short-term credit, consumer finance and public finance.
- (ii) Demand analysis is very useful tool to find the relationship between the price and supply of a commodity.
- (iii) The study of behaviour of prices, production and consumption of commodities can be done with the help of time series analysis.

iv

Ans. Population :

Population refers to all of the individuals that the study wants to describe. In a study where σ is A statistical population can be a group of existing objects or a hypothetical and potentially infinite group of objects conceived as a generalization from experience.

Sample : A part or small section selected from the population is called a sample and the process of such selection is called sampling.

Difference between population and Sample.

Population

Sample

- | | |
|--|--|
| 1. Population refer to the collection of elements possessing common characteristics, that comprises. | Sample means a subgroup of the members of population chosen for participation in the study |
| 2. Each and every unit of the group | Only a handful units of population |
| 3. Complete enumeration or census | Sample survey or sampling |
| 4. Identifying the characteristics | Making inferences about population |

| Q5(i) | Class | Frequency (f) | Cumulative Frequency (c.F.) |
|-------|-------|---------------|-----------------------------|
| | 0-10 | 15 | 15 |
| | 10-20 | 20 | 35 |
| | 20-30 | 25 | 60 |
| | 30-40 | 24 | 84 |
| | 40-50 | 22 | 106 |
| | 50-60 | 14 | 120 |
| | 60-70 | 5 | 125 |

Here $N = 125$

Median = measure of $\left(\frac{125+1}{2}\right)^{\text{th}} \text{ term}$

= measure of the term 63rd term

Thus median class = 30-40

$$\text{Median} = l + \frac{1/2 N - F}{f} \times i$$

$$= 30 + \frac{\frac{125}{2} - 60}{24} \times 10$$

$$= 30 + \frac{25}{24} \times 10$$

$$= 31.04$$

ii)

| Sol | Class | Frequency | C.F |
|-----|--------|-----------|--------|
| | 0-20 | 10 | 10 |
| | 20-40 | a | 10+a |
| | 40-60 | 30 | 40+a |
| | 60-80 | b | 40+a+b |
| | 80-100 | 14 | 54+a+b |

Here.

$$\text{Total frequency } N = 54 + a + b$$

$$94 = 54 + a + b$$

$$a + b = 40 \quad \text{--- (1)}$$

$$\text{Since mode } M_o = 54$$

$$\text{modal class} = 40-60$$

Thus

$$l = 40, f = 30, f_0 = a, f_1 = b, i = 20$$

$$M_o = l + \frac{f - f_0}{\frac{2f - f_0 - f_1}{i}} \times i$$

$$54 = 40 + \frac{30 - a}{\frac{60 - a - b}{20}} \times 20$$

$$14(60 - a - b) = 20(30 - a)$$

$$7b - 3a = 120 \quad \text{--- (2)}$$

Solving eqn (1) and (2)

$$a = 16, b = 24$$

iii

| Soal | Class | Mid value | f | f_x | $x-M$ | $(x-M)^2$ | $f(x-M)^2$ |
|------|-------|-----------|-----|-------|-------|-----------|------------|
| | 0-10 | 5 | 10 | 50 | -26 | 676 | 6760 |
| | 10-20 | 15 | 15 | 225 | -16 | 256 | 3840 |
| | 20-30 | 25 | 25 | 625 | -6 | 36 | 900 |
| | 30-40 | 35 | 25 | 875 | 4 | 16 | 400 |
| | 40-50 | 45 | 10 | 450 | 14 | 196 | 1960 |
| | 50-60 | 55 | 10 | 550 | 24 | 576 | 5760 |
| | 60-70 | 65 | 5 | 325 | 34 | 1156 | 5780 |

$$N = 100 \quad \sum f_x = 3100$$

25400

$$\text{Mean } M = \frac{\sum f_x}{N} = \frac{3100}{100} = 31$$

+1

S.D

$$\sigma = \sqrt{\frac{\sum f(x-M)^2}{N}} = \sqrt{\frac{25400}{100}} = 15.24$$

+1

Q4 (i)

Soal. We know that the coefficient of regression of y on x is $b_{yx} = \frac{\gamma \sigma_y}{\sigma_x}$

+1

Similarly regression coefficient of x on y .

$$b_{xy} = \frac{\gamma \sigma_x}{\sigma_y}$$

+1

$$\therefore b_{yx} \cdot b_{xy} = \frac{\gamma \sigma_y}{\sigma_x} \cdot \frac{\gamma \sigma_x}{\sigma_y} = \gamma^2$$

$$\therefore \text{G.M. of } b_{yx} \text{ and } b_{xy} = \sqrt{b_{yx} \cdot b_{xy}} = \sqrt{\gamma^2} = \gamma$$

+1

ii)

Sol

X

Y

 $x = X - M_x$ $y = Y - M_y$ x^2 y^2 xy

17

12

-3

-4

9

16

12

18

16

-2

0

4

0

0

19

14

-1

-2

1

4

2

19

11

-1

-5

1

25

5

20

15

0

-1

0

1

0

20

19

0

3

0

9

0

21

22

1

6

1

36

6

+3

21

16

1

0

1

0

0

22

15

2

-1

4

1

-2

23

20

3

4

9

16

12

Total

200

160

0

0

30

108

35

If the mean of X's and Y's are M_x and M_y
then

$$M_x = \frac{\sum X}{n} = \frac{200}{10} = 20$$

$$\text{and } M_y = \frac{\sum Y}{n} = \frac{160}{10} = 16$$

If the standard deviations of X's and Y's
are σ_x and σ_y then

$$\sigma_x = \sqrt{\frac{\sum x^2}{n}} = \sqrt{\frac{30}{10}} = \sqrt{3} = 1.73 +1$$

$$\sigma_y = \sqrt{\frac{\sum y^2}{n}} = \sqrt{\frac{108}{10}} = \sqrt{10.8} = 3.28$$

The coefficient of correlation r is given by

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}} = \frac{\sum xy}{n \sigma_x \sigma_y} +1$$

$$= \frac{35}{10 \times 1.73 \times 3.28} = \frac{3.5}{1.75 \times 3.25} = 0.616$$

+1

(iii)

Sol.

Paper I(X)

Paper II(Y)

 x^2 y^2 xy

| | | | | | |
|----------|-----|-----|------|-----|----|
| 1 | 9 | 1 | 81 | 9 | |
| 2 | 8 | 4 | 64 | 16 | |
| 3 | 10 | 9 | 100 | 30 | |
| 4 | 12 | 16 | 144 | 48 | |
| 5 | 11 | 25 | 121 | 55 | |
| 6 | 13 | 36 | 169 | 78 | +3 |
| 7 | 14 | 49 | 196 | 98 | |
| 8 | 16 | 64 | 256 | 128 | |
| 9 | 15 | 81 | 225 | 135 | |
| Total 45 | 108 | 285 | 1356 | 597 | |

Regression equation y on x only

$$y - \bar{y} = b_{yx} \cdot x - \bar{x} = b_{yx} (y - \bar{y}) \quad +1$$

$$b_{yx} = \frac{N \sum xy - \sum x \cdot \sum y}{N \sum y^2 - (\sum y)^2}$$

Here $N = 9$

$$\bar{x} = 45/9 = 5, \bar{y} = 108/9 = 12, \sum x = 45$$

$$\sum y = 108, \sum x^2 = 285, \sum y^2 = 1356, \sum xy = 597 \quad +1$$

$$= \frac{9(597) - (45)(108)}{9(1356) - (108)^2} = \frac{5373 - 4860}{12204 - 11664} \quad +1$$

$$= \frac{513}{540} = 0.95.$$

$$x - 5 = 0.95(y - 12)$$

$$x - 5 = 0.95y - 11.4 \Rightarrow x = 0.95y - 11.4 + 5 \quad +1$$

$$x = 0.95y - 6.4$$

~~Ans~~

05(i)

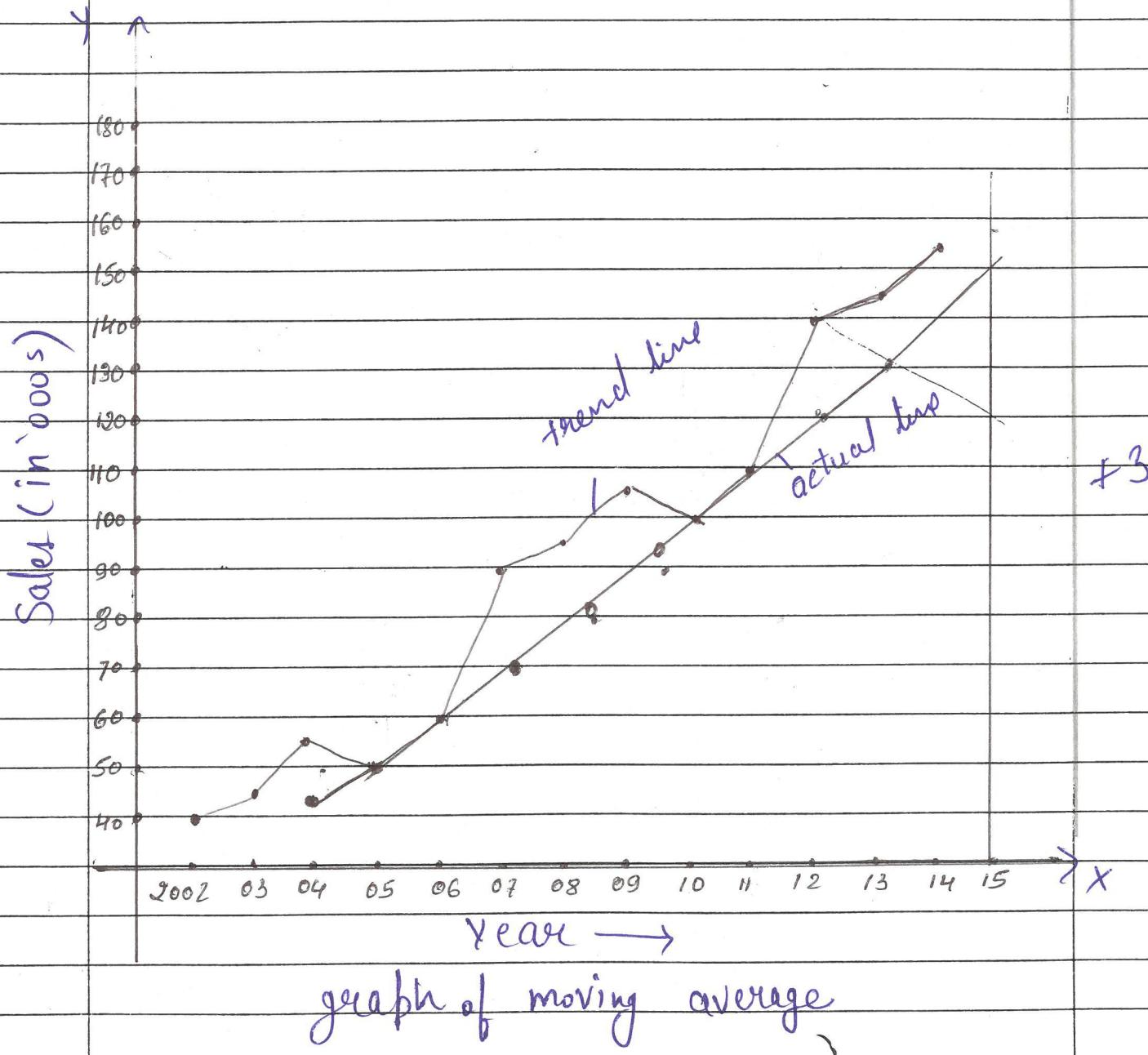
- (a) According to Patterson's "A time series consists +
of statistical data which are collected,
recorded or observed over successive
increments"
- (b) Wessel and Wellet have stated as, "When
quantitative data are arranged in the order +
of their occurrence, the resulting statistical
series is called a 'time series'."

Examples-

- i) The population of a country in different years. +1
- ii) the annual production of coal in India over the last ten years. +1

(ii)

| Sol. | Year | Sales (000Rs) | 5-yearly moving total | 5-yearly moving average. |
|------|------|------------------|--------------------------|-----------------------------|
| | 2002 | 40 | - | - |
| | 2003 | 45 | - | - |
| | 2004 | 55 | 250 | 50 |
| | 2005 | 50 | 300 | 60 |
| | 2006 | 60 | 350 | 70 |
| | 2007 | 90 | 400 | 80 |
| | 2008 | 95 | 450 | 90 |
| | 2009 | 105 | 500 | 100 |
| | 2010 | 100 | 550 | 110 |
| | 2011 | 110 | 600 | 120 |
| | 2012 | 140 | 650 | 130 |
| | 2013 | 145 | - | - |
| | 2014 | 155 | - | - |



(iii) Components of Time series

17 Secular Trend: It is the matter of common sense that there might be violent variations in a time series during a short span of time, however in a long run, it has a tendency either to rise or fall. This tendency or trend of variations may be either upward or downward set on over a long time period. This is known as 'Secular Trend' or 'Simple trend'. +1.5

17 Seasonal Variations: As we heard season the first thing comes in our mind is spring, summer, autumn and winter. Generally seasonal variations occur due to changes in weather conditions, customers, traditions, fashions etc. +1.5

Seasonal variations represent a periodic movement where the period is not longer than one year. The factors, which mainly causes this type of variations in time series, are the climatic changes of the different seasons.

17. Cyclical Variation: Most of the business activities are often characterized by recurrence of periods of prosperity and slump constituting +1.5

a business cycle. Cyclical variations are another type of periodic movement, with a period more than one year. Such movements are fairly regular and oscillatory in nature. One complete period is called a 'cycle'. Cyclical variations are not as regular as seasonal variations, but the sequence of change, marked by prosperity, decline, depression and recovery, remains more or less regular.

4) Irregular or Random Variations:

Irregular or random variations are such variations which are completely unpredictable in character. These are caused by factors which are either wholly or unaccountable or caused by such unforeseen events like Earthquakes, flood, drought, famines, epidemic etc. and some man-made situations like strike, lock-outs, war etc.

06 i

Sol

Here.

We know that

$$\text{Index number} = \frac{P_i}{P_0} \times 100$$

where P_i = Price of current year

P_0 = Price of base year

| (i) & (ii) Year | Price of Commodity | I.N (1995) | I.N (2002) |
|-----------------|--------------------|-------------------------|-------------------------|
| 1995 | 4 | $4/4 \times 100 = 100$ | $4/4 \times 100 = 40$ |
| 1996 | 5 | $5/4 \times 100 = 125$ | $5/4 \times 100 = 50$ |
| 1997 | 6 | $6/4 \times 100 = 150$ | $6/4 \times 100 = 60$ |
| 1998 | 7 | $7/4 \times 100 = 175$ | $7/4 \times 100 = 70$ |
| 1999 | 8 | $8/4 \times 100 = 200$ | $8/4 \times 100 = 80$ |
| 2000 | 10 | $10/4 \times 100 = 250$ | $10/4 \times 100 = 100$ |
| 2001 | 9 | $9/4 \times 100 = 225$ | $9/4 \times 100 = 90$ |
| 2002 | 10 | $10/4 \times 100 = 250$ | $10/4 \times 100 = 100$ |
| 2003 | 11 | $11/4 \times 100 = 275$ | $11/4 \times 100 = 110$ |

iii 1995 to 1997 as the base period :- $\frac{4+5+6}{3}$

| Year | Price of commodity | Index No. |
|------|--------------------|-------------------------|
| 1995 | 4 | $4/5 \times 100 = 80$ |
| 1996 | 5 | $5/5 \times 100 = 100$ |
| 1997 | 6 | $6/5 \times 100 = 120$ |
| 1998 | 7 | $7/5 \times 100 = 140$ |
| 1999 | 8 | $8/5 \times 100 = 160$ |
| 2000 | 10 | $10/5 \times 100 = 200$ |
| 2001 | 9 | $9/5 \times 100 = 180$ |
| 2002 | 10 | $10/5 \times 100 = 200$ |
| 2003 | 11 | $11/5 \times 100 = 220$ |

Question No.-6 (iii)

| Year | A | B | C | |
|------|-------|--------|--------|--|
| 2001 | 10 kg | 4 kg | 3 kg | |
| 2002 | 9 kg | 3.5 kg | 3 kg | |
| 2003 | 9 kg | 3 kg | 2.5 kg | |

Average price of A = $\frac{10+9+9}{3} = 7 + 1$

Average price of B = $\frac{4+3.5+3}{3} = 3.5 + 1$

Average price of C = $\frac{3+3+2.5}{3} = 2.8 + 1$

| Commodity | Average Price | 2001 | 2002 | 2003 |
|---------------|----------------|------------------------------------|------------------------------------|-------------------------------------|
| | P _o | PR | P _o | PR |
| A | 7 | 10 $\times \frac{100}{7} = 142.8$ | 4 $\times \frac{100}{7} = 57.1$ | 3 $\times \frac{100}{7} = 42.8$ |
| B | 3.5 | 9 $\times \frac{100}{3.5} = 257.1$ | 3.5 $\times \frac{100}{3.5} = 100$ | 3 $\times \frac{100}{3.5} = 85.7$ |
| C | 2.8 | 9 $\times \frac{100}{2.8} = 321.4$ | 3 $\times \frac{100}{2.8} = 107.1$ | 2.5 $\times \frac{100}{2.8} = 89.2$ |
| Total of PR | | 721.3 | 264.2 | 217.7 |
| Average of PR | | 240.43 | 88.06 | 72.56 |

+2

Ques (ii)

Aus. Index Number - Index Number are statistical devices designed to measure the relative change in the level of a phenomenon with respect to time, geographical location or other characteristics such as income, profession etc.

"In other words, these numbers are the numbers which express the value of a variable at any given date called the 'given period' as a percentage of the value of that variable at some standard date called the 'base period'. +2

Advantages of Index Numbers

1) Help in formulating policies :

Most of the economic and business decisions and policies are guided by the index numbers. e.g. to increase DA, the govt. refers to the cost-of-living index

+3

2) Study of Trends : It helps in the study of trends in variables like export, import, industrial and agricultural production, share prices and more.

3) Forecasting : It not only helps in the study of past and present behaviour, they are also used for forecasting economic and business activities.

4) Facilitates Comparative Study.

To make comparisons with respect to time and place especially where units are different, index numbers prove to be very useful.

5) Act as Economic Barometer.

Index numbers are very useful in knowing the level of economic and business activities of a country. So, these are rightly known as economic barometers.