Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No......................................

Faculty of Commerce

End Sem (Odd) Examination Dec-2022

CM3CO08 Business Statistics

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

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.

Q.1 i. A histogram is a set of adjacent- **1**

(a) Rectangles (b) Triangles

(c) Square (d) Lines

ii. Cumulative frequency is ___________ frequency. **1**

(a) Increasing (b) Decreasing

(c) fixed (d) None of these

iii. Which measure of central tendency includes the magnitude of scores? **1**

(a) Mean (b) Mode (c) Median (d) Range

iv. Mode refers to the value within a series that occurs ________ number of times. **1**

(a) Maximum (b) Minimum (c) Zero (d) Infinite

v. Correlation analysis is a ________________. **1**

(a) Univariate analysis (b) Bivariate analysis

(c) Multivariate analysis (d) Both (b) and (c)

vi. If $r = \pm 1$, the two regression lines are ___________. **1**

(a) Coincident

(b) Parallel

(c) Perpendicular to each other

(d) None of these

vii Time-series data may exhibit which of the following behaviors? **1**

(a) Trend and random variations

(b) Seasonality

(c) Cycles

(d) All of these

P.T.O.

vii: Which of the following is not a type of qualitative forecasting? **1**
(a) Sales force composites (b) Consumer surveys
(c) Delphi method (d) Moving average

ix. An index number calculated with a single variable is called ____. **1**
(a) Univariate index (b) Bivariate index
(c) Multivariate index (d) Composite index

x. The index number for the base year is- **1**
(a) 200 (b) 100 (c) 50 (d) 10

Q.2 i. Define pie chart. **2**

ii. Explain histogram and write the steps to draw a histogram. **3**

iii. What is the scope of statistics in daily life? What are the limitations of statistics? **5**

OR iv. In a city, the weekly observations made in a study on the cost of living index are given in the following table: **5**

Cost of living index	Number of weeks
140-150	5
150-160	10
160-170	20
170-180	9
180-190	6
190-200	2
Total	52

Draw a frequency polygon for the data above (without constructing a histogram).

Q.3 i. Find the mode of the following marks (out of 10) obtained by 20 students: 4, 6, 5, 9, 3, 2, 7, 7, 6, 5, 4, 9, 10, 10, 3, 4, 7, 6, 9, 9. **2**

ii. Find the median from the following data: **8**

No. of days for which absent (less than)	5	10	15	20	25	30	35	40	45
No. of students	29	224	465	582	634	644	650	653	655

OR iii. Calculate the mean and standard deviation for the following table, given the age distribution of 542 members: **8**

Age in years	20-30	30-40	40-50	50-60	60-70	70-80	80-90
No. of members	3	61	132	153	140	51	2

Q.4 i. Calculate the Karl Pearson's coefficient of correlation between x and y series from the following data: **3**
$\sum(x-\bar{x})^2 = 136$, $\sum(y-\bar{y})^2 = 138$ and $\sum(x-\bar{x})(y-\bar{y}) = 122$.

ii. Two lines of regression are given by $5y - 8x + 17 = 0$ and $2y - 5x + 14 = 0$ and $\sigma_y^2 = 16$. Find (a) the mean of x and y , (b) σ_x^2 and (c) the coefficient of correlation between x and y . **7**

OR iii. Find the correlation coefficient and regression lines for the data: **7**

x	1	2	3	4	5
y	2	5	3	8	7

Q.5 i. Explain in detail components of time series. **4**

ii. Explain simple moving average method which is used in forecasting. Write its characteristics. **6**

OR iii. Explain weighted moving average method. Write its characteristics and limitations. **6**

Q.6 Attempt any two:

i. What is index number? What are the features of index numbers? **5**

ii. Explain simple aggregative method and simple average of price relatives method to compute the index numbers. **5**

iii. Explain weighted aggregative method and weighted average of price relatives method to compute the index numbers. **5**

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End Sem . Examination Dec-2022

Faculty of commerce

Page No.: 1

Course :- Business statistics   Code :- CM3CO08

	Marks.
Q1.) MCQs	
i) a.) Rectangles	1
ii) a.) Increasing	1
iii) a). Mean	1
iv) a.) maximum	1
v) d.) Both (b) and (c).	1
vi) a.) Coincident	1
vii) d.) All of these	1
viii) d.) moving average	1
ix) a.) univariate	1
x) b.) 100.	1

Que-2 (i)

Pie chart :- A pie chart is a graphical representation of data. A pie chart is a circular statistical graphic, which is divided into slices to illustrate numerical proportion. In a pie chart, the arc length of each slice is proportional to the quantity it represents. +1

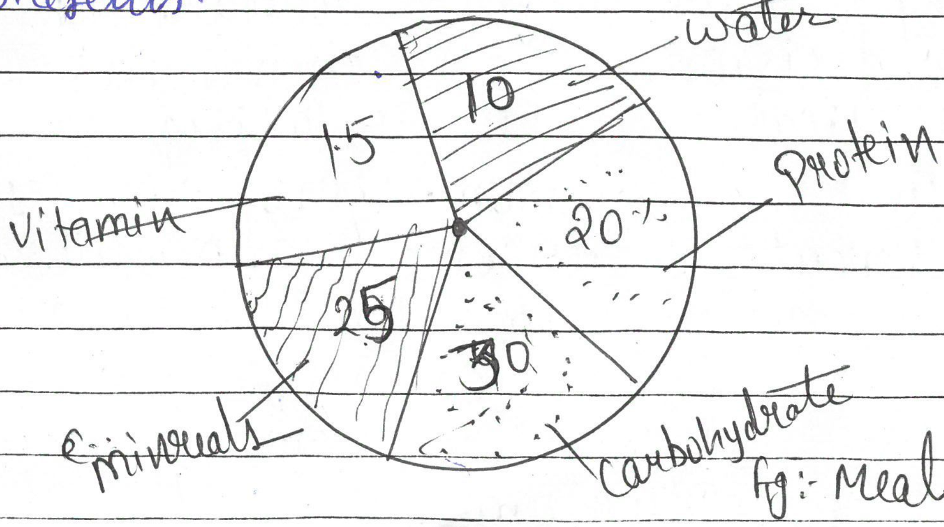


fig :- Meal nutrients +1

Marks

Ques. 2 (iii)

what is the scope of statistics in life? what are the limitations of statistics?

Scope :- Statistics was understood as a tool to collect information, However, today it is used as not just a device for collecting numerical data but as a means for their handling and analysis. There are some scope of statistics in daily Life: +1

1) planning and decision making :-
Statistics is indispensable in planning. Tippet says :"planning is the order of the day and without statistics planning is inconceivable". Today almost all organizations in the government and private sector make plans for efficient working and for formulating policy decision. To acheive this statistical data relating to production, consumption, prices investment, income, expenditure etc is needed statistical techniques and data are extensively used by the state for planning future economics Program. +1

Marks.

ii) Statistics in Business and management :- Modern statistical tools of collection, classification, tabulation analysis and interperetation of data are important aids in making wise decisions. Business forecasting techniques are very useful in formulating business policies. According to wallis and Roberts. "Statistics may be regarded as a body of methods for making decision in the fact of uncertanity". +1

iii) Importance of Statistics in Economics :-

iv) Importance of Statistics in Medical and Natural sciences :

Also it is useful in the field of physical science, Social science, Accountancy Astronomy, Market research, psychology, Education, politics, war etc.

Limitations :-

i) Statistics does not study quallitative phenomenon : Statistics are numerical statements of facts. it can be applied only to such problems that can be measure quantitatively +1

Marks

ii) Statistics does not study individual measurements : Statistics is the science of collecting, analysis and interpreting data. and gives no importance to individuals its methods do not give any recognition to an object, or person or an event is isolation. +1

iii) Statistical laws are true only on average:

iv) Statistics can be misused:

Ques. 2 (ii)

Histogram :- Histogram is a diagram in which we draw rectangles with areas propotional to the frequencies and bases as class- intervals for a given grouped frequency distribution +1

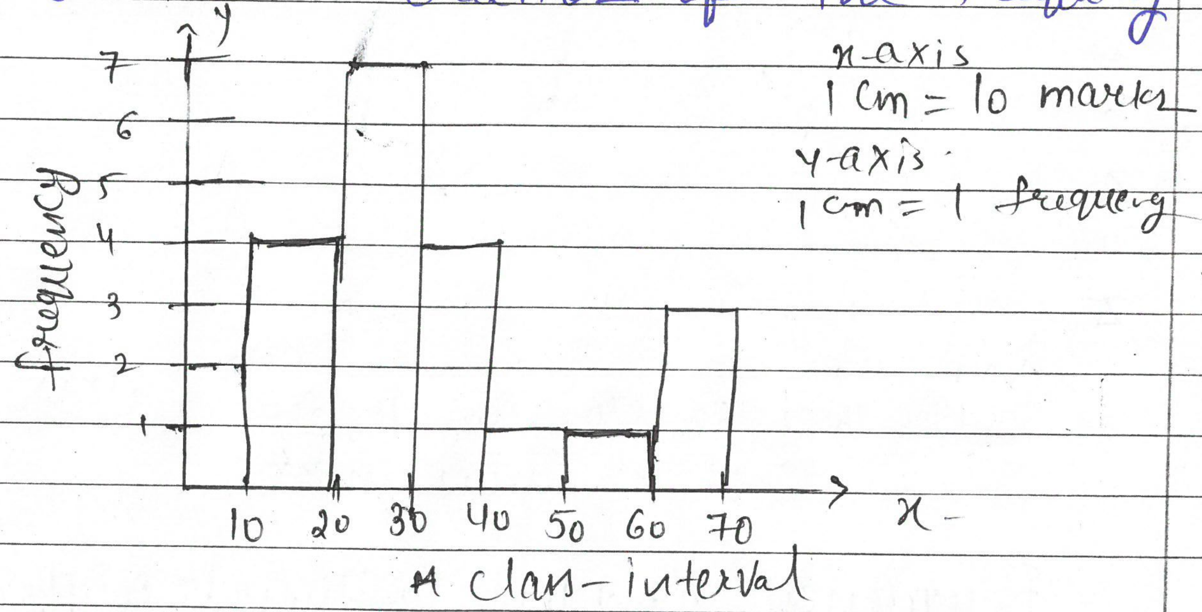
Steps to draw :- i) To draw the histogram of a given grouped frequency distribution, we first choose a suitable scale. +1

ii) we mark off along x-axis all the class intervals and frequency on y-axis

S. No. | Marks.

iii) If the class-intervals are equal, the height of the rectangles are proportional to the frequencies and if not equal the height of the rectangles are proportional to the ratios of the frequency

(eg)



+1

Ques No - 3 (i)

Mode of the following data -

4, 6, 5, 9, 3, 2, 7, 7, 6, 5, 4, 9, 10, 10, 3, 4, 7, 6, 9, 9.

Mode ~~is~~ of the data :- "which data have maximum frequency or repeated max. no. of times is called mode of the data". +1

In given data "9" has four frequency. so Mode of the data is = 9. +1

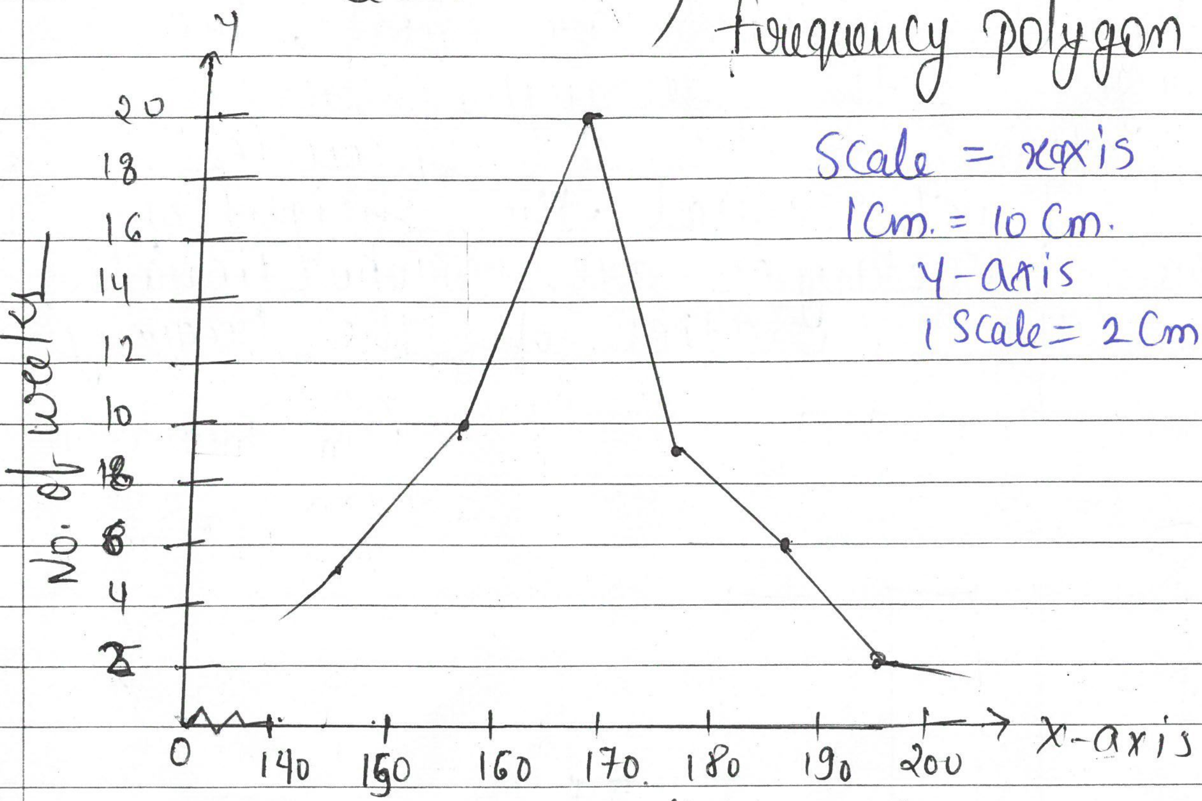
S.No. | Marks

Ques. 2(iv)

Frequency polygon

Scale = x-axis
1 Cm. = 10 Cm.
y-axis
1 Scale = 2 Cm.

+5



Frequency polygon (without constructing histogram)

Question - 3(ii)

Median :-

No. of days	No. of students (f)	~~c.f~~
Less than 5	29	
Less than 10	224	
Less than 15	465	
Less than 20	582	
" 25	634	
" 30	644	
" 35	650	
Less 40	653	
Less 45	655	

No.	Class interval	f.	C.f	Marks.
	0-5	29	29	
	5-10	224-29=195	224	+3
	$\boxed{10-15}$	465-224=241	$\boxed{465}$	
	15-20	582-465=117	582	
	20-25	634-582=52	634	
	25-30	644-634=10	644	
	30-35	650-644=6	650	
	35-40	653-650=3	653	
	40-45	655-653=2	655	

$N = \Sigma f = 655$

Now,

$$\left(\frac{N}{2}\right) = \frac{655}{2} = 327.5$$ +1

Now, 327.5 is just less than 465 (in C.f. column). So the median class is 10-15.

+1

So $l_1 = 10$, $f = 241$, $C.f = 224$,

i (class size) $= 5$

formula =

$$\text{median} = l_1 + \frac{\left(\frac{N}{2} - c\right)}{f} \times i$$ +1

$$M = 10 + \frac{(327.5 - 224)}{241} \times 5$$

$$M = 10 + \frac{103.5}{241} \times 5$$ +1

No. | Marks

$$= 10 + \frac{51.5}{24}$$

$$= 10 + 2.147$$

$$= 12.147$$ +1

$\boxed{\text{Median} = 12.147}$ lies b/w 10-15.

Ques - 3 (iii)

Age	f	x	f.x	$(x-\bar{x})$	$(x-\bar{x})^2$	$f.(x-\bar{x})^2$
20-30	3	25	75	-29.7≈30	900	2700
30-40	61	35	2135	-19.7	400	24,400
40-50	132	45	5940	-9.7	100	13200
50-60	153	55	8415	0.3	0	0
60-70	140	65	9100	10.3	100	14000
70-80	51	75	3825	20.3	400	20,400
80-90	2	85	170	30.3	900	18.00
total	542		29660			Σ = 76,500

+4

$\Sigma f = 542$, $\Sigma f.x = 29,660$

Mean $\bar{x} = \frac{\Sigma f.x}{\Sigma f} = \frac{29660}{542}$ +2 +1

$\boxed{\text{Mean} = 54.723}$ ≈ 55 +1

No. | Marks.

Standard deviation =

$$\sigma = \sqrt{\frac{\Sigma f(x-\bar{x})^2}{\Sigma f}}$$ +1

$$\sigma = \sqrt{\frac{76{,}500}{542}}$$

$$\sigma = \sqrt{141.14}$$

$$\sigma = 11.880 \approx 12$$ +1

$$\boxed{S.D = \sigma = 12}$$

Ques - 4 (i)

$\Sigma(x-\bar{x})^2 = 136$, $\Sigma(y-\bar{y})^2 = 138$,

$\Sigma(x-\bar{x})(y-\bar{y}) = 122$.

Karl pearson's coefficient of correlation.

$$r = \frac{\Sigma(x-\bar{x})(y-\bar{y})}{\sqrt{\Sigma(x-\bar{x})^2}\sqrt{\Sigma(y-\bar{y})^2}}$$ +1

$$r = \frac{122}{\sqrt{136}\sqrt{138}}$$ +1

No. | Marks

$$r = \frac{122}{11.66 \times 11.743}$$

$$r = \frac{122}{137.005} = 0.891 \quad +1$$

$$\boxed{r = 0.891}$$

Q4. (ii)

regression Lines given :- $5y - 8x + 17 = 0$
$2y - 5x + 14 = 0$.

$\sigma_y^2 = 16$.

(a) find mean of x and y.

we know that both the Lines of regression pass through the point (M_x, M_y). where M_x, M_y are the mean of x and y respectively.

$\therefore$ from the given eq^n. of regression lines, we have

$5M_y - 8M_x + 17 = 0$ and
$2M_y - 5M_x + 14 = 0$ $\quad +2$

by Solving, we get $\boxed{M_x = 4}$, $\boxed{M_y = 3}$

No. | Marks.

(b) find σ_x^2.

Suppose the lines of regression of y on x is

$$y = \frac{8x}{5} - \frac{17}{5}$$

$$y = 1.6x - 3.4$$

and regression line x on y is

$$x = \frac{2}{5}y + \frac{14}{5} \quad +1$$

$$x = 0.4y + 2.8$$

regression Coefficient of y on x = b_{yx}

$$b_{yx} = r.\frac{\sigma_y}{\sigma_x} = 1.6$$

regression Coefficient of x on y = b_{xy} +1

$$b_{xy} = r\frac{\sigma_x}{\sigma_y} = 0.4$$

Hence $r^2 = b_{xy}.b_{yx} = 0.4 \times 1.6$

(c) $r = \sqrt{0.64} = 0.8$ +1

Since $b_{yx} = r.\frac{\sigma_y}{\sigma_x}$

$$\sigma_y^2 = 16 \Rightarrow \sigma_y = 4$$

$$1.6 = 0.8 \times \frac{4}{\sigma_x} = \sigma_x$$

No. | Marks

$$\boxed{\sigma_x = 2}$$

(b) $$\boxed{\sigma_x^2 = 4}$$ +2

Que - 4 (iii)

x	y	$dx=(x-\bar{x})$	dx^2	$dy=(y-\bar{y})$	dy^2	$dx.dy$
1	2	-2	4	-3	9	6
2	5	-1	1	0	0	0
3	3	0	0	-2	4	0
4	8	1	1	3	9	3
5	7	2	4	2	4	4
total = 15	25		$\Sigma=10$		$\Sigma=26$	$\Sigma=13$

+2

$$\bar{x} = \frac{\Sigma x}{n} = \frac{15}{5} = 3$$

$$\bar{y} = \frac{\Sigma y}{n} = \frac{25}{5} = 5$$

Coefficient of correlation.

$$r \text{ or } r = \frac{\Sigma dx.dy}{\sqrt{\Sigma dx^2}\sqrt{\Sigma dy^2}}$$ +1

$$r \text{ or } r = \frac{13}{\sqrt{10} \times \sqrt{26}}$$

$$r = \frac{13}{3.16 \times 5.1} = 0.81$$ +1

Marks

$$\boxed{r = 0.8}$$

regression Lines:

$$\sigma x = \sqrt{\frac{\Sigma dx^2}{n}} = \sqrt{\frac{10}{5}} = \sqrt{2}$$

$$\sigma x = 1.414$$

$$\sigma y = \sqrt{\frac{\Sigma dy^2}{n}} = \sqrt{\frac{26}{5}} = \cancel{\ }$$ +1

$$\sigma y = 2.28$$

$$r = 0.8$$

regression line x on y.

$$(x-\bar{x}) = r \times \frac{\sigma x}{\sigma y} (y-\bar{y})$$

$$(x-3) = 0.8 \times \frac{1.414}{2.28} (y-5)$$

$$\boxed{(x-3) = 0.496 (y-5)}$$ +1

regression Line y on x:-

$$(y-\bar{y}) = r \times \frac{\sigma y}{\sigma x} (x-\bar{x})$$

Marks.

$$(y-5) = 0.8 \times \frac{2.28}{1.414}(x-3)$$

$$\boxed{(y-5) = 1.289\,(x-3)}$$ +1

Ques 5 (i)

Components of time Series :-

a) Seculare trend :- The word Secular is derived from the Latin word Seculum and the meaning is generation of age. Therefore Secular trend is thought of as long term effect. +1

b) Seasonal variation :- Seasonal variation in a time series is the repositive, recurrent Pattern of change which occurs within a year or shorter time Period. +1
i) natural Causes ii) Man-made Causes.

c) cyclic Variation :- A time Series may show a trend over long period of time, though, all values of the time Series do not fall exactly on the trend +1

Marks.

trend Line. Example of cyclic variation is so-called business cycle which presents intervals of prosperity, recession, depersion and recovery

d) Random or Irregular movements :- +1

Random or Irregular variation in time series which do not occur in definite pattern. This movements is caused by the short term, unexpected and non-recurring factors that affect the time series.
Irregular.

Ques. 5 (ii)

Simple moving average method-

method = 3+1

characteristic = 2

variations.

(c) **Method of Moving Averages.** It is a method to determine tre
thing out the variations in the data with the help of a moving average. A
s consists of seasonal, cyclic and random variations, Therefore, by
ages of appropriate periods (or extent) these variations may be eliminate
trend will remain in time series. Moving averages of extent n (or perioc
s of successive averages of n data terms at a time, starting from first, s
l data terms and so on (untill) the whole time series is exhau
nematically,

$$\text{Moving Average} = \frac{(\text{Most Recent } n \text{ data Values})}{n}$$

The term moving shows that, as a new observation becomes available fo
es, it replaces the oldest observation in above equation and a new avera
ılated. And average will change, or move, as a new observation bec
lable.

If the period of moving average n is odd. Then we express it as $n = 2m + 1$,
opriate value of m. Now, the moving average of n values is put agains
$1)^{th}$ value. In this period n is even, we put it as $n = 2m$ for some m. Now
ing average of extent n is calculated and placed in between the va
esponding to m^{th} and $(m + 1)^{th}$ observations. In this way, the moving ave
ot correspond to original time series values as they appear in between th
, we use centering (or adjusting) to bring them corresponding to orig
es. This centering (or adjusting) consists in taking average of two consecu
ing averages. Thus, the first centered (or adjusted) moving average will c
esponding to $(m + 1)^{th}$ observation in case when n is even. The graph obtai
otting the moving average values against the corresponding time series va
trend curve.

In this method, it is very difficult to find the appropriate extent (or perio
noving average that will completely eliminate seasonal and cyclic variat
the time series. If the variations are regular and periodic then the mo
ıge completely eliminates the seasonal and cyclic variations with the follo
tions :

a) The period of moving average coincides with the period of cycle, and
b) The trend is linear.

The computational procedure of 3-yearly, 4-yearly and 5-yearly mo
ges are shown in table 2, table 3 and table 4 respectively.

18

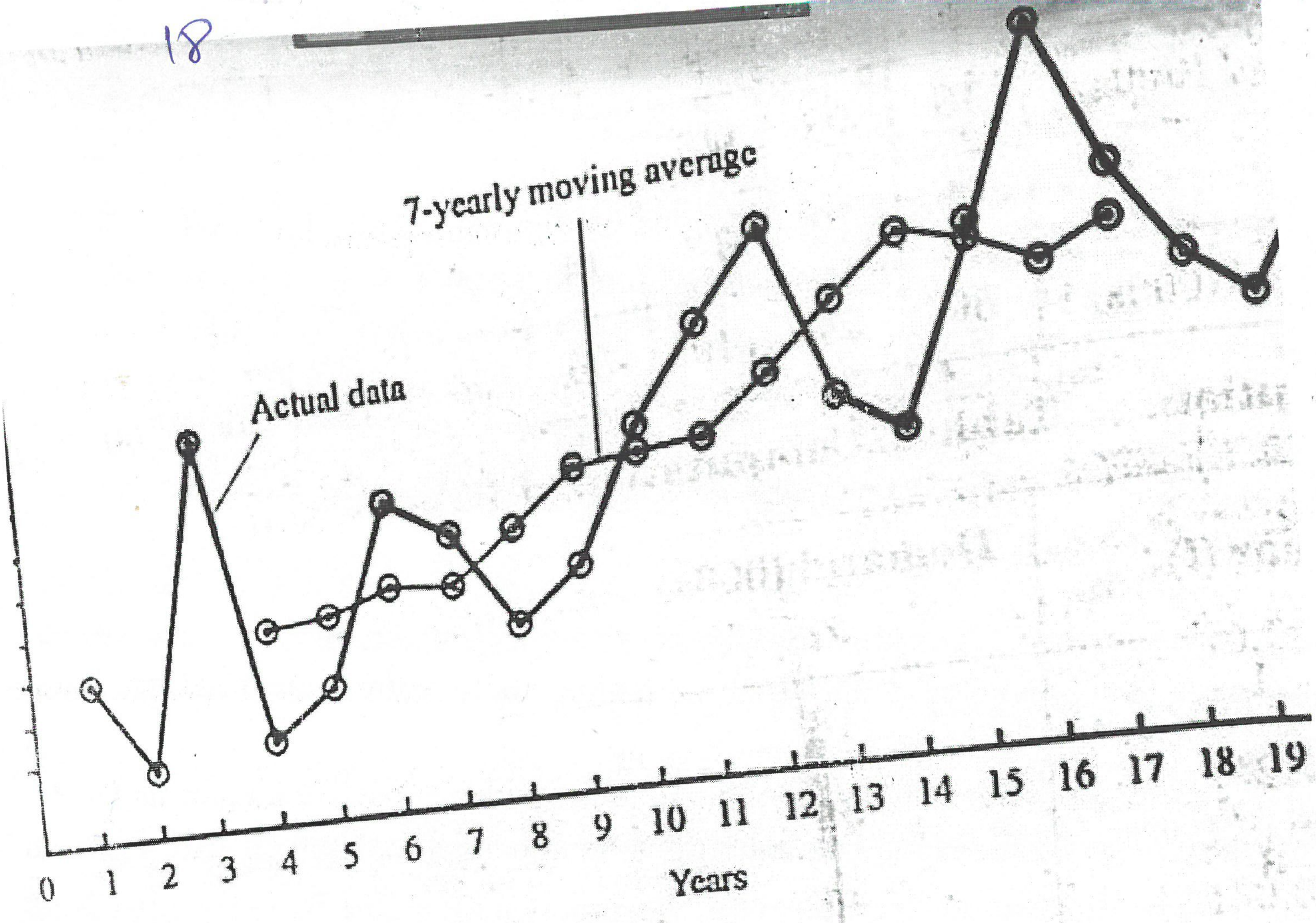


Fig. 9

ınd Demerits of Method of Moving Average :

rits :

This method is easy to calculate and simple to understand.

This method eliminates the short-term variations such as seasor cyclic variations.

) This method is very flexible in the sense that the addition of a fe figures to the data simply results in some more trend values; the p calculations are not affected at all.

:merits :

This method is affected by extreme values of observations.

Since some points are left at the begining and some at the end y this method is not suitable for forcasting, which is the main purpo trend analysis.

) This method is not completely mathematical.

) This method does not have any strict rules about choosing the period for moving averages.

No. Marks.

Ques - 5 (iii)

Weighted moving average :-

The weighted moving average (WMA) is a technical indicator that assigns a greater weighting to the most recent data points, and less weighting to data points in the distant past. +1

How to calculate the weighted moving average :- +1

When calculating the weighted moving average, the recent data points are assigned a greater weighting, whereas past data points are assigned less weighting. It is used when the figures in the data set come with different weights, relative to each other. The sum of the weight should be equal to 1 or 100%.

It is different from the simple moving average, where all numbers are assigned an equal weighting. The final weighted moving average value

No. | Marks

reflects the importance of each data point, it is therefore more ~~ds~~ descriptive of the frequency of occurrency than the simple moving average. +1

Following steps follow when calculating weighted moving average :-

i) Identify the numbers you want to average. +1

ii) Determine the weights of each number

iii) Multiply each number by the weighting factor

iv) Add up resulting values to get the weighted average.

Characteristics :-

i) Weighted moving average gives more weight to current data. WMA assign a heavier weighting to more current data points since they are more relevant than data points in the distant past. the sum of the ~~dista~~ weighting should add up to 1 (1wt) +1

Que. 6 (i)

IS AN INDEX NUMBER?

. are a series of numerical values
relative position of a variable (like
of output, export, etc.) with respect
r certain other characteristics. When
made between prices at a certain
(called *current year*) with that of
(called *base year*), these are called
...) Prices of the base year are taken
during the current year are related
ar prices. For example, when we
of consumer goods are 20 per cent
ear 2015 as compared to the year
lies that the index number in the
0 compared to the index number of
r 2005 (the year of comparison, i.e.,
aken here.). When this comparison
quantity (e.g., of industrial output,
roduction, etc.) between the two
ve *quantity index numbers;* similarly,
ave *value index numbers.*

ibers are tools for measuring magnitude of a variable or a group iables over time with respect to a ear.

cts of index numbers may be
with the help of the following
ose we are interested in studying
ange in prices of consumer goods,
which different people in the society
onsumption. When the data of prices
is collected, we observe two things:
of some of the goods may have
ed while those of the others may
ecreased during the two periods.
Further, the rates of increase or
prices may be different for diffe
The index number solves this
taking the average change.

2. Prices of different goods are different units, e.g., wheat ₹ per kg., milk and vegetable litre, cloth in ₹ per metre, etc number overcomes this proble percentage change only. Once price is expressed as a percentag unit of the commodity becomes

Therefore, by simply inspecting is not possible to know the extent price change. Further, due to differ measurement of these goods, it is to directly measure the change in th of consumer goods as a group. index numbers can handle such *Index number* is a statistical tool tha to arrive at a *single representative f* gives the average level of price goods in a group with reference t year. Thus, index number is a *speci average*. It help us to find out percen in the values of different variables of different goods or production goods) over time with reference t year, which is taken as the year of

22.2 DEFINITION

According to Croxton and Cow *numbers are devices for measuring the magnitude of a group of relate*

In the words of Spiegel: "*An in a statistical measure designed to s*

22

Features of Index no. —

In order to properly understand the term index numbers, it is essential to know its essential characteristics. These characteristics are:

1. Measures Relative Changes: Index numbers measure relative or percentage changes in a variable or a group of variables. As index numbers are essentially averages, these numbers therefore describe the relative change (viz., increase or decrease) as a single number. For example, an index number of prices of 200 for the year 2015, as compared to the index number 100 for the base year 2000, suggests that prices in the year 2012 have doubled as compared to those of the year 2000.
2. Quantitative Expression: Index numbers provide a precise measure of the quantitative changes in the concerned variable over time. For instance, the index number of prices will tell us that prices have increased by 10 per cent or 15 per cent between the current year and the base year. Index numbers are not the qualitative statements like prices are rising or falling.
3. Measures Changes over a Period of Time: Index numbers are generally used for measuring changes over a period of time such as changes in consumer prices, industrial production, industrial raw material prices, wages, etc., over two different time periods. Though index numbers can also be used to compare economic variables between different industries, different locations, etc., they are most popular for measuring changes over a period of time.
4. Specialised Average: Though index numbers are essentially averages, these are specialised averages. As explained in the chapter on measures of central tendency, an average is a single figure representing a group of data. These averages (such as arithmetic mean, mode, median, etc.) have a limitation of their own as these can be used to compare only those series, which are expressed in the same units of measurement (such as litres, metres, etc.) and are composed of the same items (e.g., males or graduates or senior citizens, etc.). But index numbers can be used to compare situations where units of measurement and/or composition of series are not the same. In this sense, index numbers are specialised averages. Moreover, index numbers show average changes only.