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

Enrollment No.....

Faculty of Commerce

End Sem (Odd) Examination Dec-2019

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. Measure of Sample observation is called **1**

(a) Parameter (b) Statistic (c) Mean (d) Variance

ii. The population of Mosquitoes in a town is an example of **1**

(a) Existent population (b) Infinite population

(c) Hypothetical Population (d) All of these

iii. Sum of deviations of value from their mean is always **1**

(a) 1 (b) 0 (c) 2 (d) 3

iv. Difference of Mode and Mean is equal to **1**

(a) 3(mean-median) (b) 2 (mean-median)

(c) 3(mean-mode) (d) 2(mean-mode)

v. The Value of Correlation Coefficient Lies between. **1**

(a) 0 to 1 (b)-1 to 1 (c) -1 to 0 (d) None of these

vi. If one of the regression coefficients is greater than 1 than other must be **1**

(a) Less than 1 (b) Greater than 1

(c) Equal to 1 (d) None of these

vii. Sale of Woollens is an example of which trend? **1**

(a) Secular Trend (b) Cyclical Variation

(c) Seasonal Variation (d) Irregular Variation

viii. A time series consists of data **1**

(a) Chronologically (b) Descriptive

(c) Geographical (d) Qualitative

ix. The index number for the base period is always taken as **1**

(a) 200 (b) 100 (c) 0 (d) 1

P.T.O.

x. Cost of living index is also known as **1**
(a) Consumer Price Index (b) Consumer Quantity Index
(c) Industrial Quantity Index (d) All of these

Q.2 i. What are the limitations of statistics? Describe any two. **2**

ii. Differentiate between population and sample? **3**

iii. Draw the histogram and frequency polygon of following data **5**

x	20-25	25-30	30-35	35-40	40-45	45-50
f	3	7	11	8	5	2

OR iv. What do you understand by bar graph? Explain percent bar graph by suitable example. **5**

Q.3 i. What do you understand by range of a data set? Find range of the following data 8,5,10,7,12,6 **2**

ii. Find standard deviation and coefficient of variation from following data. **8**

x:	0-8	8-16	16-24	24-32	32-40
f:	3	5	10	12	2

OR iii. Calculate median and mode from the following data **8**

x	0-10	10-20	20-30	30-40	40-50
f	8	20	36	24	12

Q.4 i. What do you understand by scatter diagram? Draw the scatter diagram for r =1 and r = -1? **4**

ii. Calculate Karl Pearson's coefficient for following data. **6**

X	35	34	40	43	56	20	38
Y	32	30	31	32	53	20	33

OR iii. The equation of two lines of regression obtained in analysis are as follows $2x = 8 - 3y, 2y = 5 - x$. Using this find **6**
(a) $\overline{x}$ & $\overline{y}$ (b) Coefficient of Correlation
(c) Variance

Q.5 i. What are the components of time series? Explain in brief by giving suitable example. **4**

ii. Fit a linear trend to following data. **6**

Years	1998	1999	2000	2001	2002
Sales	100	120	110	140	80

OR iii. Obtain five year moving averages for the following data **6**

Year	1970	1971	1972	1973	1974	1975	1976	1977	1978
sales	36	43	43	34	44	54	34	24	14

Q.6 Attempt any Two:

i. What are the important steps in construction of cost of living index number? **5**

ii. Calculate Laspeyer's, Paasche and Fisher ideal index from following data **5**

Commodity	p_0 (base year price)	q_0 (base year quantity)	p_1 (current year price)	q_1 (current year quantity)
A	2	7	6	6
B	3	6	2	3
C	4	5	8	5
D	5	4	2	4

iii. What do you understand by index numbers? Describe the utility of Index numbers? **5**

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Marking Scheme

CM3C008: Business Statistics
Programme: B.COM (HONS)
Branch: Commerce.

Q1.

(i)	(b) Statistic	+1
(ii)	(c) Hypothetical Population	+1
(iii)	(b) 0	+1
(iv)	(a) 3 (mean - median)	+1
(v)	(b) -1 to 1	+1
(vi)	(a) less than 1	+1
(vii)	(c) Seasonal variation	+1
(viii)	(a) Chronologically	+1
(ix)	(b) 100	+1
(x)	(a) Consumer price Index	+1
		Tot: 10

Q2 (i) The following are the limitations of Statistics (Any 2)

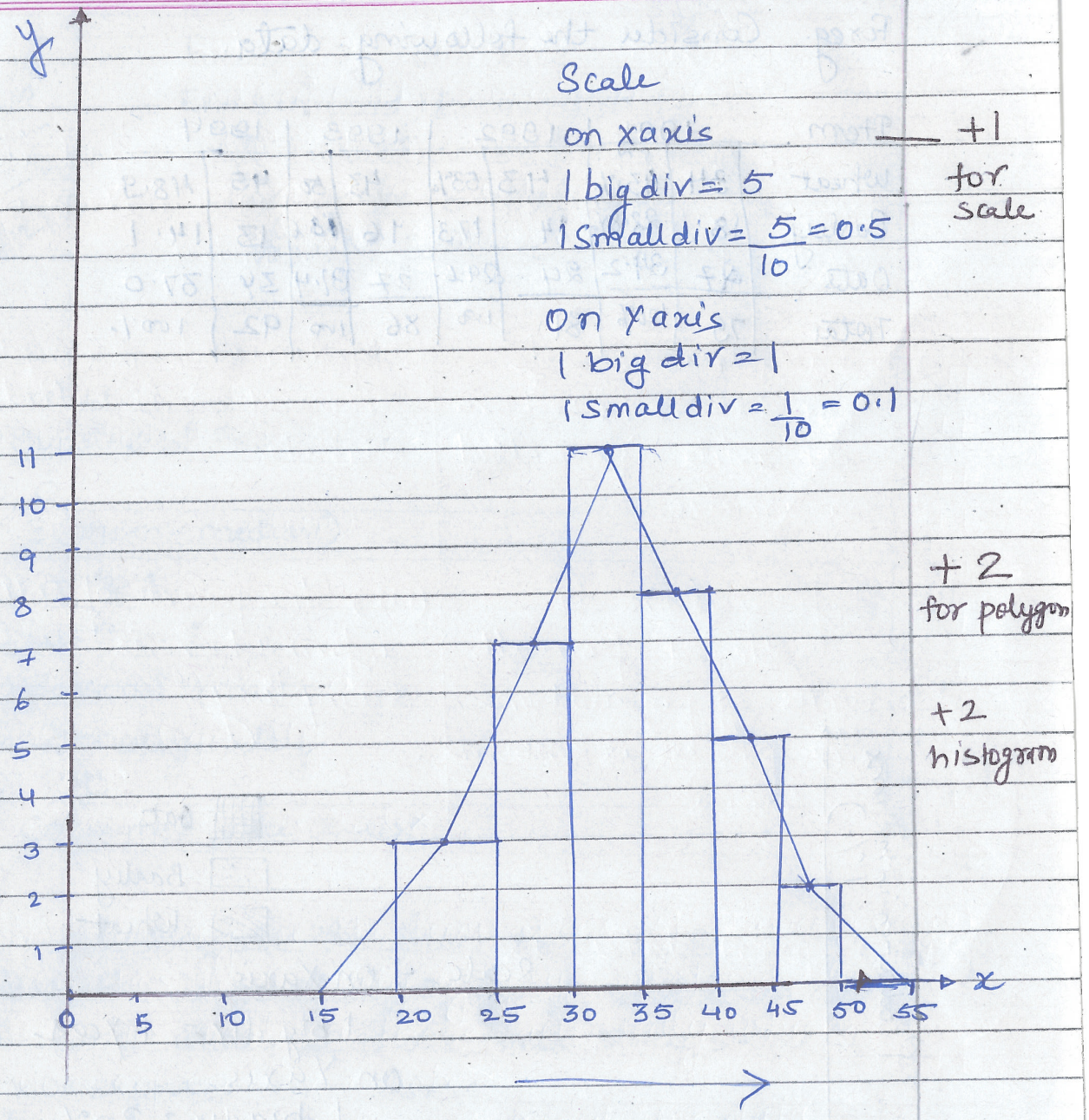
(a) Statistics is the study of group not of individuals.
(b) Statistics analysis those facts only which can be expressed in numbers. +1
(c) Statistics deals only with quantitative data
(d) Statistics law hold good only for averages +1
(e) Statistics does not and cannot study a phenomenon in its entity.
(f) Statistics provides the mean not the results Tot: 2
(g) Statistical interferences are not exact.

Q2(ii)	Population	Sample
(i)	Consist of each & every element of the entire group.	(i) Only handful items of the population is included. +1
(ii)	Characteristics of population based on all units is called parameter	(ii) Measure of sample observation is called statistic +1
(iii)	Information is collected from all units of population the process is known as Census	(iii) The process of collecting information is sampling. +1

Tot = 3

Q2 (iii) Given data is

x	f
20-25	3
25-30	7
30-35	11
35-40	8
40-45	5
45-50	2



Scale
on x axis
1 big div = 5
1 small div = $\frac{5}{10} = 0.5$
on y axis
1 big div = 1
1 small div = $\frac{1}{10} = 0.1$

+1 for scale

+2 for polygon

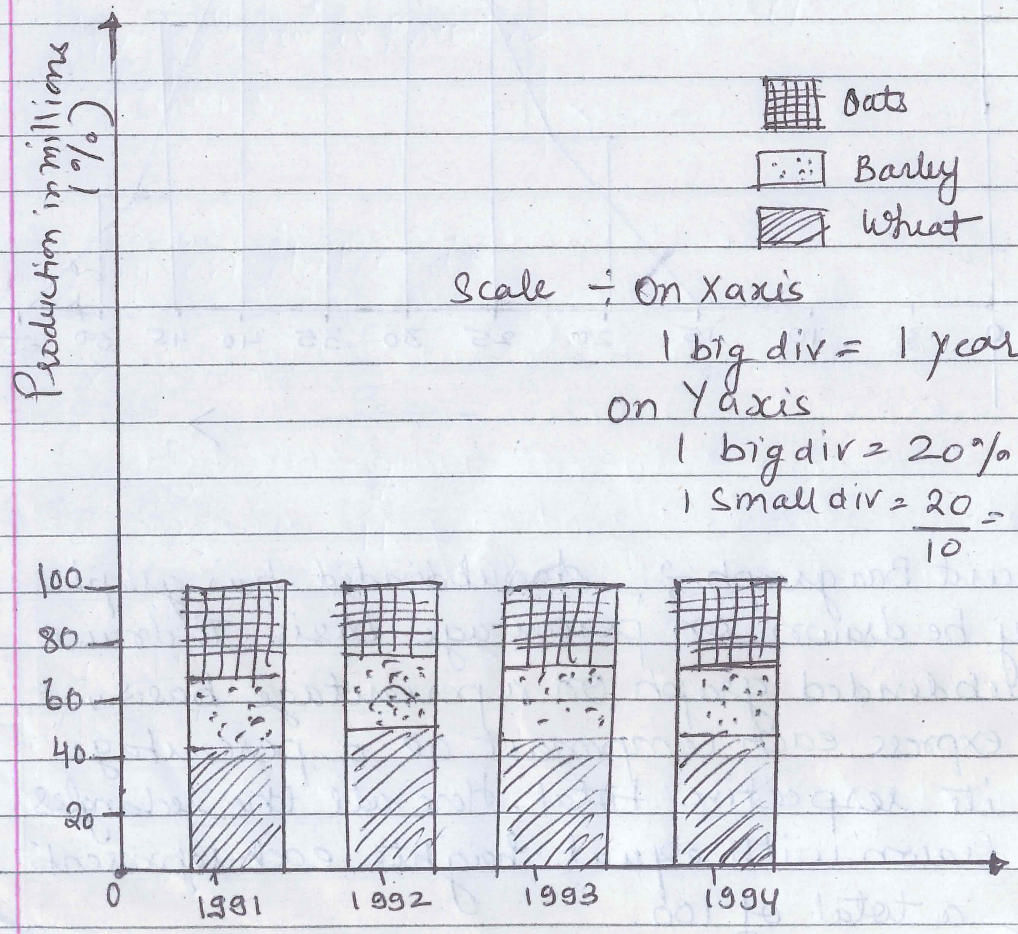
+2 histogram

Q2(iv) Percent Bar graph :- A Subdivided bar graph may be drawn on percentage basis. To draw a subdivided graph on a percentage basis, we express each component as a percentage of its respective total. Here all the rectangles are drawn with equal heights each representing a total of 100. +2

foreg. Consider the following data

Item	1991		1992		1993		1994	
Wheat	34	43.0%	43	53%	43	50	45	48.9
Barley	18	22.8%	14	17.3	16	18.6	13	14.1
Oats	27	34.2	24	29.6	27	31.4	34	37.0
Total	79	100%	81	100	86	100	92	100%

+3



Scale :- On X axis
1 big div = 1 year
on Y axis
1 big div = 20%
1 small div = $\frac{20}{10}$ = 2%

Total = 5

Q3(i) Range is defined as difference between the greatest and least value. +1

Range = Highest value − Least value.

Range of given data set is +1

Highest value = 12 Least value = 5

$R = 12 - 5 = 7$.

Q3(ii) Given data is

x	f	Mid value	$d = x - \bar{x}$
0-8	3	4	4-20 = -16
8-16	5	12	12-20 = -8
16-24	10	20	20-20 = 0
24-32	12	28	28-20 = 8
32-40	2	36	36-20 = 16
	$\Sigma f = 32$		$\Sigma d = 0$

+3

d^2	fd	fd^2
256	-48	768
64	-40	320
0	0	0
64	96	768
256	32	52
Σd^2 640	40	2368.

Steps

1. Find Mid value of given data set
2. Find Assume mean let A = 20
3. Find deviation from Assume mean i.e d
4. Find d^2, fd, fd^2

formula used

$$S.D = \sqrt{\frac{\Sigma fd^2}{\Sigma f} - \left(\frac{\Sigma fd}{\Sigma f}\right)^2}$$ +1

$$= \sqrt{\frac{2368}{32} - \left(\frac{40}{32}\right)^2}$$

$$= \sqrt{74 - 1.5625}$$ +1

$$= \sqrt{72.4375} = 8.511$$

Now Coefficient of Variation +1

$$= \frac{S.D}{Mean} \times 100$$

for this we have to find original mean

$$Mean = A + \frac{\Sigma fd}{\Sigma f}$$

$$\bar{x} = 20 + \frac{40}{32}$$ +1

$$= 20 + 1.25$$

$$= 21.25$$

So Coefficient of Variation is +1

$$= \frac{8.511}{21.25} \times 100$$

$$= 40.05\%$$

8

formula used

$$S.D = \sqrt{\frac{\Sigma fd^2}{\Sigma f} - \left(\frac{\Sigma fd}{\Sigma f}\right)^2}$$ +1

$$= \sqrt{\frac{2368}{32} - \left(\frac{40}{32}\right)^2}$$

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So Coefficient of Variation is +1

$$= \frac{8.511}{21.25} \times 100$$

$$= 40.05\%$$

8

Q3(iii)

x	f	Cumulative frequency
0-10	8	8
10-20	20	28
20-30	36	64
30-40	24	88
40-50	12	100
	$\Sigma f = 100$	

+ 1

for Median

First find Cummulative frequency

formula used

$$\text{Median} = l_1 + \frac{(N/2 - pcf)}{f} \times i \qquad + 1$$

l_1 = lower limit of median class
i = width of median class
pcf = preceding Cummulative frequency
f = frequency of class
N = total frequency.

$\frac{N}{2} = \frac{100}{2} = 50$

Our median class is 20-30 + 1

$l_1 = 20 \quad i = 10 \quad pcf = 28$
$f = 36$

$$\text{Median} = 20 + \frac{(50 - 28)}{36} \times 10$$

$$= 20 + \frac{22}{36} \times 10$$

$= 20 + 0.61 \times 10$

$= 20 + 6.1$

$= 26.11$ +1

for

Mode $= l_1 + \frac{(f_1 - f_0)}{(2f_1 - f_0 - f_2)} \times i$ +1

l_1 = lower limit of modal class

f_1 = frequency of modal class

f_0 = frequency of the class proceeding to modal class

f_2 = frequency of the class succeeding the modal class

i = width of class.

Here modal class with maximum frequency is 20-30 $l_1 = 20$

$i = 10$ +1

$f_0 = 20$

$f_1 = 36$

$f_2 = 24$

Putting the values in formula.

$$\text{Mode} = 20 + \frac{(36-20) \times 10}{(36 \times 2 - 20 - 24)}$$

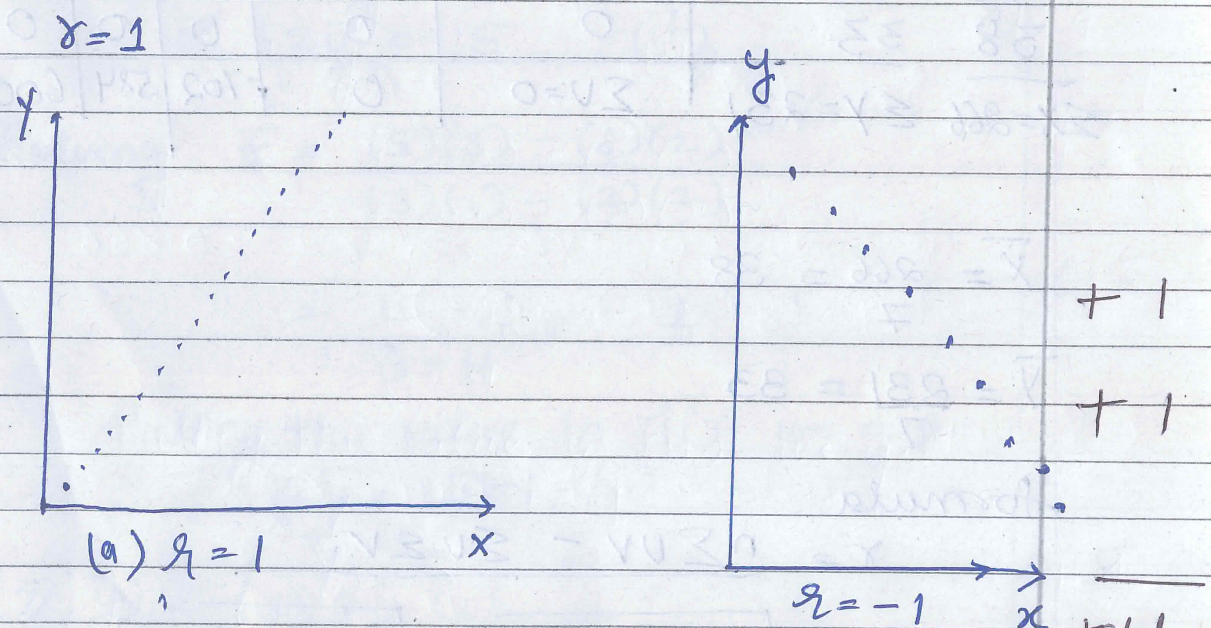
$$= 20 + \frac{(16) \times 10}{(72 - 44)}$$ +2

$$= 20 + \frac{160}{28} = 20 + 5.71$$

$= 25.71$ Ans

Total = 8

Q4(i) Scatter diagram is one of the most ~~simplest~~ method of determining the correlation between two variables. Let a bivarite distribution is given in following way $(x_1, y_1), (x_2, y_2), (x_3, y_3) \ldots (x_n, y_n)$ +2
The value of the variables plotted along the x axis & y axis in a coordinate ~~axis~~ plane by choosing a suitable scale so that it measure the range of the data of both the variates under consideration.



Scatter diagrams
(a) $r = 1$
b = $r = -1$

Q4 (ii)

Given data is

x	y	$U = x - \bar{x}$	$V = y - \bar{y}$	U^2	V^2	UV
35	32	−3	−1	9	1	3
34	30	−4	−3	16	9	12
40	31	2	−2	4	4	−4
43	32	5	−1	25	1	−5
56	53	18	20	324	400	360
20	20	−18	−13	324	169	234
38	33	0	0	0	0	0
$\Sigma x = 266$	$\Sigma y = 231$	$\Sigma U = 0$	0	702	584	600

+3

$\bar{x} = \frac{266}{7} = 38$

$\bar{y} = \frac{231}{7} = 33$

+1

formula.

$$r = \frac{n\Sigma UV - \Sigma U \Sigma V}{\sqrt{n\Sigma U^2 - (\Sigma U)^2}\ \sqrt{n\Sigma V^2 - (\Sigma V)^2}}$$

+1

$$r = \frac{7 \times 600 - 0 \times 0}{\sqrt{7 \times 702}\ \sqrt{7 \times 584}} = \frac{600}{\sqrt{702} \times \sqrt{584}}$$

$= 0.937$

+1

Q4(iii)

Equations of Regression lines are

$$2x = 8 - 3y \quad \& \quad 2y = 5 - x$$

(a) Write it as $2x + 3y = 8$

$2y + x = 5$ ——— 0.5

intersecting points of these eqs are $(\bar{x}, \bar{y})$

$\therefore 2\bar{x} + 3\bar{y} = 8$ — (i)

$\bar{x} + 2\bar{y} = 5$ — (ii) ——— 0.5

Solving $\bar{x} = \dfrac{(5)(3) - (8)(2)}{(3)(1) - (2)(2)}$ ...

——— 0.5

$= \dfrac{15 - 16}{3 - 4} = 1$

Putting this value in (ii) we get ...

$2\bar{y} = 5 - 1 = 4$

$\bar{y} = 2$ ——— 0.5

$(\bar{x}, \bar{y}) = (1, 2)$

(b) Coeff. of Correlation $r = \sqrt{b_{xy} \times b_{yx}}$ + 0.5

So from I line we get

$x = \dfrac{-3}{2}y + \dfrac{8}{2}$ Compare this by 0.5

$(x - \bar{x}) = b_{xy}(y - \bar{y})$ $b_{xy} = \dfrac{-3}{2}$

Similarly

Using second eq.

$2y = 5 - x$

$\Rightarrow 2y = -x + 5$

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

Comparing it by

$y - \bar{y} = byx(x - \bar{x})$ +0.5

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

Clearly $bxy \times byx \leq 1$

$r = \sqrt{\frac{-3}{2} \times \frac{-1}{2}} = \frac{1.732}{2} = -0.866$ +1

as both are -ve. So $r = -0.866$
(bxy & byx are negative)

(c) Variance

We know that $bxy = r\frac{\sigma x}{\sigma y}$ -(i) +0.5

$byx = r\frac{\sigma y}{\sigma x}$ -(ii)

Dividing (i) by (ii)

$\frac{bxy}{byx} = \frac{\sigma^2 x}{\sigma^2 y}$ +0.5

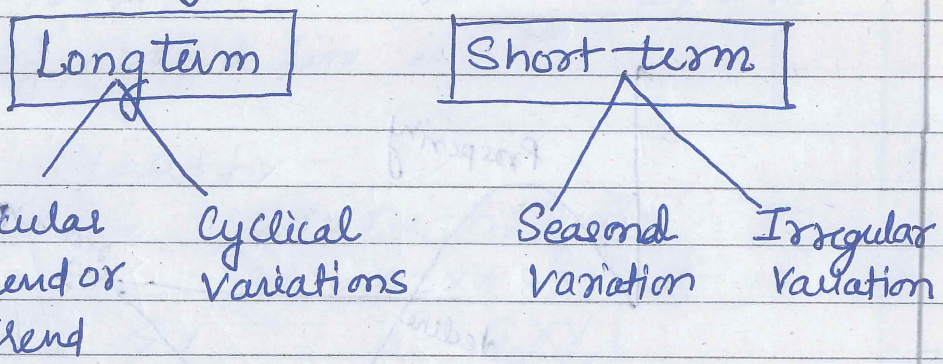
$\frac{\sigma^2 x}{\sigma^2 y} = \frac{+3/2}{+1/2}$

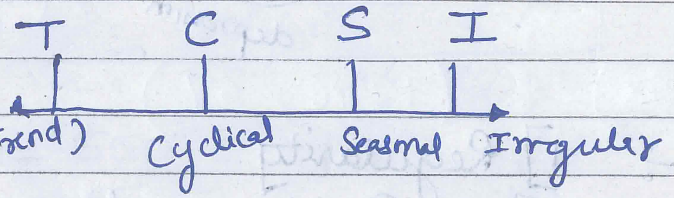
On comparing Variance along $x = 3$
& " " $y = 1$ +0.5

i.e $\sigma^2 x = 3$
$\sigma^2 y = 1$

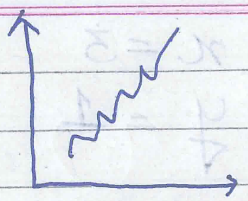
total = 6

Q5(i) There are four components of time series categorised in following manner

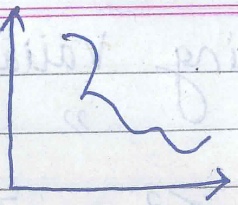




Secular Trend :- 1] Basically known as Trend
2] General tendency of data to grow or decline over a long period of time +1
3] For e.g population change Formation of rocks etc
4] Purpose of Measuring trend is Knowledge of Past Behaviour & Estimation



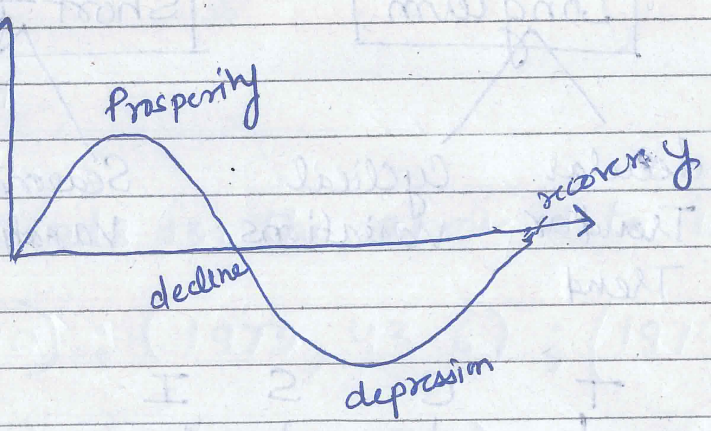
Upward trend



Downward trend

Cyclical :- 1] Refers to recurrent variations
2] usually last longer than a year
3] For e.g Business Cycle

+1



Seasonal :- 1] Regularity
2] In fixed proportion
3] Easy to forecast
4] It is responsible for regular rise or fall in the time series during a period not more than 1 year.
For e.g Sale of woollens

+1

Irregular :- 1] It is irregular & unpredictable
2] No definite pattern
3] Short period of time.
4] No statistical technique.

+1
total = 4

Q5(ii)

Given data is

Years	Sales	$X = x - 2000$	XY	X^2
1998	100	−2	−200	4
1999	120	−1	−120	1
2000	110	0	0	0
2001	140	1	140	4
2002	80	2	160	1
	$\Sigma Y = 550$	$\Sigma X = 0$	$\Sigma XY = -20$	$\Sigma X^2 = 10$

+2

Linear eq. of Straight line is

$$Y = a + bx \quad - (A)$$ +1

normal eq. are $\Sigma Y = na + b\Sigma X$ -(i)

$\Sigma XY = a\Sigma X + b\Sigma X^2$ -(ii) +1

Here $a = \frac{\Sigma Y}{n}$ $b = \frac{\Sigma XY}{\Sigma X^2}$ +1

$a = \frac{550}{5}$ $b = \frac{-20}{10}$ +0.5

$a = 110$ $b = -2$

Putting the values in A

linear trend is $Y = 110 - 2X$ +0.5

Q5 (iii)

Given

Year	Sales	Sum	Avg
1970	36		
1971	43		
1972	43	→ 36+43+43+34+44 = 200	200/5 = 40
1973	34	→ 43+43+34+44+54 = 218	218/5 = 43.6
1974	44	→ 43+34+44+54+34 = 209	209/5 = 41.8
1975	54	→ 34+44+54+34+24 = 190	190/5 = 38
1976	34	→ 44+54+34+24+14 = 170	170/5 = 34
1977	24		
1978	14		

+2 for sum

+2 for avg

So the trends for the above data is

(1972, 40) ; (1973, 43.6) ; (1974, 41.8)

(1975, 38) ; (1976, 34)

+2 for writing trend

Q6(i) The important steps in construction of cost of living index numbers are.

—

① First Step is the decision about the class of people whom for Index number is meant for. It is also necessary to decide geographical area +1

② Second Step is to conduct a family budget enquiry +1

③ Next step is to collect retail price of items from market +1

④ After collection of retail price we will find average price of each item. +1

⑤ Price of Price relatives are always weighted therefore Cost of living index is always weighted +1

total =5

$$CPI = \frac{\sum IW}{\sum W}$$

It is also known as Consumer Price Index

Q6(ii)

P.T.O

6(ii) Given data is

Commodity	P_0 base year price	q_0 base year quantity	P_1	q_1
A	2	7	6	6
B	3	6	2	3
C	4	5	8	5
D	5	4	2	4

+2

Find P_0q_0	P_1q_0	P_0q_1	P_1q_1
14	42	12	36
18	12	9	6
20	40	20	40
20	8	20	8
$\Sigma P_0q_0 = 72$	102	61	90

Price Relative Index number

Laspeyer's $= \frac{\Sigma P_1q_0}{\Sigma P_0q_0} \times 100$ +1

$= \frac{102}{72} \times 100 = 141.67$

Paasche $= \frac{\Sigma P_1q_1}{\Sigma P_0q_1} \times 100$ +1

$= \frac{90}{61} \times 100 = 147.54$

Fisher $= \sqrt{\text{Lasp} \times \text{Paasche}} = \sqrt{141.67 \times 147.54}$ +1

$= 144.58$ Ans +1

Q6(iii) An index number is a device for comparison between the price, quantity & value of a group of articles in different situation at a certain place or period of time. +2.5

Types (1) Price relative
(2) Quantity relative
(3) Value relative.

Utility

(1) To study the relative positions of business & economic conditions — +0.5
(2) To measure the changes in price of commodities. — +0.5
(3) Help in framing suitable economic & business policies — +0.5
(4) Help in population indices — +0.5
(5) Very useful in deflation. +0.5

Total = 5

—X—