QB365 Question Bank Software Study Materials

Applied Statistics Important 2,3 & 5 Marks Questions With Answers (Book Back and Creative)

12th Standard

Business Maths and Statistics

Total Marks : 50

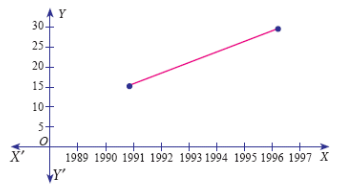
2 Marks

10 x 2 = 20

1) Fit a trend line by the method of semi-averages for the given data.

Year	1990	1991	1992	1993	1994	1995	1996	1997
Sales	15	11	20	10	15	25	35	30

Answer : Since the number of years is even(eight), we can equally divide the given data it two equal parts and obtain the averages of first four years and last four years.



Year	Production	Average
1990	15	
1991	11	$\frac{15+11+20+10}{4}=14$
1992	20	
1993	10	
1994	15	
1995	25	$\frac{15+25+35+30}{4}=26.25$
1996	35	
1997	30	

2) Define Time series.

Answer : A time series consists of a set of observations arranged in chronological order (either ascending or descending). It is a statistical data which relates to successive intervals or point of time.

3) What is the need for studying time series?

Answer : (i) It helps in the analysis of the past behavior

(i) It helps in forecasting and for future plans

(ii) It helps in the evaluation of current achievements

(iv) It helps in making comparative studies between one time period and others

4) Explain cyclic variations.

Answer : Cyclic uniformly periodic in nature. They may or may not follow exactly similar patterns after equal intervals of time. Generally one cyclic period ranges from 7 to.9 years and there is no hard and fast rule in the fixation of years for a cyclic period. For example, every business cycle has a Start-Boom-Depression- Recover maintenance during booms and depressions, changes in government monetary policies, changes in interestrates.

5) State the two normal equations used in fitting a straight line.

Answer : The two normal equations are

$\sum Y = na + b\sum X$

$\sum XY = a\sum X + b\sum X^2$ where n is the number of years given in the data.

6) Write note on Fisher's price index number.

Answer : Fisher's price index number is the geometric mean of Laspeyre's and Paasche's price index number. Hence it is weighted index number.

Fisher's price index number = $\sqrt{\frac{\sum p_1q_0}{\sum p_0q_0}\times\frac{\sum p_1q_1}{\sum p_0q_1}}\times 100$

7) Define Time Reversal Test.

Answer : Time reversal test is an important test for testing the consistency of a good index number. This test maintains time consistency by working both forward and backward with respect to time (here time refers to base year and current year). Symbolically the following Relationship should be satisfied, $P_{01} \times P_{10} = 1$ Fisher's index number formula satisfies the above relationship

i.e. $P_{01} = \frac{1}{P_{10}}$ or $P_{01} \times P_{10} = 1$(Except the factor 100)

8) Explain Factor Reversal Test.

Answer : Factor reversal test is another test for testing the consistency of a good index number. The product of price index number and quantity index number from the base year to the current year should be equal to the true value ratio. That is ratio between the total value of current period and total value of the base period is known as true value ratio. Factor reversal test is given by,

i.e. $P_{01} \times Q_{01} = \frac{\sum P_1 q_1}{\sum p_0 q_0} = V_{01}$(Except the factor 100)

9) What do you mean by process control?

Answer : The main objective in any product process is to control and maintain a satisfactory quality level of the manufactured product. This is done by Process Control. In process control the proportion of defective items in the production process is to be minimized and it is achieved through the technique of control charts.

10) Write the control limits for the R chart.

Answer :

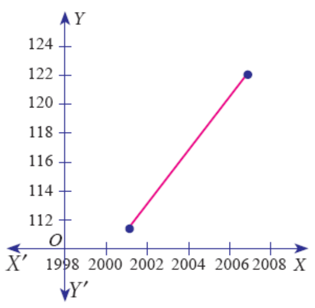
Case (i) when SD are given	**Case (ii)** when SD are not given
(i) UCL = $\overline{R} + 3\sigma_R$	(i) UCL = $D_4 \overline{R}$
(ii) CL = $\overline{R}$	(ii) CL = $\overline{R}$
(iii) LCL = $\overline{R} - 3\sigma_R$	(iii) LCL = $D_3 \overline{R}$

3 Marks 5 x 3 = 15

11) Fit a trend line by the method of semi-averages for the given data.

Year	2000	2001	2002	2003	2004	2005	2006
Production	105	115	120	100	110	125	135

Answer : Since the number of years is odd(seven), we will leave the middle year's production value and obtain the averages of first three years and last three years.



Year	Production	Average
2000	105	
2001	115	$\frac{105+115+120}{3} = 113.33$
2002	120	
2003	100(left out)	
2004	110	
2005	125	$\frac{110+125+135}{3} = 123.33$
2006	135	

12) A machine drills hole in a pipe with a mean diameter of 0.532 cm and a standard deviation of 0.002 cm. Calculate the control limits for mean of samples 5.

Answer : Given $\bar{X}$ = 0532., σ = 0.002, n = 5

The control limits for $\bar{X}$ chart is

$$UCL = \bar{\bar{X}} + 3\frac{\sigma}{\sqrt{n}} = 0.532 + 3\frac{0.002}{\sqrt{5}} = 0.5346$$

$$CL = \bar{\bar{X}} = 0.532$$

$$UCL = \bar{\bar{X}} - 3\frac{\sigma}{\sqrt{n}} = 0.532 - 3\frac{0.002}{\sqrt{5}} = 0.5293$$

13) Construct the cost of living Index number for 2015 on the basis of 2012 from the following data using family budget method.

Commodity	Price		Weight
	2012	2015	
Rice	250	280	10
Wheat	70	280	5
Corn	150	170	6
Oil	25	35	4
Dhal	85	90	3

Answer :

Commodity	Price		P = $\frac{p_1}{p_0}$ $\times 100$	V	[PV
	2012 (p_0)	2015 (p_0)			
Rice	250	280	112	10	1120
Wheat	70	85	121.42	5	607.1
Corn	150	170	113.33	6	679.98
Oil	25	35	140	4	560
Dhal	85	90	105.88	3	317.64
				28	3284.72

Using family budget method,

C.L.I = $\frac{\sum PV}{\sum V}$ = $\frac{3284.72}{28}$ = 117.31

14) From the following data, calculate the trend values using fourly moving averages.

Year	1990	1991	1992	199	1994	1995	1996	1997	1998
Sales	506	620	1036	673	588	696	1116	738	663

Answer : The treand values is using fourly moving average given below

Year	Sales	4 Yearly moving total	4 Yearly moving average
1990	506	-	-
1991	620		
		2835	708.75
1992	1036		
		2917	729.25
1993	673		
		2993	748.25
1994	588		
		3073	768.25
1995	696		
		3138	784.5
1996	1116		
		3213	803.25
1997	738		
1998	663		

15) An Enquiry was made into the budgets of the middle class families in a city gave the following information.

Expenditure	Food	Rent	Clothing	Fuel	Rice
Price(2010)	150	50	100	20	60
Price(2011)	174	60	125	25	90

Weights	35	15	20	10	20

What changes in the cost of living have taken place in the middle class families of a city?

Answer :

Expenditure	**Weights (V)**	**Rent 2010 (p0)**	**Price 2011 (p1)**	**P =** $\frac{p_1}{p_0} \times 100$	**PV**
Food	35	150	174	116	4060
Rent	15	50	60	120	1800
Clothing	20	100	125	125	2500
Fuel	10	20	25	125	1250
Rice	20	60	90	150	3000
	100				**12610**

Cost of living index number = $\frac{\sum PV}{\sum V}$ = $\frac{12610}{100}$ = 126.10

∴ The cost ofliving has increased upto 26.10% in 2011 as compared to 2010.

5 Marks 3 x 5 = 15

16) Given below are the data relating to the sales of a product in a district.

Fit a straight line trend by the method of least squares and tabulate the trend values.

Year	1995	1996	1997	1998	1999	2000	2001	2002
Sales	6.7	5.3	4.3	6.1	5.6	7.9	5.8	6.1

Answer : Computation of trend values by the method of least squares.

In case of EVEN number of years, let us consider

$X = \frac{\text{(x-Arithimetic mean of two middle years)}}{0.5}$

Year(x)	**Sales(Y)**	**X=**$\frac{(x-1998.5)}{0.5}$	**XY**	**X²**	**Trend Values (Y_t)**
1995	6.7	-7	-46.9	49	5.6166
1996	5.3	-5	-26.5	25	5.7190
1997	4.3	-3	-12.9	9	5.8214
1998	6.1	-1	-6.1	1	5.9238
1999	5.6	1	5.6	1	6.0261
2000	7.9	3	23.7	9	6.1285
2001	5.8	5	29.0	25	6.2309
2002	6.1	7	42.7	49	6.3333
N = 8	47.8	$\sum X$ = 0	8.6	168	

$a = \frac{\sum Y}{n} = \frac{47.8}{8} = 5.975; \quad b = \frac{\sum XY}{\sum X^2} = \frac{8.6}{168} = 0.05119$

Therefore, the required equation of the straight line trend is given by

Y = a + bX; Y = 5.975 + 0.05119 X.

When X = 1995, Y_t = 5.975 + 0.05119$\left(\frac{1995-1998.5}{0.5}\right) = 5.6166$

When X = 1996, Y_t = 5.975 + 0.05119$\left(\frac{1996-1998.5}{0.5}\right) = 5.7190$

similarly other values can be obtained.

17) Using the following data, construct Fisher's Ideal index and show how it satisfies Factor Reversal Test and Time Reversal Test?

Commodity	**Price in Rupees per unit**		**Number of units**	
	Base year	**Current year**	**Base year**	**Current year**
A	6	10	50	56
B	2	2	100	120
C	4	6	60	60
D	10	12	50	24
E	8	12	40	36

Answer :

Commodity	Price in Rupees per unit		Number of units	
	p_0	p_1	q_0	q_1
A	6	10	50	56
B	2	2	100	120
C	4	6	60	60
D	10	12	50	24
E	8	12	40	36

p_0q_0	p_0q_1	p_1q_0	p_1q_1
300	560	500	336
200	240	200	240
240	360	360	240
500	288	600	240
320	432	480	288
1560	1880	2140	1344

Fisher's price index number

$P_{01}^{P} = \sqrt{\frac{\sum p_1q_0 \times \sum p_1q_1}{\sum p_0q_0 \times \sum p_0q_1}} \times 100$

$= \sqrt{\frac{2140 \times 1880}{1560 \times 1344}} \times 100$

$= \sqrt{\frac{4023200}{2096640}} \times 100$

$= \sqrt{1.9188} \times 100$

$P_{01}^{F} = 138.5$

Time reversal test :

$P_{01} \times P_{10} = \sqrt{\frac{\sum p_1q_0 \times p_1q_1 \times p_0q_1 \times p_0q_0}{\sum p_0q_0 \times p_0q_1 \times p_1q_1 \times p_1q_0}}$

$= \sqrt{\frac{2140 \times 1880 \times 1344 \times 1560}{1560 \times 1344 \times 1880 \times 2140}}$

$= \sqrt{1} = 1$

Time reversal test = 1

Factor reversal test:

$P_{01} \times Q_{01} = \sqrt{\frac{\sum p_1q_0 \times p_1q_1 \times p_0q_1 \times p_0q_0}{\sum p_0q_0 \times p_0q_1 \times p_1q_1 \times p_1q_0}}$

$= \sqrt{\frac{2140 \times 1880 \times 1344 \times 1560}{1560 \times 1344 \times 1880 \times 2140}}$

$= \sqrt{(\frac{1880}{1560})^2}$

$= \frac{1880}{1560}$

$P_{01} \times Q_{01} = \frac{\sum p_1q_1}{\sum p_0q_0}$

18) From the following data, calculate the control limits for the mean and range chart.

Sample No.	1	2	3	4	5	6	7	8	9	10
Sample Observations	50	51	50	48	46	55	45	50	47	56
	55	50	53	53	50	51	48	56	53	53
	52	53	48	50	44	56	53	54	49	55
	49	50	52	51	48	47	48	53	52	54
	54	46	47	53	47	51	51	57	54	52

Answer :

Sample No.	Observation					Total	x	R = X_{max} - X_{min}
	1	2	3	4	5			
1	50	55	52	49	54	260	52	55-49 = 6
2	51	50	53	50	46	250	50	53-46 = 7
3	50	53	48	52	47	250	50	53-47 = 6
4	48	53	50	51	53	255	51	53-48 = 5
5	46	50	44	48	47	235	47	50-44 = 6
6	55	51	56	47	51	260	52	56-47=9
7	45	48	53	48	51	245	49	53-45=8
8	50	56	54	53	57	270	54	57-50 = 7
9	47	53	49	52	54	255	51	54-47 = 7
10	56	53	55	54	52	270	54	56-52 = 4
							510	**65**

$\overline{\overline{X}} = \frac{510}{10} = 51$

$\overline{R} = \frac{65}{10} = 6.5$

The control limits of mean chart are

UCL = $\overline{\overline{X}} + A_2\overline{R}$

= 51 + 0.577 (6.5)

= 51 + 3.75 = 57.75

CL = $\overline{\overline{X}}$ = 51

LCL = $\overline{\overline{X}} - A_2\overline{R}$

= 51 - 3.75 = 47.25

The control limits of range chart are

UCL = $D_4\overline{R}$ = 2.114 (6.3) = 13.32

CL = $\overline{R}$ = 6.5

[For n=5, A_2 = 0.577, D_3 = 0, D_4 = 2.114]

LCL = $D_3\overline{R}$ = 0