

SATAVAHANA UNIVERSITY, KARIMNAGAR.
Department of Statistics
CBCS Pattern with Semester System (w.e.f.2016-2017)
B.Sc (Statistics) IIIYear- Semester –V
Paper –V-
(Sampling Theory, Time Series, Index Numbers &
Demand Analysis)
(Question Bank for Practical Examinations)

UNIT – I

1. Explain Sampling and Non-Sampling errors.

2. Consider a population of 4 units with values 1,2, 3 ,4. Write down all possible samples of size 2 (Without replacement) from this population and Verify that sample mean is unbiased estimate of the population mean and also estimate its sampling variance.

3. Consider a population of 5 units with values 2, 3, 6, 8, 11 consider all possible samples of size 2 which can be drawn with replacement from this population. Calculate the Standard Error of sample mean. Also calculate the Standard Error of the sample mean when the samples of size 2 are drawn without replacement.

4. Explain Subjectivity Sampling and Probability Sampling.

5. Derive the Variance of Sample mean under SRSWR.

6. Consider a population of 5 units with values 3 5,7,9,11 Write down all possible samples of size 2 (With replacement) from this population and Verify that sample mean is unbiased estimate of the population mean.

7. Explain the Random numbers method.

8. There are 200 small industrial establishments in a city. The number of employees in each establishment in a simple random sample of size 20 establishments is given below.

12	28	39	52	76	81	75	84	28	68
98	35	82	13	20	52	15	21	43	59

Estimate the average no. of employees per establishment in city and find Standard Error of estimate.

9. Explain the Lottery method.

10. Define Population proportion 'P' and Sample proportion p and prove that $E(p) = P$

UNIT-II

11. Find the Variance of the Sample Mean in Stratified Random Sampling.

12. Population of size is 660 divided in to 3 strata as follows:

Strata No.	I	II	III
Population size	150	250	260
S.D.	5	7	6

A stratified random sampling size of 100 is to be selected from the population. Find the sample size of Proportional allocation and Optimum allocation method.

13. In Stratified random sampling, for a specified cost function, $V(y_{st})$ is minimum if $n_i \propto (N_i S_i) / \sqrt{C_i}$

14. Comparison the Variance of Stratified random sampling under Proportional allocation and Optimum allocation.

15 A population of size 800 is divided in to 3 strata their sizes & Std.Deviations are given below.

	Strata		
	I	II	III
Size	200	300	300
S.D.	6	8	12

A Stratified random sample of size 120 is to be drawn from population. Determine the sizes of samples from the three strata in case of

(i) Proportional Allocation (ii) Optimum Allocation.

16. Define Systematic sampling. Prove that Sample mean is unbiased estimate of the population mean in Systematic sampling.

17. Prove that Variance of the Systematic sample mean is given by

$$V(y_{sys}) = S^2 (N-1)/N - S_{wsy}^2 k(n-1)/N$$

18. Find the Efficiency of Systematic sampling over Simple random sampling.

19. Prove that Variance of the Systematic sample mean is given by

$$V(y_{sys}) = (S^2/n)(nk-1)/nk [1+(n-1)\rho]$$

Where ρ is the infraclass correlation co-efficient between the units of the same Systematic sample.

20. Prove that Variance of the Systematic sample mean is given by

$$V(y_{sys}) = S_{wst}^2 (k-1)/nk [1+(n-1)\rho_{wst}]$$

UNIT-III

21. Fit a linear trend to the following data by the least squares method. Verify that $\Sigma(y-y_e) = 0$, Where y_e is the corresponding trend value of y

Year	1990	1992	1994	1996	1998
Prod.('000 units)	18	21	23	27	16

Also estimate the production for the year 1999.

22. The sales of a company (in million of rupees) for the year 1994-2001 are given below:

Year	1994	1995	1996	1997	1998	1999	2000	2001
Sales	550	560	555	585	540	525	545	585

(i) Find the liner trend equation.

(ii) Find the slope of the straight line.

23. The liner trend of sales of a company is Rs 6, 50,000 in 1995 and it rises by Rs 16,500 per year.

(i) Write down the trend equation

(ii) If a company knows that it sales in 1998 will be 10% below the forecasted trend sales, find its expected sales in 1998.

24. Fit a second degree parabola to the data.

X	1	2	3	4	5
Y	1090	1220	1390	1625	1915

25. The following is a monthly trend equation:

$$Y_e = 20 + 2X$$

(Origin: Jan.1992; X-unit= One month; Y unit= Month sales (in '000 Rupees)

Convert it in to an annual trend equation.

26. Fit an Exponential Curve of the form $U_t = ab^t$ to the given data by using the method of least squares.

Years	1978	1979	1980	1981	1982
Sales('000)	10	12	13	10	8

27. Calculate (i) Three yearly (ii) Five yearly moving averages for the following data and comment on the results.

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
y	242	250	252	249	253	255	251	257	260	265	262

28. Calculate the trend values by the method of moving average assuming a for a **four-yearly cycle**, from the data relating to sugar production in India:

Year	Sugar Production	Year	Sugar Production
1971	37.4	1977	48.4
1972	31.1	1978	64.6
1973	38.7	1979	58.4
1974	39.5	1980	38.6
1975	47.9	1981	51.4
1976	42.6	1982	84.4

29. The data below gives the average Quarterly prices of a commodity for 4 years.

Year	Ist Quarter	IInd Quarter	IIIrd Quarter	IVth Quarter
1980	40.3	44.8	46	48
1981	50.1	53.1	55.3	59.5
1982	47.2	60.1	52.1	55.2
1983	55.4	59	61.6	65.3

Calculate the Seasonal Indices by the method of simple averages.

30. Calculate Seasonal Indices by the method of Link Relatives to the following data.

Years	Price of Rice (in Rs for kg)			
	2001	2002	2003	2004
1	75	86	90	100
2	60	65	72	78
3	54	63	66	72
4	59	80	82	93

UNIT-IV

31. Construct Laspeyre's and Paasch's index numbers for the year 1990 with 1980 as the base year to the following data.

Commodity	Price		Quantity	
	1980	1990	1980	1990
A	10	12	12	15
B	7	5	15	20
C	5	9	24	20
D	16	14	5	5

32. Show that the Fisher's index number satisfy Time Reversal Test and Factor Reversal Test to the following data.

Commodity	Price		Quantity	
	2010	2013	2010	2013
A	17	19	40	42
B	14	17	30	35
C	19	21	10	17
D	13	16	20	14
E	21	31	16	12
F	50	60	15	10

33. Compute Cost of Living Index Numbers (COLIN) by Aggregate Expenditure Method and Family Budget Method to the following data.

Commodity	Quantity consumed	Price(Rs) in 2005	Price(Rs) in 2005
Rice	50 kgs	15	30
Wheat	4 kgs	10	18
Pulses	3 kgs	30	85
Ghee	1 kg	47	73
Jaggery	2 kg	12	18
Sugar	5 kg	16	28
Oil	3 liters	32	63
Clothing	10 meters	15	27
Fuel	30 liters	10	17
House rent	-	1200	2000

34. Two price index Series are given splicing the two series.

Year	2003	2004	2005	2006	2007	2008	2009
Series-I	100	130	150	120			
Series-II				100	130	160	140

35. The annual Wages (in Rs) of workers are given along with consumer Price Indices. Find (i) The real wages

(ii) The real wage indices.

Year	2000	2001	2002	2003
Wages	1800	2200	3400	3600
Consumer Price Index	100	170	300	320

36. If demand curve $D = 250 - 3P^2$ and Supply curve $S = P^2 + 2P^4$ Find the equilibrium price and quantities exchanged.

37. If a demand function is $P = 4 - 5x^2$ for what value of x the elasticity of demand will be unity.

38. If X_1 and P_1 are demand & price of tea and X_2 and P_2 are demand & price of coffee and the demand functions are given by

$$X_1 = (P_1^{-0.3}) (P_2^{0.5}) \quad ; \quad X_2 = (P_1^{0.3}) (P_2^{-0.5})$$

Show that the two commodities are competitive and If also find partial elasticity's of demand.

39. The Demand function is given by $X = 10 - p$ Where X is the demand and P is the price. Find the price elasticity of demand at $P=6$. If the price increases by 5% determine the percentage of change in demand.

40. If demand curve of the form $P = ae^{-kx}$. Where P is the price and x is demand. Prove that the elasticity of demand is $1/(kx)$. Hence deduce the elasticity of demand $P = 10e^{-x/2}$
