

SATAVAHANA UNIVERSITY, KARIMNAGAR.
Department of Statistics
CBCS Pattern with Semester System (w.e.f.2021-2022)
B.Sc (Statistics) III Year- Semester –V
Paper –V(A) : Applied Statistics - I
(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

$$V(\bar{y}_{sys}) = S^2 (N-1)/N - S_{wsy}^2 k(n-1)/N$$

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

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

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

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

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

UNIT-III

21. Fit a linear trend to the following data by the least square's 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. You are given the values of sample mean X-bar and the range for ten samples of size 5 each. Draw mean and range charts and comment on the state of control of the process.

Sample No.	1	2	3	4	5	6	7	8	9	10
X-bar	43	49	37	44	45	37	51	46	43	47
R	5	6	5	7	7	4	8	6	4	6

You may use the following control charts constants:

For n= 5. $A_2 = 0.58$ $D_3 = 0$ and $D_4 = 2.11$

32. The following data give the measurements of the axles of bicycle wheels
12 samples were taken so that each sample contains the measurements of 4 axles. The measurement which was more than 5 inches are given here.
Obtain trial control limits for X-bar and R –charts and comment whether the process is under control or not.

139	140	142	136	145	146	148	145	140	140	141	138
140	142	136	137	146	148	145	146	139	140	137	140
145	142	143	142	146	149	146	147	141	139	142	144
144	139	141	142	146	144	146	144	138	139	139	138

For n=4 $A_2 = 0.73$ $D_3 = 0$ and $D_4 = 2.28$

33. The following figures give the number of defectives in 20 samples, each containing 2,000 items.

425	430	216	341	225	322	280	306	337	305
356	402	216	264	126	409	193	326	280	389

Calculate the values for central line and the control limits for p-chart .

34. An inspection of 10 samples of size 400 each from 10 lots revealed the following number of defective items.

17 15 14 26 9 4 19 12 9 15

Calculate control limits for the number of defective units. Plot the control limits and the observations and state whether the process is under control not.

35. The past records of a factory using quality control methods show that on the average 4 articles produced are defective out of a batch of 100. What is the maximum number of defective articles likely to be encountered in the batch of 100, when the production process is in a state of control?

36. Construct the 3- σ control limits for Standard Deviation Chart.

37. Distinguish clearly between control charts for variables and control charts attributes.

38. During an examination of equal length of cloth, the following are the number of defects observed:

2 3 4 0 5 6 7 4 3 2

Draw a control chart for the number of defects and comment whether the process is under control or not?

39. Construct the 3- σ control limits for U-Chart.

40. 10 computers were examined for quality control test. The number of defects for each computer is given below:

2 3 6 7 4 2 3 4 1 1

Draw a suitable control chart and comment.
