BSc Statistics

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Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree Examination, April 2024

First Degree Programme under CBCSS

Statistics

Core Course – X

ST 1642 : APPLIED STATISTICS

(2018 Admission Onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. Define an index number.
2. What are the two methods of construction of index number?
3. Define price index number.
4. If Laspeyre's price index is 150 and Paasche's index is 144, what is Fisher's index?
5. What is price relative?
6. Variation due to earthquake is an example of ———— component of time series.
7. What do you mean by secular trend?

8. A time series is a set of values arranged in ———— order.

9. Give the multiplicative model of a time series.

10. What is the full form of NSSO?

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. **Each** question carries **2** marks.

11. The consumer price index number for 1981 and 1982 to the base 1974 are 320 and 400 respectively. Find the consumer price index for 1981 to the base 1982.

12. What is chain base index number?

13. What are the desirable properties of a base period?

14. Name one principal limitation of index numbers.

15. What are the four phases of cyclical variations?

16. What is the need for studying time series?

17. If the trend line with 1975 as origin is Y = 20.6 + 1.68 X, give the trend line with 1971 as origin.

18. What is meant by deseasonalization of data of a time series?

19. For the given values 15, 24, 18, 33, 42, find the thee-year moving averages.

20. What is meant by population census for India?

21. What is labour statistics?

22. Write down the important activities of Central Statistics Organization.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

23. What are the applications of index numbers?

24. What are the tests to be satisfied by a good index number? Explain any one test.

25. Why are index numbers called economic barometers?

26. Explain Pasche's and Laspeyre's index numbers.

27. Explain the method of semi averages.

28. What are the merits and demerits of moving average method?

29. How do you fit a trend line by the method of least squares?

30. Compare de facto and de jure method of census.

31. Explain the methods of national income estimation.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

32. Define Consumer price index number. Explain the base shifting, splicing and deflating index numbers.

33. Explain the four components of time series with example.

34. What do you mean by seasonal indices? How do we analysis the seasonal fluctuations? Explain any one of them.

35. Explain the following :

    (a) Agricultural statistics

    (b) Forest statistics

    (c) Fisheries statistics.

(2 × 15 = 30 Marks)

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Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree Examination, April 2024

First Degree Programme under CBCSS

Statistics

Core Course – XI

ST 1643 : OPERATIONS RESEARCH AND STATISTICAL QUALITY CONTROL

(2018 Admission Onwards)

Time : 3 Hours Max. Marks : 80

I. Answer **all** questions. Each question carries **1** mark.

1. What is a basic feasible solution of an LPP?

2. When do you introduce artificial variables in an LPP?

3. What is the need of introducing a dummy source or destination in a transportation problem?

4. Define an assignment problem.

5. What are chance causes?

6. What is process control?

7. Define natural tolerance limit.

8. Distinguish between defects and defectives.

9. What are acceptance sampling plans for attributes?

10. What do you mean by Average Outgoing Quality?

(10 × 1 = 10 Marks)

II. Answer any **eight** questions. Each question carries **2** marks.

11. Write the properties of the canonical form of an LPP.

12. Define alternate optimum solution.

13. When do you get an unbounded solution for an LPP?

14. Explain the two phase method.

15. When do you say an optimal simplex table has an infeasible solution?

16. Write the primal – dual relationship in an LPP.

17. Distinguish between control limits and specification limits.

18. What are the control limits for σ – chart (S.D chart)?

19. Define consumer's risk.

20. What do you mean by quality control?

21. What is Process Capability?

22. What is the role of an OC curve in acceptance sampling plans?

(8 × 2 = 16 Marks)

III. Answer any **six** questions. Each question carries **4** marks.

23. Solve graphically:

Maximize $Z = 2x_2 - x_1$; subject to $x_1 - x_2 \geq -1$,

$$-x_1 + 2x_2 \leq 4,\ x_1 \geq 0,\ x_2 \geq 0.$$

24. State and prove the fundamental theorem on duality.

25. Explain the Big M method.

26. Give the mathematical formulation of a transportation problem.

27. Compare R-chart and $\overline{X}$-chart.

28. Differentiate between a p-chart and an np-chart.

29. What is the difference between ASN curve and ATI curve.

30. What are the applications of sampling inspection plan?

31. Distinguish between AQL and L.T.P.D.

(6 × 4 = 24 Marks)

IV. Answer any **two** questions. Each question carries **15** marks.

32. Solve by Simplex method: Minimize $Z = x_1 - 3x_2 + 2x_3$, subject to

$$3x_1 - x_2 + 3x_3 \leq 7,$$

$$-2x_1 + 4x_2 \leq 12,$$
$$-4x_1 + 3x_2 + 8x_3 \leq 10,$$
$$x_1, x_2, x_3 \geq 0$$

33. (a) Explain the Hungarian method of solving an assignment problem.

(b) A department of a company has five employees with five jobs to be performed. The time (in hours) that each man takes to perform each job is given in the effectiveness matrix. How should the jobs be assigned? What is the minimum total man-hours required for the performance?

Jobs \ Employees	A	B	C	D	E
I	10	5	13	15	16
II	3	9	18	13	6
III	10	7	2	2	2
IV	7	11	9	7	12
V	7	9	10	4	12

34. (a) Explain the procedure of a double sampling plan.

(b) Ten pieces of cloth out of different rolls of equal length contained the following number of defects.: 1, 3, 5, 0, 6, 0, 9, 4, 4, 3. Draw a control chart for the number of defects and state whether the process is in statistical control.

35. The following data pertains to 6 samples whose values being taken every hour for 5 hours. Construct the X-bar and *R*-charts and comment on your findings.

Sample No.	Sample values				
1	42	65	75	78	87
2	42	45	68	72	90
3	19	24	80	81	81
4	16	54	69	77	84
5	42	51	57	59	78
6	51	74	75	78	60

(2 × 15 = 30 Marks)

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Reg. No. : .....

Name : .....

Sixth Semester B.Sc. Degree Examination, April 2024

First Degree Programme under CBCSS

Statistics

Elective Course

ST 1661.2 : STOCHASTIC PROCESSES

(2018 Admission Onwards)

Time : 3 Hours Max. Marks : 80

I. Answer **all** questions. Each question carries **1** mark.

1. Define a random process.

2. When do you say the state space of a Stochastic Process is discrete?

3. Which type of random variables have the probability generating function? How it gets the name?

4. When do you say a Markov Chain is irreducible?

5. When is a TPM said to be stochastic?

6. State the Ergodic theorem.

7. Define a stochastic process with independent increments.

8. Define a compound Poisson process.

9. What is a time series data?

10. Define a Branching process.

(10 × 1 = 10 Marks)

II. Answer any **eight** questions. Each question carries **2** marks.

11. Define independence of two random variables.

12. If X and Y are independent Poisson random variables with same parameter λ, then what is the distribution of X+Y?

13. Define absorbing state of a Markov chain.

14. Consider a Markov chain with TPM $P = \begin{pmatrix} \frac{3}{4} & \frac{1}{4} \\ \frac{1}{2} & \frac{1}{2} \end{pmatrix}$. Find the stationary probabilities.

15. Define a Markov Process.

16. When do you say two states of a Markov Chain are communicative?

17. Write the Chapman-Kolmogorov equations.

18. What are the properties of a TPM?

19. Define a stochastic process with independent increments.

20. What is stationary in Stochastic Processes?

21. Define the probability of extinction in a branching process.

22. What do you mean by the order of an auto-regressive model in time series?

(8 × 2 = 16 Marks)

III. Answer any **six** questions. Each question carries **4** marks.

23. If $X_1, X_2, \cdots$, are identically distributed count random variables with common PGF say $P_X(\cdot)$ and that of N is $P_N(\cdot)$, with $S_N = \sum_{i=1}^{N} X_i$. Then show that $P_{S_N}(\cdot) = P_X(\cdot) = P_N(\cdot)$.

24. Find the Probability generating function of a Geometric random variable.

25. Show that recurrence is a class property.

26. When do you say a state is periodic or aperiodic?

27. Define the probability of extinction in a branching process.

28. Explain the components of time series.

29. Define exponential smoothing in a time series data.

30. Discuss on autocorrelation and its applications.

31. Distinguish between an Auto-regressive (AR) model and a Moving Average (MA) model.

(6 x 4 = 24 Marks)

IV. Answer any **two** questions. **Each** question carries **15** marks.

32. The joint pdf of the random vector (X,Y) is $f(x,y) = 2, 0 < x < y < 1$ and 0 otherwise. Find the

    (a) marginal pdfs

    (b) conditional pdfs of X and Y. Hence check

    (c) Whether they are independent or not.

33. A Markov Chain defined with state space $S = \{1,2,3,4,5\}$ has the following transition probability matrix P. Find

(a) all closed classes,

(b) irreducible classes,

(c) recurrent and

(d) transient states.

$$P = \begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array} \begin{array}{c} \begin{array}{ccccc} 1 & 2 & 3 & 4 & 5 \end{array} \\ \begin{pmatrix} 0.3 & 0.4 & 0.4 & 0 & 0 \\ 0 & 0 & 0.3 & 0.4 & 0.4 \\ 0 & 0.3 & 0 & 0.3 & 0.4 \\ 0 & 0 & 0 & 0.4 & 0.6 \\ 0 & 0 & 0 & 0.6 & 0.4 \end{pmatrix} \end{array}$$

34. Discuss the various classifications of Stochastic processes with suitable examples.

35. Define Poisson process. State the important postulates of the Poisson process. If the arrival process is Poisson, then establish the distribution of the inter arrival (waiting) times.

(2 × 15 = 30 Marks)

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Reg. No. : .....

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Sixth Semester B.Sc. Degree Examination, April 2024

First Degree Programme under CBCSS

Statistics

Core Course – IX

ST 1641 – DESIGN OF EXPERIMENTS AND VITAL STATISTICS

(2018 Admission Onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** the questions. Each question carries **1** mark.

1. Expand the term ANCOVA.

2. The precision of the experiment is inversely proportional to ———— of the replication.

3. Three principles of experimental designs are replication, randomisation and ————

4. ———— gives a clear picture of the age distribution of mortality in a given population.

5. If the population trend is decreasing then Birth rate is ———— Death rater.

6. The death rate of babies under one month is known as ————

7. _____ is regarded as a good index of population growth.

8. Death rate computed for a particular specified section of the population is termed as ————

9. The complete expectation of life is denoted by ————

10. The birth rate obtained for a segment of a population is known as ————

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. Each question carries **2** marks.

11. State any two advantages of CRD.
12. Define the Randomised block design.
13. Define sex ratio.
14. List out the demerits of crude death rate.
15. Define general fertility rate. Give its formula.
16. What are the uses of life table?
17. Which is the design in which no local control is applied?
18. Define randomisation.
19. Explain the methods of collection of vital statistics.
20. What do you mean by vital statistics?
21. Define specific fertility rate.
22. Explain the purpose for standardising death rate.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. Each question carries **4** marks.

23. State the merits ar demerits of crude birth rate.
24. What are the main sources of experimental errors? What methods are adopted to increase the efficiency of a design?
25. Show, by suitable examples. How replication enables us to apply statistical methods?

26. Explain gross reproduction rate.

27. What is meant by confounding in a factorial experiments?

28. Construct a 4 × 4 Latin square. When do you recommend the use of LSD over RBD.

29. Briefly explain the direct and indirect method of standardizing death rates.

30. Define Total Fertility Rate (IFR). Give its disadvantages.

31. Fill in the blanks in a portion of life table given below :

Age (in years)	l_x	d_x	p_x	q_x	L_x	T_x	e_x^0
4	95000	500	?	?	?	4850300	?
5	?	400	?	?	?	?	?

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. Each question carries **15** marks.

32. What are factorial experiments? Explain what is meant by main effects and interaction effects in factorial experiments?

33. Derive the complete statistical analysis of RBD.

34. Calculate crude and Standardized death rates for the Local population from the following data and compare them with crude death rate of the standard population (use both direct and indirect method).

Age group	Standard Population	Deaths	Local Population	Deaths
0 – 10	600	18	400	16
10 – 20	1000	5	1500	6
20 – 60	3000	24	2400	24
60 – 100	400	20	700	21

35. Give a brief account on sample registration system in India.

(2 × 15 = 30 Marks)