R – 1331

Reg. No. : ....

Name : ....

Sixth Semester B.Sc. Degree Examination, April 2023

First Degree Programme Under CBCSS

Statistics

Elective Course

ST 1661.2 : STOCHASTIC PROCESSES

(2018 Admission Onwards)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer all questions. Each question carries 1 mark.

1. Define the state space of a Stochastic Process.

2. When do you say that a Stochastic Process is a continuous time process?

3. Find the probability generating function of a Binomial Random variable.

4. Define a Markov chain.

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

6. Define a compound Poisson process.

7. When is a TPM said to be stochastic?

8. Define a Branching process.

9. What is stationarity in Stochastic Process?

10. Define Time Series.

SECTION – B

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

11. Establish the expression to get the variance from a probability generating function.

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

13. If $f(x,y) = Ae^{-(x+y)}, 0 < X, Y < \infty$, is the joint probability density function of X and Y, find A and also find the marginal pdfs of X and Y and check their independence.

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

15. Define absorbing Markov Chain with an example.

16. What is the period of a particular state in a Markov Chain?

17. When is a TPM said to be doubly stochastic?

18. What are the postulates of a Poisson Process?

19. "In an irreducible Markov chain all states are of the same type" Justify.

20. What do you mean by the order of an autoregressive model in time series?

21. What is the significance of autocorrelation in time series analysis?.

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

(8 × 2 = 16 Marks)

R – 1331

SECTION – C

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

23. If the joint probability density function of X and Y is

$$F(x, y) = \begin{cases} 2y + x - 3x^2y; & 0 \le x, y \le 1 \\ 0 & \text{otherwise} \end{cases}$$

Then,(i) find the marginal densities of X and Y, and (ii) check the independence of X and Y.

24. Distinguish between weakly and strongly stationary Stochastic Processes.

25. Show that for an irreducible Markov Chain, the stationary distribution if exists is unique.

26. Distinguish between recurrent and transient states of Markov Chain.

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

28. Discuss on the components of a time series data.

29. Show that for a Gaussian Stochastic process both weak and strong stationarity are equivalent.

30. Define the first order autoregressive model.

31. Establish the Branching process recursion formula on the probability generating function.

(6 × 4 = 24 Marks)

SECTION – D

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

32. Let $x_1, x_2 \ldots \ldots$ be a sequence of independent and identically distributed random variables with common PGF as $G_x(S)$. Let N be a random variable independent of the random variables $x_i's$ with PGF as $G_N(s)$ and let $T_N = \sum_{i=1}^{N} x_i$ Then show that the PGF of $G_{TN}(S) = G_N(G_x(s)) T_N$. Also compute the mean of T_N.

33. Discuss the various classifications of Stochastic Processes with appropriate examples.

34. A Markov Chain defined with state space S={ 1,2,3,4,5) has the following transition probability matrix P. Find (1) all closed classes, (2) irreducible classes, (3) recurrent and (4) transient states.

$$P = \begin{array}{ccccc} 1 & 2 & 3 & 4 & 5 \end{array}$$

$$P = \begin{pmatrix} 0.3 & 0.4 & 0.4 & 0 & 0 \\ 0 & 0 & 0.3 & 0.4 & 0.4 \\ 0 & 0.3 & 0 & 0.3 & 0.4 \\ 0 & 0 & 0 & 0.4 & 0.6 \\ 0 & 0 & 0 & 0.6 & 0.4 \end{pmatrix}$$

35. How do you fit a trend line by the method of least squares in a time series analysis. Also mention the merits and demerits of the method.

(2 × 15 = 30 Marks)

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Reg. No. : ....

Name : ....

Sixth Semester B.Sc. Degree Examination, April 2023

First Degree Programme under CBCSS

Statistics

Core Course

ST 1643 : OPERATIONS RESEARCH AND STATISTICAL QUALITY CONTROL

(2018 Admission Onwards)

Time : 3 Hours　　　　　　　　　　　　　　　　　　Max. Marks : 80

SECTION – A

Answer all questions. Each question carries 1 mark.

1. Define LPP.

2. What is a feasible region in an LPP?

3. Name the methods used to solve LPP while introducing artificial variables.

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

5. Define quality control.

6. What are chance causes?

7. Define process control.

8. What are d-charts (u-charts)?

9. Define AOQ.

10. What do you mean by ASN?

<div align="right">(10 × 1 = 10 Marks)</div>

SECTION – B

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

11. Write an LPP in the matrix form.

12. Define slack and surplus variables.

13. What are degenerate basic solutions?

14. Explain the two phase method.

15. State the fundamental theorem on duality.

16. Distinguish between control limits and specification limits.

17. Discuss the procedure to prepare a control chart.

18. Write the control limits for σ - chart (S.D. chart).

19. What are 3-sigma limits?

20. Define consumers risk.

21. What is Process Capability?

22. What are the purposes of a sampling inspection plan for attributes?

<div align="right">(8 × 2 = 16 Marks)</div>

SECTION – C

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

23. Write the simplex algorithm to solve an LPP.

24. Give the mathematical formulation of a transportation problem.

25. Form the dual of the following primal.

    Minimize $Z = 20x_1 + 40x_2$

    Subject to:

    $$2x_1 + 20x_2 = 40,$$

    $$20x_1 + 3x_2 = 20,$$

    $$4x_1 + 15x_2 = 30, \ x_1, x_2 \geq 0$$

26. What is the difference between process control and product control?

27. Write the control limits for R-charts.

28. When should you prepare the control charts for fraction defectives?

29. Differentiate between a *p*-chart and an *np*-chart

30. Explain the procedure of a single sampling plan.

31. Discuss the purpose of an O.C curve for an acceptance sampling plan.

(6 × 4 = 24 Marks)

SECTION – D

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

32. (a) Explain the traveling salesman problem.

(b) A salesman has to travel to 4 cities, including his home city. The travelling cost in rupees is given in the table. Find the least cost of his travelling through the shortest route in this task by visiting each city once only.

	A	B	C	D
A	0	25	75	45
B	35	0	150	25
C	35	40	0	15
D	65	75	130	0

33. 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

34. Compare sampling inspection by attributes with sampling inspection by variables.

35. 12 samples of 200 bulbs each were examined and the number of defective bulbs was recorded as follows:

Sample No	1	2	3	4	5	6	7	8	9	10	11	12
No. of defectives	23	32	40	30	43	27	28	24	10	12	9	10

Draw the control chart for fraction defective and comment on your findings from the chart.

(2 × 15 = 30 Marks)

Reg. No. : ....

Name : ....

Sixth Semester B.Sc. Degree Examination, April 2023

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

1. The ANOVA test is based on the test statistic _____.

2. Give the mathematical model of two way ANOVA.

3. What do you meant by the precision of a design?

4. Given two factors A and B each at 2 levels, the simple effect B at the second level of A is _____.

5. Each contrast among k treatments has _____ degrees of freedom.

6. Population census is usually conducted at an interval of _____ years.

7. If NRR<1, the population will in general tend to _____.

8. The value of vital index greater than 1 is indicative of _____.

9. Define stationary population.

10. Define crude death rate.

<div align="right">(10 × 1 = 10 Marks)</div>

SECTION – B

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

11. What are the requirements of a good experimental design?

12. Define the relative efficiency of one design over the other.

13. Give the analysis of variance table for a group of m Latin squares of side k.

14. What is meant by a factorial experiment?

15. What procedure should be adopted for analysis of data of a randomized block design having on missing value?

16. Construct a 4 × 4 Latin square.

17. Give statistical model for completely randomized design with one observation per unit.

18. Distinguish between complete confounding and partial confounding.

19. Write a note on adhoc surveys.

20. What do you meant by general fertility rate?

21. Define age specific death rate.

22. Define life table.

<div align="right">(8 × 2 = 16 Marks)</div>

SECTION – C

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

23. Describe the technique of one way analysis of variance.

24. Discuss the statistical model for randomized block design with one observation per experimental unit.

25. What are the advantages of a Latin square design?

26. Compare the efficiency of LSD with respect to that of a RBD.

27. Give the Yates' method of analysis of data of 2^n factorial experiment.

28. Discuss gross reproduction rate.

29. What are the drawback of net reproduction rate?

30. Describe the various components of a life table.

31. What are the demerits of CRD.

(6 × 4 = 24 Marks)

SECTION – D

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

32. Explain the principles of experimental design.

33. Outline the various steps in carrying out the analysis of variance of a two-way classified data with one observation per cell.

34. Explain what is meant by main effects and interactions in factorial experiment. A complete 2^3-experiment is replicated r times. Describe the procedure for testing the presence of different main effects and interactions.

35. Define the term 'Vital Statistics'. Describe their nature and the methods of collection of vital statistics.

(2 × 15 = 30 Marks)

Reg. No. : ....

Name : ....

Sixth Semester B.Sc. Degree Examination, April 2023

First Degree Programme under CBCSS

Statistics

Core Course - X

ST 1642 : APPLIED STATISTICS

(2018 Admission Onwards)

Time　3 Hours　　　　　　　　　　　　　　　　Max. Marks : 80

Use of calculator is permitted

SECTION – A

Answer all questions. Each question carries 1 mark.

1.　What is the index number for the base period?

2.　The best average used in the construction of index number is

_____

3.　Purchasing power of money is the reciprocal of _____

4.　Which index number is considered ideal?

5.　The best fitted trend line is one for which sum of squares of residuals is

　　(a)　Maximum

　　(b)　Positive

　　(c)　Minimum

　　(d)　Negative

6.　Wheat crops badly damaged on account of heavy rain is corresponding to _____ variation in a time series.

7. A time series consists of

   (a) Short term variations

   (b) Long term variations

   (c) Irregular variations

   (d) All of the above

8. What is the full form of CSO?

9. The agency estimating the national income of India is _____.

10. The method for which census is conducted on the base of usual place of residence is called _____

(10 × 1 = 10 Marks)

SECTION – B

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

11. Define price index number.

12. Name any two index numbers which satisfies time reversal test.

13. Why index numbers are called as economic barometers?

14. Point out any two limitations of index numbers.

15. Define Splicing in index numbers.

16. What are the methods of studying seasonal variation?

17. Give any two merits of moving average method for measuring trend in time series.

18. Write down the normal equations for fitting exponential trend.

19. Point out any two utilities of time series.

20. Define Fisher's quantity index number.

21. Write down the four divisions of NSSO.

22. What is the importance of statistics in agricultural research?

(8 × 2 = 16 Marks)

SECTION – C

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

23. Explain the semi average method of measuring trend.

24. Explain the ratio to trend method.

25. Bring out the significance of moving averages in analyzing a time series.

26. Explain the additive and multiplicative models of time series. Which of these models is more popular in practice and why?

27. Distinguish between simple and weighted index numbers. Give examples.

28. What are the considerations in the selection of base period for constructing general price index numbers?

29. Define chain base index number. What are its advantages over fixed base index number?

30. What is bias in an index number? Describe the type of bias appear in Laspeyre's and Paasche's index numbers.

31. What do you mean by labour statistics? What is its importance?

(6 × 4 = 24 Marks)

SECTION – D

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

32. (a) Explain different components of a time series with examples.

    (b) Compute 4 yearly moving average values from the following time – series:

Year	1991	1992	1993	1994	1995	1996
Production (lakh tones)	37.4	31.1	38.7	39.5	47.9	42.6
Year	1997	1998	1999	2000	2001	2002
Production (lakh tones)	48.4	64.6	58.4	38.6	51.4	84.4

10 + 5 = 15

R – 1325

33. (a) Define Laspeyre's, Paasches, Fisher's and Marshall Edgeworth price index numbers.

(b) Calculate Fishers index number from the following data:

	Base Period		Current Period	
Commodity	Price	Expenditure	Price	Expenditure
A	8	80	10	120
B	10	120	12	96
C	5	40	5	50
D	4	56	3	60
E	20	100	25	150

8 + 7 = 15

34. (a) Explain the methods of measuring national income.

(b) Write short notes on (i) National sample survey (ii) De Facto and De Jure census **9 + 6 = 15**

35. (a) Describe the steps in construction of cost of living index numbers. Interpret the formulae used in this connection.

(b) An enquiry into the budgets of the middle class families of a certain city revealed that an average of the percentage expenses on the different groups was:

Item	Food	Rent	Clothing	Fuel and light	Miscellaneous
Percentage	45	15	12	8	20

The group index numbers for the current year as compared with a fixed base period were respectively 410, 150, 343, 248, and 285. Calculate the cost of living index number.

12 + 3 = 15

(2 × 15 = 30 Marks)