N18STU23

**PSG COLLEGE OF ARTS & SCIENCE**
(AUTONOMOUS)

**BSc DEGREE EXAMINATION MAY 2025**
(Sixth Semester)

Branch – **STATISTICS**

**OPERATIONS RESEARCH - II**

Time: Three Hours Maximum: 50 Marks

**SECTION-A (5 Marks)**
Answer **ALL** questions
**ALL** questions carry **EQUAL** marks (5 x 1 = 5)

1 The size of the pay-off matrix of a game can be reduced by using the principle of
(i) Dominance (ii) Rotation reduction
(iii) Game inversion (iv) Game transpose

2 An item is replaced immediately after it fails is called
(i) Individual replacement policy (ii) Group replacement policy
(iii) Mixed replacement policy (iv) Double replacement policy

3 Monte Carlo simulation gets its name from which of the following?
(i) Data collection (ii) Model formulation
(iii) Random number assignment (iv) Analysis

4 In Queuing theory, $\lambda$ is the
(i) Mean arrival rate (ii) Mean service rate
(iii) Number of people in the system (iv) Both (i) and (ii)

5 The word CPM mean
(i) Critical Path Method (ii) Crash Project Management
(iii) Critical Project Management (iv) Critical Path Management

**SECTION - B (15 Marks)**
Answer **ALL** Questions
**ALL** Questions Carry **EQUAL** Marks (5 x 3 = 15)

6 a Solve the game whose payoff matrix is given by Player A / Player B $\begin{bmatrix} 0 & 2 \\ -1 & 4 \end{bmatrix}$

OR

b Explain the terms: (i) Pure strategy (ii) Mixed strategy (iii) Payoff matrix.

7 a Classify the different types of replacement problem.

OR

b A firm is considering replacement of a machine, whose cost price is Rs.12, 200 and the scrap value, Rs.200. The running costs in rupees are found from experience to be as follows:

| **Year** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| **Running Cost** | 200 | 500 | 800 | 1200 | 1800 | 2500 | 3200 | 4000 |

Determine the optimum period for replacement of the machine.

8 a At a telephone booth, suppose that the customers arrive with an average time of 1.2 time units between one arrival and the next. Service times are assumed to be 2.8 times units. Simulate the system for 12 time units by assuming that the system at t=0. Calculate the average waiting time per customer?

OR

b Explain the different types of simulation models.

9 a Explain the important characteristics of queuing system.

OR

b Customers arrive at a sales counter manned by a single person according to Poisson process with mean rate of 20 per hour. The time required to serve a customer has an exponential distribution with a mean of 100 seconds. Calculate the average waiting time of a customer.

10 a The following are the details of estimated times of activities of a certain project

| **Activity** | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| **Predecessor activity** | - | - | - | A | B | C | D,E | B | H,F |
| **Estimated times (in weeks)** | 3 | 5 | 4 | 2 | 3 | 9 | 8 | 7 | 9 |

i) Sketch the network diagram.
ii) Identify critical path and find the total project duration.

OR

b Distinguish between CPM and PERT.

**Cont...**

## SECTION -C (30 Marks)

Answer **ALL** questions
**ALL** questions carry **EQUAL** Marks (5 x 6 = 30)

11 a Solve the following problem graphically $\begin{bmatrix} 2 & 1 & 0 & -2 \\ 1 & 0 & 3 & 2 \end{bmatrix}$

OR

b Solve the following game using dominance property

| | | Player B | | |
|---|---|---|---|---|
| **Player A** | 1 | 7 | 2 |
| | 6 | 2 | 7 |
| | 5 | 1 | 6 |

12 a Summarize Individual Replacement and Group Replacement.

OR

b A truck owner finds from his past records that the maintenance costs per year, of a truck whose purchase price is Rs.8,000 are as given below:

| **Year** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 9 |
|---|---|---|---|---|---|---|---|---|
| **Maintenance cost (Rs.)** | 1000 | 1300 | 1700 | 2200 | 2900 | 3800 | 4800 | 6000 |
| **Resale Price (Rs.)** | 4000 | 2000 | 1200 | 600 | 500 | 400 | 400 | 400 |

Determine at which time it is profitable to replace the truck.

13 a A retail store experiences the following probability distribution for sales of a product:

| **Sales (Units)** | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| **Probability** | 0.08 | 0.12 | 0.28 | 0.24 | 0.14 | 0.10 | 0.04 |

Using the following random numbers, simulate demand for ten days and determine the average sales over the 10 days period: 87, 02, 37, 76, 56, 19, 99, 47, 78 and 14

OR

b Explain the steps involved in Monte – Carlo simulation.

14 a A supermarket has a single cashier. During the peak hours, customers arrive at a rate of 20 customers per hour. The average number of customers that can be processed by the cashier is 24 per hour. Enumerate:

(i) Probability that the cashier is idle.
(ii) Average number of customers in the queuing system.
(iii) Average time a customer spends in the system.

OR

b Assume that the goods trains are coming in a yard at the rate of 30 trains per day and suppose that the inter-arrival times follow an exponential distribution. The service time for each train is assumed to be exponential with an average of 36 minutes. If the yard can admit 9 trains at a time, enumerate the probability that the yard is empty and find the average queue length.

15 a Given the following information:

| **Activity** | 0-1 | 1-2 | 1-3 | 2-4 | 2-5 | 3-4 | 3-6 | 4-7 | 5-7 | 6-7 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Duration (in days)** | 2 | 8 | 10 | 6 | 3 | 3 | 7 | 5 | 2 | 8 |

(i) Trace the network diagram.
(ii) Identify critical path and find the total project duration.
(iii) Determine total, free and independent floats.

OR

b A small project is composed of seven activities whose time estimates are given in the following table:

| **Activity** | 1-2 | 1-3 | 1-4 | 2-5 | 3-5 | 4-6 | 5-6 |
|---|---|---|---|---|---|---|---|
| **Optimistic time** | 6 | 6 | 12 | 6 | 12 | 12 | 18 |
| **Most likely** | 6 | 12 | 12 | 6 | 30 | 30 | 30 |
| **Pessimistic** | 24 | 18 | 30 | 6 | 48 | 42 | 54 |

(i) Identify the expected duration and variance for each activity.
(ii) What is the expected project length?
(iii) Identify the variance and standard deviation of the project length.

Z-Z-Z END