20. (a) The probability distribution of monthly sales of an items is as follows:

Monthly Sales (Units)	0	1	2	3	4	5	6
Probabilities	0.01	0.06	0.25	0.3	0.22	0.1	0.06

The cost of carrying inventory (unsold during the month) is Rs.30 per unit per month and the cost of unit shortage is Rs.70. Determine optimum stock to minimize expected cost.

Or

(b) A tourist car operator finds that during the past few months the car's use has varied so much that the cost of maintaining the car varied considerably. During the past 200 days the demand for the car fluctuated as below:

Trips per week	Frequency
0	16
1	24
2	30
3	60
4	40
5	30

Using random numbers simulate the demand for a ten-week period.

Reg. No. : .....

Code No. : 5659 **Sub. Code : ZBAM 32**

M.B.A. (CBCS) DEGREE EXAMINATION, NOVEMBER 2023

Third Semester

Business Administration – Core

OPERATION RESEARCH

(For those who joined in July 2021–2022)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Which technique is used in finding a solution for optimizing a given objective, such as profit maximization or cost reduction under certain constraints?

(a) Quailing Theory

(b) Waiting Line

(c) Both (a) and (b)

(d) Linear Programming

2. In graphical representation the bounded region is known as ———— region.

(a) Solution

(b) Basic solution

(c) Feasible solution

(d) Optimal

3. The transportation problem is basically a

(a) Maximization model

(b) Minimization model

(c) Transhipment problem

(d) Iconic model

4. Hungarian Method is used to solve

(a) A transportation problem

(b) A travelling salesman problem

(c) A LP problem

(d) Both (a) and (b)

5. The objectives of Network analysis is to

(a) Minimize total project duration

(b) Minimize total project cost

(c) Minimize production delays, interruption and conflicts

(d) Maximize total project duration

6. ———— and ———— are techniques applied in project management.

(a) CPM and PERT

(b) Assignment and Transportation

(c) Decision theory and Inventory models

(d) None of the above

7. Which one of the following is a part of every game theory model?

(a) Players (b) Payoffs

(c) Probabilities (d) Strategies

8. Which of the following is not an assumption of EOQ model?

(a) Cost of carrying is a fixed proportion of the average value of inventory

(b) The demand is even throughout the year

(c) The usage for one year can be anticipated

(d) Cost per order is proportional to the size of the order

9. Which of the following statements are NOT true of simulation?

(a) Simulation model cannot prescribe what should be done about a problem

(b) Simulation models can be used to study alternative solutions to a problem

(c) Simulation models the behaviour of a system

(d) The equations describing the operating characteristics of the system are known

10. The process of modifying an or model ton observe the effect upon its outputs is called

(a) Sensitivity Analysis

(b) Cost/benefit analysis

(c) Model validation

(d) Input variation

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Old hens can be bound at Rs. 2 each and young ones at Rs. 5 each. The old hens lay 3 eggs per week and the young ones lay 5 eggs per week, each egg being worth 30 paise. A hen costs Rs. 1 per week to feed. A person has only Rs.80. to spend for hens. How many of each kind should 'he buy to give a profit of more than Rs.6 per week, assuming that he cannot house more than 20 hens. Formulate this as a L.P.P.

Or

(b) Identify the dual of the following primal LPP.

Maximize $F = x_1 + 2x_2 + x_3$

Subject to $2x_1 + x_2 - x_3 \leq 2$

$-2x_1 + x_2 - 5x_3 \leq -6$

$4x_1 + x_2 + x_3 \leq 6$

$x_1 x_3 - x_3 \geq 0$

12. (a) Distinguish between Transportation problem and Assignment problem.

Or

(b) Solve the transportation problem

		Destinations			
		1	2	3	Capacities
Source	1	2	2	3	10
	2	4	1	2	15
	3	1	3	1	40
Requirement		20	15	30	

13. (a) Evaluate the network for the project whose activities and their precedence relationship are as given below:

Activity :	A	B	C	D	E	F	G	H	I
Immediate Predecessor:	–	A	A	–	D	B,C,E	F	E	G,H

Or

(b) Distinguish between PERT and CPM methods.

14. (a) A manufacturer has to supply his customer with 600 units of his products per year. Shortage are not allowed and storage cost amounts to 60 paise per unit per year. The set up cost is Rs. 80.00 discover. Find

(i) the economic order quantity

(ii) the minimum average yearly cost

(iii) the optimum number of orders per year

(iv) the optimum period of supply per optimum order

Or

(b) Solve the game whose pay-off matrix is given by

		Player B		
		B_1	B_2	B_3
Player A	A_1	1	1	3
	A_2	0	–4	–3
	A_3	1	5	–1

15. (a) Explain different types of simulation and its limitations.

Or

(b) A manufacturing company keeps stock of a special product. Previous experience indicates the daily demand as given below:

Daily Demand	5	10	15	20	25	30
Probability	0.01	0.2	0.15	0.5	0.12	0.02

Simulate the demand for the next 10 days. Also evaluate the daily average demand for that product on the basis of simulated data.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) A production planner in a soft drink plant has two bottling machines A and B. A is designed for 8-ounce bottles and B for 16-ounce bottles. However, each can be used on both types with some loss of efficiency. The following data is available:

Machine	8-ounce bottles	16-ounce bottles
A	100/minutes	40/minutes
B	60/minutes	75/minutes

The machine can be run 8-hours per day, 5 days per week. Profit on 8-ounce bottle is 15 paise and on 16-ounce bottle is 25 paise. Weekly production of the drink cannot exceed 3,00,000 ounces and the market can absorb 25,000 eight-ounce bottles and 7000 sixteen ounce bottles per week. The planner wishes to maximize his profit. Formulate this as a L.P.P.

Or

(b) Solve the following L.P.P by the graphical method

Max $Z = 3x_1 + 5x_2$

Subject to $-3x_1 + 4x_2$ 12

$x_1 \geq 4$

$2x_1 - x_2 \geq -2$

$x_2 \geq 2$

$2x_1 - 3x_2 \geq 12$ and $x_1, x_2 \geq 0$

17. (a) Find the starting solution of the following transportation model

1	2	6	7
0	4	2	12
3	1	5	11
10	10	10	

Using

(i) North West Corner rule and

(ii) Least Cost method

Or

(b) Solve the following travelling salesman problem so as to minimize the cost per cycle.

		To				
		A	B	C	D	E
From	A	–	3	6	2	3
	B	3	–	5	2	3
	C	6	5	–	6	4
	D	2	2	6	–	6
	E	3	3	4	6	–

18. (a) Construct the network for the project whose activities are given below and compute the total, free and independent float of each activity and hence determine the critical path and the project duration.

Activity (in weeks)	0-1	1-2	1-3	2-4	2-5	3-4	3-6	4-7	5-7	6-7
Duration (in weeks)	3	8	12	6	3	3	8	5	3	8

Or

(b) A Project consists of the following activities and time estimates:

Activity	Least Time (days)	Greatest Time (days)	Most likely (days)
1-2	3	15	6
1-3	2	14	5
1-4	6	30	12
2-5	2	8	5

2-6	5	17	11
3-6	3	15	6
4-7	3	27	9
5-7	1	7	4
6-7	2	8	5

(i) Draw the network

(ii) What is the probability that the project will be completed in 27 days.

19. (a) A company has a demand of 12,000 units/year for an item and it can produce 2000 such items per month. The cost of one setup is Rs. 400 and the holding cost/unit/month is Rs. 0.15. Find the optimum lot size, max inventory, manufacturing time, total time.

Or

(b) Find the optimal order quantity for which the price breaks are as follows:

Quantity	Unit cost
$0 \leq q_1 < 500$	Rs. 10
$500 \leq q_2 < 750$	Rs. 9.25
$750 \leq q_3$	Rs. 8.75

The monthly demand for the product is 200 units, shortage cost is 2% of the unit cost and the cost of ordering is Rs.100.