

# Faculty of Management Studies

## End Semester Examination May 2025

### MS5CO25 Operations Research

<b>Programme</b>	:	MBA	<b>Branch/Specialisation</b>	:	-
<b>Duration</b>	:	3 hours	<b>Maximum Marks</b>	:	60

**Note:** All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary.  
 Notations and symbols have their usual meaning.

#### Section 1 (Answer all question(s))

**Marks CO BL**  
 1 1 1

**Q1.** Operations Research is a very powerful tool for?

<b>Rubric</b>	<b>Marks</b>
All of these	1

- Research
- Decision making
- Optimizing operations
- All of these

**Q2.** The innovative science of operations research was discovered during \_\_\_\_\_.

1 1 1

<b>Rubric</b>	<b>Marks</b>
world war 2	1

- World war I
- Civil war
- World war II
- Industrial revolution

**Q3.** Which technique is used in finding a solution for optimizing a given objective, such as profit maximization or cost minimization under certain constraints?

<b>Rubric</b>	<b>Marks</b>
LPP	1

- Queuing theory
- Transport problem
- Linear programming problem
- None of these

**Q4.** According to algebra of simplex method, slack variables are assigned zero coefficients because of \_\_\_\_\_.

1 1 1

<b>Rubric</b>	<b>Marks</b>
no contribution in objective function	1

- No contribution in objective function.
- High contribution in objective function.
- Divisor contribution in objective function.
- Base contribution in objective function.

**Q5.** To test optimality by MODI method, the Initial basic feasible solution of transportation problem should be-

1 2 2

<b>Rubric</b>	<b>Marks</b>
non-degenerate	1

- Degenerate
- Non-degenerate
- Non-feasible
- Both (A) and (C)

**Q6.** Which of following is used to find an optimal solution to an assignment problem?

1 2 1

Rubric	Marks
Hungarian Method	1

- Hungarian method
- Modified distribution method
- Johnson's method
- None of these

**Q7.** In context of Markov Analysis, which condition is true for steady state condition here P is transition probability matrix and R is steady state vector?

Rubric	Marks
steady state condition $R=RP$	1

- $R = RP^2$
- $R = RP^3$
- None of these

**Q8.** In single server queuing model, if mean arrival rate ( $\lambda$ ) is equal to mean service rate ( $\mu$ ) then what will be the value of traffic intensity ( $\rho$ ) is?

Rubric	Marks
if mean arrival rate is equal to mean service rate then the value of traffic intensity is one	1

- 0
- 1
- 0.5

**Q9.** The word simulation means-

1 1 1

Rubric	Marks
simulation is the imitation Of reality	1

- Unstructured model
- Imitation Of reality
- A visual display
- A single model on computer

**Q10.** For a fair game the value of game should be-

1 1 1

Rubric	Marks
fair game means net sum is zero	1

- 0
- 1
- None of these

### Section 2 (Answer any 2 question(s))

Marks CO BL

**Q11.** Define term operations research. Write any three characteristics of operations research .

5 1 1

Rubric	Marks
2 marks for definition and 3 for characteristic	5

**Q12.** Explain any five applications of operations research in real life.

5 1 1

Rubric	Marks
one marks for each application	5

- Q13.** Define models in operations research. Write short note on-
- (i) Descriptive and predictive model
  - (ii) Probabilistic and deterministic model.

5 2 2

Rubric	Marks
<p>a representation of a real-world system or problem, often mathematical or theoretical, used to understand, analyze, and optimize decision-making. <u>1 marks</u></p> <p>a descriptive model aims to describe and understand existing phenomena or systems, using data analysis techniques to extract meaningful information like patterns, trends, and relationships, without making predictions or prescribing actions.</p> <p>Predictive model are used for future prediction <u>2 mark</u>.</p> <p>A probabilistic model uses probabilities to represent uncertainty and make predictions, unlike deterministic models which offer single, precise outcomes. Examples include weather forecasting, spam detection, and Netflix's recommendation system. <u>2 marks</u></p>	5

### Section 3 (Answer any 2 question(s))

Marks CO BL

5 2 2

- Q14.** Write short note on-

- (a) Feasible solution in context of Linear Programming Problem
- (b) Optimal solution in context of Linear Programming Problem.
- (c) Slack variables in simplex method.

Rubric	Marks
<p>A feasible solution of an LPP satisfies all the constraints, while an optimal solution is a special case of a feasible solution that either maximizes or minimizes the objective function. Slack variables are additional variables that are introduced into the linear constraints of a linear program to transform them from inequality constraints to equality constraints. <u>marks 2+2+1</u></p>	5

- Q15.** Solve given Linear Programming Problem by graphical method-

5 4 4

$$\text{Min } Z = 3x_1 + 2x_2$$

$$\text{Subject to } 5x_1 + x_2 \geq 10$$

$$x_1 + x_2 \geq 6$$

$$x_1 + 4x_2 \geq 12$$

$$x_1, x_2 \geq 0$$

Rubric	Marks
<p>points on axes <u>±2</u> graph <u>±1</u> and ans <math>x_1=1</math>, <math>x_2=5</math> and <math>\text{min}z = 13</math> <u>±2</u> marks</p>	5

- Q16.** Solve given Linear Programming Problem by simplex method-

5 4 4

$$\text{Max } Z = x_1 + x_2 + 3x_3$$

$$\text{Subject to } 3x_1 + 2x_2 + x_3 \leq 3$$

$$2x_1 + x_2 + 2x_3 \leq 2$$

$$x_1, x_2, x_3 \geq 0$$

Rubric	Marks
<p>for table 1 <u>marks 2.5</u> answer <math>x_1=0</math>, <math>x_2=0</math>, <math>x_3=1</math> <u>Z=3 2.5</u> marks</p>	5

### Section 4 (Answer any 2 question(s))

Marks CO BL

**Q17.** Define

5 2 2

- (i) Balanced transportation problem.
- (ii) Non degenerate basic feasible solution.
- (iii) Assignment problem and its assumptions.

Rubric	Marks
1+2+2 for 3 parts	5

**Q18.** Find optimal solution following transportation problem here three supply centers and four destinations with cost matrix are given as follows

	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	Supply
S <sub>1</sub>	5	2	4	3	22
S <sub>2</sub>	4	8	1	6	15
S <sub>3</sub>	4	6	7	5	8
Demand	7	12	17	9	

Rubric	Marks
using any method IBFS +2 modi method +3 answer 104	5

**Q19.** A company has four different jobs that can be done on four different machines .The matrix below gives the cost in rupees of producing job i on machine j.

	M <sub>1</sub>	M <sub>2</sub>	M <sub>3</sub>	M <sub>4</sub>
J <sub>1</sub>	5	7	11	6
J <sub>2</sub>	8	5	9	6
J <sub>3</sub>	4	7	10	7
J <sub>4</sub>	10	4	8	3

How the jobs should be assigned to the various machines so that the total cost is minimized.

Rubric	Marks
row and column reduction <u>marks 2</u> then lines <u>+1 mark</u> then final term Answer 23 <u>±2marks</u>	5

### Section 5 (Answer any 2 question(s))

Marks CO BL

**Q20.** Explain basic structure of queuing system, various queue discipline and customer behavior in context of queuing theory.

Rubric	Marks
basic structure of queuing system <u>+1 mark</u> various queue discipline <u>+ 2marks</u> , customer behaviour in context of queuing Theory <u>±2marks</u> .	5

**Q21.** (i) In a Problem, If The transition Probability Matrix for is

5 3 3

		Next State		
		A	B	C
Current State	A	0.5	0.4	0.1
	B	0.2	x	0.4
C	0.5	0.3	0.2	

Find the value of x?

(ii) At a service center customers arrive at the rate of 10 per hour and are served at the rate of 20 per hour. Their arrival follows Poisson distribution and service in exponentially distributed. The capacity of system is infinite and follow first come first serve basis. Find the value of utilization factor? Also find mean numbers of customers in the system?

Rubric	Marks
(a) 2 marks (b) 3 marks	5

**Q22.** Two brands of Cars TATA and HONDA are competing with each other in a market over a year, customer using TATA has shown high degree of loyalty as measured by the fact that they are using Brand TATA , 70% of the time . Also customers who have purchased Brand HONDA have been switched to brand TATA , 60% of the time. Find -

5 4 4

(i) Find Transition Probability Matrix of given problem

(ii) Draw the state transition diagram?

(iii) Calculate the probability of a customer purchasing brand HONDA at the end of second year?

Rubric	Marks
(i) Transition Probability Matrix	2
(ii) state transition diagram	1
(iii) The probability of a customer purchasing brand HONDA at the end of second year?	2

### Section 6 (Answer any 2 question(s))

Marks CO BL

**Q23.** Write short note on simulation, two person zero sum game theory, saddle point and deterministic game.

5 2 2

Rubric	Marks
simulation definition	1
two person zero sum game	2
definition saddle point and deterministic game .	2

**Q24.** An Ice Cream shop keep stocks of Amul Ice Cream . Daily demand based on past experience is given below

5 4 4

Daily demand	0	10	20	30	40	50
Probability	.04	0.16	0.15	0.48	0.12	0.05

Consider the following sequence of random numbers-

48, 78, 19 , 51, 56, 77, 15, 14, 68 and 9.

(i) Using the sequence, simulate the demand for the next 10 days.

(ii) Find average daily demand on basis of simulated data.

Rubric	Marks
(i)random number generation	2
(ii)simulate demand	2
(iii)average demand	1

**Q25.** In a game of matching coins, Player A wins rupees 5 if there are two tails, wins 1 rupee if there are two heads and losses rupees 2 when there is one head and one tail. Determine pay off matrix and best strategies for each player.

Rubric	Marks
matrix prepare	2
solution by any method	3

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