ME-705C

OPERATIONS RESEARCH

Time Allotted: 3 Hours | Full Marks: 70

The questions are of equal value.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

GROUP A
(Multiple Choice Type Questions)

1. Answer any *ten* questions. 10×1 = 10

(i) Total number of allocations in a basic feasible solution of transportation problem of $m \times n$ size is equal to
(A) $m \times n$ (B) $(m/n) - 1$ (C) $m + n - 1$ (D) $m - n - 1$

(ii) The assignment matrix is always a/an
(A) rectangular matrix (B) square matrix (C) identity matrix (D) none of these

(iii) In a game theory problem if the payoff matrix is formed in favour of player A (all the elements of the matrix will be profit of A), then he should follow
(A) max-max principle (B) min-max principle
(C) max-min principle (D) min-min principle

(iv) If the inter-arrival time between two consecutive arrivals follows exponential distribution, then the distribution of the total number of persons could be present after a certain period of time will follow
(A) normal distribution (B) Poisson distribution
(C) binomial distribution (D) exponential distribution

(v) The shortest path between any two nodes in a Network is determined by the following
(A) Djikastra's Algorithm (B) Floyd's Algorithm
(C) Critical path method (D) Decision tree

(vi) Dynamic problem deals with the
(A) multi-stage decision-making problems
(B) single stage decision making problems
(C) time dependent decision making problems
(D) problems which fix the levels of different decisions

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(vii) Which method is used to solve a LPP problem using artificial variables
(A) simplex method (B) Charne's Big-M (C) VAM (D) none of these

(viii) In PERT the span of times between the optimistic and pessimistic time estimates of an activity is
(A) 3σ (B) 6σ (C) 12σ (D) σ

(ix) For a salesman who has to visit n cities which of the following are the ways of his tour plan?
(A) $n!$ (B) $(n+1)!$ (C) $(n-1)!$ (D) n

(x) Laplace criteria is applicable for decision making under
(A) certainty (B) uncertainty (C) risk (D) none of these

(xi) The decision makers' knowledge and experience may influence the decision making process when using the criterion of
(A) maximax (B) minimax regret (C) realism (D) maximin

(xii) If Dual has unbounded solution, primal has
(A) no feasible solution (B) unbounded solution
(C) feasible solution (D) none of these

GROUP B
(Short Answer Type Questions)

Answer any *three* questions. 3×5 = 15

2. Five men are available to do five different jobs. From past records the time (in hrs) that each man takes to do each job is known and is given in the following table. Assign each man to a job to get minimum time. 5

Man	Job				
	1	2	3	4	5
1	8	4	2	6	1
2	0	9	5	5	4
3	3	8	9	2	6
4	4	3	1	0	3
5	9	5	8	9	5

3. Solve the following game whose pay off matrix is given by: 5

		Player B			
		B1	B2	B3	B4
Player A	A1	18	4	6	4
	A2	6	2	13	7
	A3	11	5	17	3
	A4	7	6	12	2

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4. The Manager of an oil refinery must decide on the mixture of two possible blending processes of which the input and output production runs are as follows: 5

The maximum amount available of crude A and B are 250 units and 200 units respectively. Market demand shows that at least 150 units of gasoline X and 130 units of gasoline Y must be produced. The profits per production run from Process 1 and Process 2 are Rs 4.00 and Rs 6.00 respectively. Formulate the LPP for maximizing the profit of the above problem.

Process	Input		Output	
	Crude A	Crude B	Gasoline X	Gasoline Y
1	6	4	6	9
2	5	6	5	5

5. Obtain the dual of the following primal LPP 5

Maximize $z = -2x_1 - 2x_2 - 4x_3$
Subject to $2x_1 + 3x_2 + 5x_3 \geq 2$
$3x_1 + x_2 + 7x_3 \leq 3$
$x_1 + 4x_2 + 6x_3 \leq 5$
where, $x_1, x_2, x_3 \geq 0$

GROUP C
(Long Answer Type Questions)

Answer any *three* questions. 3×15 = 45

6. (a) A steel company has three open hearth furnaces and five rolling mills. Transportation cost (Rs. per quintal) for shipping steel from furnaces to rolling mills are shown in the following table. What is the optimal shipping schedule? 10+5

	M_1	M_2	M_3	M_4	M_5	Capacity in quintals
F_1	4	2	3	2	6	8
F_2	5	4	5	2	1	12
F_3	6	5	4	7	3	14
Requirement	4	4	6	8	8	

(b) Show the complete formulation of the above problem.

7. A small project is composed of 7 activities are listed in the table below. Activities are identified by their beginning (i) and end (j) node numbers.

Activity	Optimistic time (weeks)	Most likely (weeks)	Pessimistic time (weeks)
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

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(a) Draw the network diagram of the activities in the project. 2
(b) Find the expected duration and variance of each activity. 4+3
(c) What is the expected project length? 2
(d) What is the probability that the project will be completed at least 4 weeks earlier than expected time? 4

8. Use Big M method to solve the following LP problem: 15

Minimize $Z = 5x_1 + 2x_2 + 10x_3$
Subject to: $x_1 - x_2 \leq 10$
$x_2 + x_3 \geq 10$
and $x_1 \geq 0$, $x_2 \geq 0$ and $x_3 \geq 0$

9. Solve the following by simplex method: 15

Maximize $Z = 2x_1 + 3x_2 + 4x_3$
Subject to: $3x_1 + x_2 + 6x_3 \leq 600$
$2x_1 + 4x_2 + 3x_3 \geq 480$
$2x_1 + 3x_2 + 3x_3 = 540$
and $x_1 \geq 0$, $x_2 \geq 0$ and $x_3 \geq 0$

10.(a) Briefly describe *ABC* analysis. 3+5+3+4
(b) Write note on Bin Card.
(c) What are the functions of purchase department?
(d) Explain the difference between marketing and selling.

11.(a) Write short notes on *any two* of the following: 8
(i) Training scheme
(ii) Budget and budgetary control
(iii) Industrial disputes
(iv) Industrial safety

(b) Two workmen A and B while working on two identical machines produced respectively 750 and 850 numbers of the same job whose standard production is 100 nos. per hour. The following are the particulars of the wage incentive plan: 7

Standard output per hour: 100 nos.

Rate differentials to be applied: 80 per cent of the standard piece rate for below standard performance and 120 percent of the standard piece rate for standard and above standard performance. Calculate the earnings of each operator.

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