

JK Lakshmipat University Jaipur

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Special Backlog), January 2016

B. Tech. / B. Tech. + M. Tech (CSE & ECE), Semester V

Roll No.....

MA 502: OPTIMIZATION TECHNIQUES

Time: 3 hours

Max. Marks: 40

Instructions to students:

1. Do not write anything other than your roll number on question paper.

Q.1 Choose the correct answer for the following problems (10 questions @ 1 mark) 10

- i. Any change in cost and availabilities of an LPP simultaneously may disturb;
(a) optimality (b) feasibility (c) both (a) and (b) (d) none of these
- ii. If the LPP is given in a symmetric form with ' $\geq$ ' sign in all constraints and satisfies the non-negative restrictions, then its dual problems is a;
(a) (Max, $\geq$) problem (b) (Max, $\leq$) problem
(c) (Min, $\geq$) problem (d) (Min, $\leq$) problem
- iii. The transportation problem is a;
(a) non-linear programming problem (b) a linear programming problem
(c) a quadratic programming problem (d) none of these
- iv. Which of the following methods is used to solve an assignment problem;
(a) Simplex (b) MODI (c) Hungarian (d) Vogel's approximation
- v. The time for which a machine does not work is known as;
(a) total elapsed time including idle time
(b) total elapsed time excluding idle time
(c) idle time (d) none of these
- vi. The study of the influence of discrete parameter changes on the optimal solution in an LPP is known as;
(a) Parametric analysis (b) Simulation
(c) Sensitivity analysis (d) Iteration
- vii. In M/M/1 queueing model, arrival rate is as per;
(a) Exponential distribution (b) Poisson distribution
(c) Binomial distribution (d) None of these
- viii. Basic EOQ model represents a
(a) Deterministic inventory model (b) Stochastic inventory model
(c) Inventory model with shortage allowed only (d) None of these
- ix. The amount of time by which an event can be delayed beyond its expected time is called;
(a) Lead time (b) Surplus time (c) Float (d) Delay time
- x. Simulation is application for only;
(a) situations with certainty (b) situations with uncertainty
(c) both (a) and (b) (d) none of these

Q.2 Solve the following problems (4 questions @ 2.5 marks)

i. Write down the dual of the following primal LP problem:

$$\text{Maximize } Z = 60x_1 + 120x_2$$

$$\text{Subject to: } 2x_1 + x_2 \leq 1500; 2x_1 + 5x_2 \leq 1200; 2x_1 + 3x_2 \leq 1000 \text{ and } x_1, x_2 \geq 0$$

ii. Find the value of following game.

	B ₁	B ₂	B ₃
A ₁	1	3	1
A ₂	0	-4	-3
A ₃	1	5	1

iii. Write down three essential mathematical requirements that build an LPP model.

iv. Write down any five applications areas of queuing theory. Also mention the server and customer in these applications.

Q.3A Solve the following transportation problem.

	D ₁	D ₂	D ₃	Available
P ₁	18	30	25	155
P ₂	20	21	22	180
P ₃	19	17	28	185

Required 170 200 150

Q.3B Solve the following assignment problem.

	1	2	3	4
A	10	25	15	20
B	15	30	5	15
C	35	20	12	24
D	17	25	24	20

Q.4A A firm dealing in TVs wishes to carry TVs in stock. The firm utilizes reorder level system to replenish stock, i.e., a fresh order is placed when the stock of TVs falls or approaches its pre-fixed level (re-order level). The past records of weekly demand of TVs costing Rs. 10,400 has the following distribution:

Weekly demand	0	1	2	3	4	5	6
Probability	0.02	0.08	0.22	0.34	0.18	0.09	0.07

Estimate the daily average demand by simulating the demand for 10 weeks. Use the random numbers: 39, 85, 75, 26, 95, 16, 59, 46, 06 and 35.

Q.4B State the Kuhn-Tucker conditions. Write down the Kuhn-Tucker conditions to get an optimal solution of the following Non-linear programming problem:

$$\text{Maximize } Z = x^2 + y^2 + 40x + 20y$$

$$\text{Subject to: } x \geq 50, x + y \geq 100 \text{ and } x, y \geq 0.$$

Q.5A Solve the following problem using dynamic programming:

$$\text{Maximize } Z = x_1x_2x_3$$

$$\text{Subject to: } x_1 + x_2 + x_3 = 5 \text{ and } x_1, x_2, x_3 \geq 0.$$

05

05

- Q.5B Use graphical method to find the optimal strategy of each player and the value of the following game.

		Player B			
		1	2	3	4
Player A	1	2	1	0	-2
	2	1	0	3	2

- Q.6A At a cycle shop with one person repairing the cycles, on an average a customer arrives every 5 min and on an average the service time is 4 min per customer. Suppose the inter-arrival time and the service time are exponentially distributed, Find (a) P_0 (b) L_s (c) L_q (d) W_s (e) W_q .

- Q.6B A company has two machines, M_1 and M_2 , on which six jobs are to be processed in the order M_1M_2 . The processing time (in hrs) are given as per the following table.

Jobs → Machines ↓	J_1	J_2	J_3	J_4	J_5	J_6
M_1	1	3	8	5	6	3
M_2	5	6	3	2	2	10

Find (a) the optimal job sequence, (b) the total elapsed time, and (c) the idle time for each machine.

- Q.7A The storage of one item costs Rs. 1 per month and the set-up cost is Rs. 25 per run. If the production is instantaneous and the demand is 200 units per month, find the optimal size of the batch and the best time for the replenishment of the inventory. 05

- Q.7B Use the graphical method to minimize the total time elapsed to complete jobs 1 and 2 based on the following details. 05

Job 1 Machines						
Sequence	A	C	D	B	E	F
Time (h)	20	10	10	30	25	16

Job 2 Machines						
Sequence	A	C	B	D	F	E
Time (h)	10	30	15	10	15	20

- Q.8 A small project is composed of nine activities whose time estimates are listed in the table below: 10

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

- (a) Draw the project network diagram.
 (b) Find the expected duration and variance of each activity.
 (c) Find the critical path and expected project length.
 (d) Calculate the variance and standard deviation of project length. What is the probability that the project will be completed in 4 weeks later than expected?
 (e) If the project due date is 19 weeks, what is the probability of meeting the due date?

Q.9 Solve the following LPP using the revised simplex method.

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$$\text{Maximize } Z = 4x_1 + 10x_2$$

Subject to: $2x_1 + x_2 \leq 50$; $2x_1 + 5x_2 \leq 100$; $2x_1 + 3x_2 \leq 90$ and $x_1, x_2 \geq 0$.

OR

Q.9 Five warehouses are supplied by four factories. The supply available from each factory, the demand at each warehouse and the cost per unit of transporting goods from the factories to the warehouses are summarized in the following table:

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Factories	Warehouses					Supply
	W1	W2	W3	W4	W5	
F1	13	9	15	10	12	40
F2	11	10	12	12	9	10
F3	12	9	11	12	9	20
F4	13	12	13	12	10	10
Demand	12	15	20	15	18	

(a) Use the North-West Corner method to find an initial basic feasible solution of this problem.

(b) Find the optimal solution of this problem, i.e. the solution that minimizes the transportation costs, clearly showing and explaining your working.

Q.10 Solve the following LPP using the dual simplex method.

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$$\text{Minimize } Z = 5x_1 + 6x_2$$

Subject to: $x_1 + x_2 \geq 2$; $4x_1 + x_2 \geq 4$ and $x_1, x_2 \geq 0$.

OR

Q.10 On an average, 72 patients per day (24 hrs.) require the service of an emergency clinic and on an average a patient requires 10 min. of active attention. The facility can handle only one emergency at a time. Assuming that it costs the clinic Rs. 100 per patient treated to obtain an average servicing time of 10 patients and that each min. of decrease in this average time would cost Rs. 10 per patient treated, how much would have to be budgeted by the clinic to decrease the average size of the queue from one and one third patients to half a patient.

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