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APJ Abdul Kalam Technological University

Second Semester M.Tech Degree Examination, May 2016

Ernakulam II Cluster

Branch: Mechanical Engineering

Specialisation**:** Industrial Engineering And Management

05ME 6402 ADVANCED OPERATIONS RESEARCH

Time: 3 Hours Max. Marks: 60

Answer ALL questions

1. (a). Solve the LP problem graphically

Minimize $Z = 100X_1 + 80X_2$

Subject to

$5X_1 + 10X_2 \leq 50$

$8X_1 + 2X_2 \geq 16$

$3X_1 - 2X_2 \geq 6$

X_1 and $X_2 \geq 0$ (4 marks)

(b). Solve the following LP problem

Maximize $Z = 6X_1 + 8X_2$

Subject to

$5X_1 + 10X_2 \leq 60$

$4X_1 + 4X_2 \leq 40$

X_1 and $X_2 \geq 0$

If a new variable is included in the above LP problem with a profit of 20, and 6 and 5 as the coefficients of the first and second constraints, respectively, find the solution to the new problem. (8 marks)

2. (a). Discuss Dijkstra's algorithm. (3 marks)

(b). Consider the data of a flow network as shown below and determine the maximum flow from Node 1 to Node 6

Arc i-j	flow	
	f_{ij}	f_{ji}
1-2	20	0
1-3	30	0
1-4	10	0
2-3	40	0
2-5	30	0
3-4	10	5
3-5	20	0
4-5	20	0

(9 marks)

3. Alpha logistic company has to load a cargo out of four items whose details are shown in the following table. The maximum weight of the cargo is 7 tons. Find the optimal cargo loading using dynamic programming method such that the total return is maximized.

Item i	1	2	3	4
Weight, w_i/unit (in tons)	2	1	4	3
Return, r_i/unit (in rupees)	1000	400	2100	1400

(18 marks)

OR

4. (a). Define dynamic programming problem and give its application areas. (6 marks)
(b). In a harbour, ships arrive with a mean rate of 18 per week. The harbor has 4 docks to handle unloading and loading of ships. The service rate of individual dock is 6 per week. The arrival rate and service rate follow Poission distribution. At a point of time, the maximum number of ships permitted in the harbor is 6. Find p_0, L_q, L_s, W_q and W_s (12 marks)

5. An office equipment manufacturer produces two kinds of products: computer covers and floppy boxes. Production of either a computer cover or a floppy box requires 1 hour of production capacity in the plant. The plant has a maximum production capacity of 10 hours per day. Because of the limited sales capacity, the maximum number of computer covers and floppy boxes that can be sold are 6 and 8 per day, respectively. The gross margin from the sale of a computer cover is Rs. 80 and Rs. 40

for a floppy box. The overtime hour should not exceed 2 hours/day. The plant manager has set the following goals arranged in order of importance.

1. To avoid any underutilization of production capacity.

2. To limit the overtime hours to 2 hours.

3. To sell as many computer covers and floppy boxes as possible. Since the gross margin from the sale of a compute cover is set at twice the amount of profit from a floppy box, he has twice as much desire to achieve the sales goal for computer covers as for the floppy boxes.

4. To minimize the overtime operation of the plant as much as possible

Formulate a goal programming model and solve it. (18 marks)

OR

6. Solve the following nonlinear programming problem using Kuhn-Tucker conditions

Maximize $Z = 3X_1^2 + 14X_1X_2 - 8X_2^2$

Subject to

$3X_1 + 6X_2 \leq 72$

X_1 and $X_2 \geq 0$ (18 marks)