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16331(D)

M. Tech 1st Semester Examination

Computer Oriented Optimization Methods

CSE1-513

Time : 3 Hours

Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt one question from sections A, B, C and D. Section E is compulsory. Each question carries equal marks.

### SECTION - A

1. (a) Explain the Stages of Development of Operations Research. (10)
- (b) A company owns two flour mills viz. A and B, which have different production capacities for high, medium and low quality flour. The company has entered a contract to supply flour to a firm every month with at least 8, 12 and 24 quintals of high, medium and low quality respectively. It costs the company Rs. 2000 and Rs. 1500 per day to run mill A and B respectively. On a day, Mill A produces 6, 2 and 4 quintals of high, medium and low quality flour, Mill B produces 2, 4 and 12 quintals of high, medium and low quality flour respectively. How many days per month should each mill be operated in order to meet the contract order most economically? (10)
2. (a) "Operation Research is an ongoing process". Explain this statement with examples. (10)
- (b) A company purchasing scrap material has two types of scrap materials available. The first type has 30% of material X, 20% of material Y and 50% of material Z by weight. The second type has 40% of material X, 10% of material Y and 30% of material Z. The costs of the two scraps are Rs. 120 and Rs. 160 per kg respectively. The company requires at least 240 kg of material X, 100 kg of material Y and 290 kg of material Z. Find the optimum quantities of the two scraps to be purchased so that the company requirements of the three materials are satisfied at a minimum cost. (10)

### SECTION - B

3. (a) Solve following problems using dual simplex method  
Minimize  $3x_1 + x_2$   
Constraints:  
 $x_1 + x_2 \geq 1$   
 $2x_1 + 3x_2 \geq 2$   
 $x_1, x_2 \geq 0$  (Non negativity constraint) (10)
- (b) Use the revised simplex algorithm, to solve the following problem.  
Minimize  $5x_1 + 2x_2 + 4x_3$   
s.t.  $3x_1 + x_2 + 2x_3 \leq 4$   
 $6x_1 + 3x_2 + 5x_3 \leq 10$   
 $x_1, x_2, x_3 \geq 0$  (10)
4. (a) A company manufactures and sells three models of large sized pressure cookers for canteen use. While market demands pose no constraints, supplies of aluminum limited to 750 kgs. per week and availability of machine time limited to 600 hours per week restrict the product mix. Resource usage of three models and their profitability are given below:

	$x_1$	$x_2$	$x_3$
Aluminum/unit	6	3	5
Machine time/unit	3	4	5
Cost contribution Rs/unit	60	20	80

Formulate the problem as an LPP and solve for optimal solution by using the concept of dual. (10)

- (b) The following table gives the activities in a construction project and other relevant information:

Activity	1-2	1-3	2-3	2-4	3-4	4-5
Duration (Days)	20	25	10	12	6	10

- Draw the network for the project.
- Find critical path and project length.
- Find free float, total float and independent float for non-critical activities,
- Draw the time scale version diagrams for the project. (10)

## SECTION - C

5. (a) Explain the difference between a transportation problem and an assignment problem. (10)
- (b) A contractor has three different types of excavation equipment that are needed to be assigned to three different excavation sites. The production cost for each 1 m<sup>3</sup> of the excavated soil is as given in the following table.

		Job site		
		1	2	3
Machine	1	8	3	7
	2	-	10	3
	3	6	5	4

The contractor desires to make the optimum assignment to minimize total cost. Formulate the mathematical model to optimally assign the equipment to the excavation sites. Solve it using Vogel's approximation method to determine an initial basic feasible solution. (10)

6. (a) Explain Optimality in an Assignment problem. (10)
- (b) A leading firm has three auditors. Each auditor can work upto 160 hours during the next month, during which time three projects must be completed. Project 1 will take 130 hours, project 2 will take 140 hours, the project 3 will take 160 hours. The amount per hour that can be billed for assigning each auditor to each project is given as follow

Auditor	Project 1 (In Rs.)	Project 2 (In Rs.)	Project 3 (In Rs.)
1	1200	1500	1800
2	1400	1300	1300
3	1600	1600	1600

Formulate this as a transportation problem and find the optimal solution. Also find out the maximum total billings during the next month. (10)

## SECTION - D

7. (a) Discuss various methods of finding solutions to a given game. (10)

- (b) Write a note on Inventory control. (10)
8. (a) How Does ABC Analysis Affect Inventory Optimization? (10)
- (b) If 2 spiders find a dead insect at the same time, each spider will make menacing gestures to scare off the other. If one spider backs down, that spider gets nothing and the other spider gets the insect to itself. If both spiders back down, they can share the insect. If neither backs down, the spiders will fight. The payoffs resulting from the fight depend on the sizes of the spiders and are described below.

		Spider 2	
		Back down	Fight
Spider 1	Back down	5,5	0,10
	Fight	10,0	x,y

- Suppose the spiders are of the same size so that  $x=y$ . For what values of  $x$ , will each spider have a dominant strategy? What is the dominant strategy?
- Suppose when spider 1 is smaller than spider 2 that  $x < 0 < y$ . Show that this game does not have a dominant strategy equilibrium but that it can be solved using iterated elimination of dominated strategies.

(10)

## SECTION - E

9. (a) "OR study is performed by a team of scientists". Discuss.
- (b) What is sensitivity analysis and how it is used in OR techniques?
- (c) Explain Unbalanced Assignment Problem.
- (d) Explain major assumptions and limitations of Linear Programming.
- (e) Write short note on applications of "Game Theory".