Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII • EXAMINATION – SUMMER • 2014

Subject Code: 172503 Date: 05-06-2014

Subject Name: Optimization Methods

Time: 02:30 pm - 05:00 pm Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 (a) Describe methodology of operation research. **07**

(b) A Company owns two flour mills, A and B, which have different production capacities for high, medium and low grade flour. This company has entered a contract to supply flour to a firm every week with 12, 8 and 24 quintals of high, medium and low grade respectively. It cost the company Rs 5000 and Rs 4000 per day to run mill A and B respectively. On a day, mill A produce 6, 2 and 4 quintal of high, medium and low grade flour respectively; mill B produce 2, 2 and 12 quintals of high, medium and low grade flour respectively. How many days per week should each mill be operated in order to meet the contractual obligation most economically? Use graphical method. **07**

Q.2 (a) ABC Company manufactures and sells three models of cookers. While market demands pose no restriction, the capacity to produce is currently constrained by the limited supplies of special grade aluminum limited to 1200 hrs per week. In order to determine the optimal product-mix to maximize weekly contribution, a LP model as under was formulated: **07**

$$\text{Maximize } Z = 60X_1 + 40X_2 + 80X_3 \quad \text{(Contribution)}$$
$$\text{Subject to, } 6X_1 + 3X_2 + 5X_3 \le 1500 \quad \text{(Aluminum)}$$
$$3X_1 + 4X_2 + 5X_3 \le 1200 \quad \text{(Machine hrs)}$$
$$X_1, X_2, X_3 \ge 0$$

Using the simplex method, the following final optimal tableau was obtained:

Basis		X_1	X_2	X_3	S_1	S_2	b_i
X_1	*	1	-1/3	0	1/3	-1/3	100
X_3	*	0	1	1	-1/5	2/5	180
	C_j	60	40	80	0	0	
	Z_j	*	*	*	*	*	

(a) Fill in all the numerical values in starred positions (*).

(b) Analyze the sensitivity of the optimal solution to the following changes, giving the new solution.

i. Due to a machine breakdown, the machine hours available gets reduced to 1050 hr.

ii. The second cooker model does not feature in the current optimal solution. What should be the minimum increase in unit contribution on this model to feature in the optimal solution?

(b) **07**

$$\text{Minimize } Z = 20X_1 + 10X_2$$
$$\text{Subject to, } X_1 + X_2 \le 40$$
$$3X_1 + X_2 = 30$$
$$4X_1 + 3X_2 \ge 60$$
$$\text{where, } X_1, X_2 \ge 0$$

Solve LP problem using Big-M method.

OR

(b) Minimize $Z = 20X_1 + 10X_2$ **07**

Subject to, $X_1 + 2X_2 \leq 40$

$3X_1 + X_2 \leq 30$

$4X_1 + 3X_2 \geq 60$

where, $X_1, X_2 \geq 0$

Solve LP problem using dual simplex method.

Q.3 (a) Solve following transportation problem. Use VAM method to get initial feasible solution and stepping stone method for optimal solution. **07**

	D_1	D_2	D_3	Supply
S_1	8	5	6	120
S_2	15	10	12	80
S_3	3	9	10	80
Demand	150	80	50	

(b) There are five batsmen in Indian cricket team who could play at any position from number 1 to 5. The Indian team captain and coach wants to maximize the score based on average of these players at the five positions based on past data. Based on the following table, suggest the batting order. Use Hungarian Method. **07**

Player	Batting Position				
	1	2	3	4	5
Sachin	54	47	37	41	36
Saurav	37	31	40	28	34
Sehwag	51	52	32	34	21
Dravid	29	42	39	45	47
Dhoni	26	29	31	23	26

OR

Q.3 (a) Calculate transportation cost for following problem using MODI method. **07**

Godowns

		P	Q	R	S	T	U	Supply
Plant	A	7	5	7	7	5	3	60
	B	9	11	6	11	--------	5	20
	C	11	10	6	2	2	8	90
	D	9	10	9	6	9	12	50
	Demand	60	20	40	20	40	40	

(b) Salesman wants visit cities A, B, C, D and E. He does not want to visit any city twice before completing his tour of all the cities and wishes to return to the point of starting journey. Cost of going from one city to another (in Rs.) is shown in table below. Find the least cost route. 07

	A	B	C	D	E
A	0	2	5	7	1
B	6	0	3	8	2
C	8	7	0	4	7
D	12	4	6	0	5
E	1	3	2	8	0

Q.4 (a) What is two person zero sum game? With suitable example explain principle of dominance. **07**

(b) Determine value of game and optimal strategy for player A and B. **07**

Player B's Strategy

Player A's Strategy	B1	B2	B3	B4
A1	-1	2	-1	10
A2	1	-2	5	-2
A3	-5	2	-5	10
A4	1	-10	5	-10

OR

Q.4 **(a)** With figure explain various arrangements of service facilities in queuing system. **07**

(b) In a game of matching coins with two players, suppose A wins one unit of value when there are two heads, wins nothing when there are two tails and losses ½ unit of value when there is one head and one tail. Determine the payoff matrix, the best strategies for each player and the value of the game to A. **07**

Q.5 **(a)** What is simulation? Discuss various types of simulation techniques. **07**

(b) A road transport company has one reservation clerk on duty at a time. He handles information of bus schedules and makes reservations. Customers arrive at a rate of 8 per hour and the clerk can, on an average service 12 customers per hour. After stating your assumptions, answer the following. **07**

(a) What is the average number of customers waiting for the service of the clerk?
(b) What is the average time a customer has to wait before being served?
(c) What is average waiting time for the customer in the queue?
(d) What is probability of queue size exceed 6 customers?

OR

Q.5 **(a)** People arrive at the railway station to buy tickets according to the following frequency of distribution: **07**

Arrival Time (min)	2	3	4	5	6
Frequency	10	20	40	20	10

The service time is 5 minutes and there is only one ticket counter. The head of railway station is interested in predicting the operating characteristics of the counter during a typical operating day from 9.00 am to 9.36 am. Use simulation to determine the average waiting time a person spends in railway station.
Use random number series: 93, 14, 72, 10, 21, 81

(b) Define following terms. **07**

1. Balking 2. Reneging 3. Jockeying 4. FCFS 5. LCFS
6. Queue 7. Calling population

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