Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER 2012

Subject code: 710904N **Date: 10-01-2013**

Subject Name: Optimization Techniques

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)** Explain "Optimization". State its applications related to engineering field. Also classify optimization methods based on several ways. **07**

(b) A rectangular beam is to be cut from a circular log of radius *r*. Find the cross sectional dimension *s* of the beam to **07**

(a) Maximize the cross sectional area of the beam, and

(b) Maximize the perimeter of the beam cross section.

Q.2 **(a)** A firm makes two products X and Y, and has a total production capacity of 9 tons per day. X and Y require the same production capacity. The firm has a permanent contract to supply at least 2 tons of X and at least 3 tons of Y per day to another company. Each ton of X requires 20 machine hours of production time and each ton of Y requires 50 machine hours of production time. The daily possible number of machine hours is 360. All the firms output can be sold and the profit made is Rs 80 per ton of X and Rs 120 per ton of Y. It is required to determine the production schedule for maximum profit. **07**

a) Formulate the linear programming problem

b) Solve using graphical method.

c) Find the quantities of X and Y in tons for maximum profit.

(b) Minimize $Z = 20x + 10y$ **07**

Subject to, $x + 2y \leq 40$

$4x + 3y \geq 60$

$3x + y \geq 30$

$x, y \geq 0$

Solve the given problem by using Simplex method.

OR

(b) Maximize $Z = 5x_1 + 12x_2 + 4x_3$ **07**

Subject to $x_1 + 2x_2 + x_3 \leq 10$

$2x_1 - x_2 + 3x_3 = 8$

$x_1, x_2, x_3 \geq 0$

Convert the above primal into its dual.

Q.3 **(a)** Minimize x_1 **07**

Subject to $-4x_1 + 4x_2 \leq 1$

$x_1 + x_2 \geq 24$

$x_1, x_2 > 0$

Solve using complementary geometric programming method.

(b) Find the extreme points of the function, **07**

$f(x) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

OR

Q.3 **(a)** How is the degree of difficulty defined for constrained geometrical programming problem (GPP)? What is arithmetic geometric inequality related to GPP? **07**

(b) Maximize $Z = 3x_1 + 2x_2$ **07**

Subject to, $2x_1 + x_2 \leq 40$

$2x_1 + 3x_2 \leq 60$

$x_1 + x_2 \leq 24$

Solve the given problem by using Simplex method.

Q.4 **(a)** Minimize $f = (x_1 - 2)^2 + (x_2 - 1)^2$ **07**

Subject to

$2 \geq x_1 + x_2$

$x_2 \geq x_1^2$

Apply Kuhn-Tucker conditions.

(b) Solve the following transportation problem by using Vogel's approximation method and test for optimality of your solution by using Modified distribution method. The data is given in the following table. **07**

		Ware Houses			Capacity
		W1	W2	W3	
Plants	A	35	25	15	875
	B	10	20	30	575
Requirement		350	350	450	

OR

Q.4 **(a)** Find the initial basic feasible solution of the following transportation problem by Vogel's approximation method. The cost of transportation from factories to warehouses, capacities and requirements are given in the table. **07**

		Ware Houses				Capacity
		W1	W2	W3	W4	
Plants	F1	19	30	50	10	7
	F2	70	30	40	60	9
	F3	40	8	70	20	18
Requirement		5	8	7	14	

Q.4 **(b)** Minimize $f = x_1^2 + x_2^2$ **07**

Subject to

$2x_1 + 6x_2 = 2000$

Solve above problem using Lagrange Multiplier method. Also prove local minima by determinant method.

Q.5 **(a)** Solve the following LP problem using the branch and bound method: **07**

Maximize $f = 30A + 40B$

Subjected to

$60A + 120B \leq 12000$

$8A + 5B \leq 630$

$3A + 4B \leq 500$

$A \geq 0, B \geq 0$

A, B Both are integer.

(b) A student is currently taking three courses. It is important that he will not fail all of them. If the probability of failing French is P_1, the probability of failing English is P_2 and the probability of failing Statistics is P_3, then the probability of failing all of them is $P_1 P_2 P_3$. He has left himself with four hours to study. How should he minimize his probability of failing all his courses? Use **07**

backward recursive method. The following gives the probability of failing each course given he studies for a certain number of hours on that subject, as shown in Table below.

Hours	French	English	Statistics
0	0.8	0.75	0.9
1	0.7	0.7	0.7
2	0.65	0.67	0.6
3	0.62	0.65	0.55
4	0.6	0.62	0.5

OR

Q.5 **(a)** Minimize $f = -3x_1 - 4x_2$ **07**

$$3x_1 - x_2 = 12$$

$$3x_1 + 11x_2 = 66$$

$x_1 \geq 0, x_2 \geq 0$ And x_2 is only integer.

Solve the Integer-programming problem using cutting plane algorithm.

Solution to the LP relaxation using simplex method is given in the table below:

Basic Variables	Coefficient of Variables				-f	$\overline{b_i}$
	x_1	x_2	S_1	S_2		
x_1	1	0	11/36	1/36	0	11/2
x_2	0	1	-1/12	1/12	0	9/2
-f	0	0	7/12	5/12	1	69/2

(b) Explain dynamic programming. How is it different from linear programming? Distinguish between deterministic and probabilistic dynamic programming with some examples. **07**

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