Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject code: 714603 **Date: 10-01-2013**

Subject Name: Advance Operation Research

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) Atul Ltd. Company manufactures 2 products P & Q. They can sell unlimited amount of each product of each product & wishes to determine an optimal product mix to maximize profit. Following are the resources: **07**

Availability of Raw material X = 1600kg
Availability of Raw material Y = 750kg
Equipment time = 60 Hours;
Labor time = 150 Hours
Bill of material:

Material	Product 'P'	Product 'Q'
X	1 kg	---
Y	0.5 kg	0.5 kg
Equipment time	0.06 Hr	0.04 Hr
Labor time	0.1 Hr	0.15 Hr

Cost & Price information:
Selling price of product 'P' = Rs. 6/unit
Selling price of product 'Q' = Rs. 5/unit
Material cost of X = Rs. 1/kg
Material cost of Y = Rs. 0.5/kg
For 1 unit cost of product 'P':
Equipment cost is Rs. 3 and Labor cost is Rs. 0.4
For 1 unit cost of product 'Q':
Equipment cost is Rs. 2 and Labor cost is Rs. 0.6
Find out the LPP formulation of the problem for maximizing the profit.

(b) Solve the following LPP by simplex method. **07**

Max $Z = 120x + 100y$
Subject to constraints
$2x + 2.5y \leq 1000$
$3x + 1.5y \leq 1200$
$1.5x + 4y \leq 1200$
$x, y \geq 0$

Q.2 (a) Using a stepping-stone method find out the optimum solution of the transportation problem. **07**

	Distribution Centre's				
Sources	D1	D2	D3	D4	Supply
S1	2	3	11	7	6
S2	1	0	6	1	1
S3	5	8	15	9	10
Requirement	7	5	3	2	

(b) i. State the conditions required for applying simplex method to a LP problem. How we proceed in a case when both of these are not met. **02**

ii. The following is a primal problem. Formulate its corresponding dual. **05**

Minimize $Z = 10x1 + 20\ x2 + 15x3 + 12x4$

Subject to constraints,

$x1 + x2 + x3 + x4 \geq 100$

$2x1 - x3 + 3x4 \leq 140$

$x1 + 4x2 - 2x4 = 50$

$x1, x3, x4 \geq 0$, x2 unrestricted

OR

(b) Given below is simplex table for maximization type of LPP. **07**

CBV	Basis	bi	X1	X2	S1	S2
4	X2	6	1	1	1	0
0	S2	2	1	0	-1	1
Z=24		Cj	3	4	0	0
		Zj	4	4	4	0
		Cj-Zj	-1	0	-4	0

Give reasons in brief for the following questions:

i. Is this an optimal solution?
ii. Are there more than one optimal solution?
iii. Is this solution degenerate?
iv. Is S1 is the slack in machine A (hr/week) and S2 in machine B (hr/week), which of these machines is used to the full capacity?
v. How many units of X1 and X2 are produced? What is the profit?
vi. What are the shadow prices of the machine hours?

Q.3 (a) Solve the following game. **07**

		B	
		B1	B21
A	A1	2	6
	A2	4	5
	A3	12	4

(b) Five lathes are to be allotted to five operators, the following table gives weekly output figures: **07**

		L1	L2	L3	L4	L5
Operator	P	20	22	27	32	36
	Q	19	23	29	34	40
	R	23	28	35	39	34
	S	21	24	31	37	42
	T	24	28	31	36	41

Profit per piece is 25%. Find the maximum profit per week.

OR

Q.3 (a) Explain the following terms in brief. **07**

i. Two person-zero-sum game
ii. Pure strategy
iii. Mixed strategy
iv. Saddle point

(b) Discuss in brief of significance of Operation Research in modern business management. **07**

Q.4 (a) Discuss Integer linear programming. Give an example each of a pure and **07**

a mixed integer linear programming problem.

(b) Explain the degeneracy in LP problem and Transportation problem **07**

OR

Q.4 (a) For the given cost matrix of an assignment problem having three workers and three jobs, formulate the Integer programming problem. **07**

Worker	Job		
	J1	J2	J3
W1	4	7	8
W2	6	5	10
W3	7	7	9

(b) What is Extremum Difference Method? Mention the steps of this algorithm. **07**

Q.5 (a) A factory manufacturing tanks for military use has a separate tool room where special maintenance tools are stored. The average time between requirements of tool from tool room is 10 minutes and this follows the poisson's distribution. Average service time of the store keeper is 9 minutes. Determine: **07**

i. Average queue length
ii. Average length of non-empty queue
iii. Average number of mechanics in the system
iv. Mean waiting time of a mechanic
v. Average waiting time of mechanic who waits

(b) An R & D project has following activities: **07**

Activity	Precedence	Times		
		To	Tm	Tp
A	---	4	6	8
B	A	6	10	8
C	A	8	18	10
D	B	9	9	9
E	C	10	4	4
F	A	5	5	5
G	D,E,F	8	6	10

i. Draw a PERT network for the activities given in table
ii. Prepare the schedule of the 7 activities and find out critical path
iii. If the management puts a deadline of 37 days for the completion of this project, determine the probability of completion
Given data: For Z= 3.00, Area = 0.9986

OR

Q.5 (a) Explain the steps of Maximal flow network analysis algorithm. **07**

(b) Find the critical path for the network based on the following table. Also find out free float, independent float and total float for the activities A, G & L. **07**

Activity	A	B	C	D	E	F	G	H	I	J	K	L
Depends On	-	A	A	B,C	D	E	B,C	F	F,G	H,I	B	G,K,F
Time	30	7	10	14	10	7	21	7	12	15	30	15

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