GUJARAT TECHNOLOGICAL UNIVERSITY
BE SEM-VII Examination-Nov/Dec.-2011

Subject code: 171901   **Date: 19/11/2011**
Subject Name: Operation Research
Time: 10.30 am-01.00 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) Discuss the Various phases in solving an Operation Research model   **07**
   (b) Use the graphical method to solve the following LP problems   **07**
   Maximize $Z=2X_1+X_2$
   Subject to the constraints:
   $X_1 + 2X_2 <= 10$
   $X_1 + X_2 <= 6$
   $X_1 - X_2 <= 2$
   $X_1 - 2X_2 <= 1$
   and $X_1 , X_2 >= 0$

Q.2 (a) An advertising company wishes to plan an advertising campaign in three   **07** different media: television, radio and a magazine. The purpose of the advertising is to reach as many potential customers as possible. Following are the result of a market study:

	Television		Radio Rs.	Magazine Rs.
	Prime Day Rs.)	Prime Time Rs.		
Cost of an advertising unit	40,000	75,000	30,000	15,000
Nuber of potential customers reached /unit	4,00,000	9,00,000	5,00,000	2,00,000
Number of Women customers reached /unit	3,00,000	4,00,000	2,00,000	1,00,000

The company does not want to spend more than Rs.8,00,000 on advertising. It is further required that
(i) at least 20,00,000 exposures take place among women
(ii) advertising on television be limited to Rs. 5,00,000
(iii) at least 3 advertising units be bought on prime day and two units during prime time; and (iv) the number of advertising units on radio and magazine should each be between 5 and 10. Formulate this problem as an L.P. model to maximize potential customer reach

(b) State the general rules for formulating a dual LP problem from its primal. **07**
Write the dual to the following LP problem.

Maximize $Z = X_1 - X_2 + 3X_3$

Subject to Constraints

$X_1 + X_2 + X_3 \leq 10$

$2X_1 - 0X_2 - X_3 \leq 2$

$2X_1 - 2X_2 - 3X_3 \leq 6$

and $X_1, X_2, X_3 \geq 0$

OR

(b) Use the simplex method to solve the following L.P. problem **07**

Max (Total Profit) $Z = 4X_1 + 3X_2$

Subject to Constraints

$2X_1 + X_2 \leq 1000$

$X_1 + X_2 \leq 800$

$X_1 \leq 400$

$X_2 \leq 700$

and $X_1, X_2 \geq 0$

Q.3 **(a)** Explain in brief the main characteristics of the queuing system **07**
(b) A self service store employs one cashier at its counter. Nine customers **07**
arrive on an average every 5 minutes while the cashier can serve 10
customers in 5 minutes. Assuming Poisson distribution for arrival rate and
exponential distribution for service rate, find
1. Average number of customers in the system
2. Average number of customers in queue
3. Average time a customer spends in the system
4. Average time a customer waits before being served.

OR

Q.3 **(a)** Explain clearly with suitable examples the different costs that are involved **07**
in the inventory problems.
(b) The production department for a company requires 3,600 Kg of raw **07**
material for manufacturing a particular item per year. It has been estimated
that the cost of placing an order is Rs. 36 and the cost of carrying inventory
is 25 per cent of the investment in the inventories. The price is Rs. 10 per
Kg. The purchase manager wishes to determine an ordering policy for raw
material. Calculate (1) The optimal lot size (2) The optimal order cycle time
(3) The minimum yearly variable inventory cost (4) The minimum yearly
total inventory cost

Q.4 **(a)** A computer centr has three expert programmers. The centre wants three **07**
application programmes to be developed. The head of the computer centre,
after studying carefully the programmes to be developed, estimates the
computer time in minutes required by the experts for the application
programmes as follows.

Programmes	Programmers		
	A	B	C
1	120	100	80
2	80	90	110
3	110	140	120

Assign the programmers to the programmes in such a way that the total
computer time is minimum

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(b) A firm is considering replacement of a machine, whose cost price is Rs. **07** 12,200 and the scrap value Rs. 200. The running costs are found from experience to be as follows.

Year	1	2	3	4	5	6	7	8
Running Cost Rs.	200	500	800	1,200	1,800	2,500	3,200	4,000

When should the machine be replaced?

OR

Q.4 (a) What is degeneracy in transportation problems? Explain how to resolve **07** degeneracy in a transportation problem

(b) A company has factories at F1, F2 and F3 which supply to warehouses at **07** W1, W2, W3. Weekly factory capacities are 200 ,160 and 90 units, respectively. Weekly warehouses requirement are 180,120 and 150 units, respectively. Unit shipping costs(in Rs.) are as follows. Determine the optimal distribution to minimize total transportation cost

Factory	Warehouse			
	W1	W2	W3	Supply
F1	16	20	12	200
F2	14	8	18	160
F3	26	24	16	90
Demand	180	120	150	450

Q.5 (a) Listed in the table are the activities and sequencing necessary for a **07** maintenance job on the heat exchangers in a refinery. Draw a network diagram for the project.

Activity	Description	Predecessor Activity
A	Dismantle pipe connections	-
B	Dismantle heater ,closure, and floating front	A
C	Remove tube bundle	B
D	Clean bolts	B
E	Clean heater and floating head front	B
F	Clean tube bundle	C
G	Clean shell	C
H	Replace tube bundle	F, G
I	Prepare shell pressure test	D,E,H
J	Prepare tube pressure test and reassemble	I

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(b) A company management and the labour union are negotiating a new three year settlement. Each of these has 4 strategies: **07**

I: Hard and aggressive bargaining
II: Reasoning and logical approach
III:Legalistic strategy
IV: Conciliatory approach

The cost to the company are given in the fo;;owing table for every pair of strategy choice. What strategy will the two side adopt ? Also determine the value of the game.

Union Strategies	Company Strategies			
	I	II	III	IV
I	20	15	12	35
II	25	14	8	10
III	40	2	10	5
IV	-5	4	11	0

OR

Q.5 (a) Define the following dynamic programming terms: **07**
(i) Stage (ii) State Variable (iii) Decision variable (iv) Immediate return(v)Optimal return(vi) State transformation function

(b) What are the advantages and limitations of simulation models **07**

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