B.E. Sem. VI (IT) (NEW)
June – 2009
Operation Research

Time : 3 Hours]
[Max. Marks : 100

Instructions : (1) Attempt **first** question and any **four** questions from **2 to 7**.
(2) Figure to the right indicates full marks.
(3) Make suitable assumption whenever necessary and mention it clearly.
(4) Parts of same question should be answered together and in the same sequence.

1. Answer the following :   **20**

   (a) What is Operation Research ? What are different models of OR.   **4**

   (b) Draw Flow chart of Simulation Process.   **4**

   (c) Explain Single-Server Finite Population Model of Queuing.   **4**

   (d) What are the rules to construct Dual of a Simplex problem ?   **4**

   (e) Identify the following situations :   **4**

       (i) In a Transportation problem, internal transportation from source to source, destination to destination is possible.

       (ii) Durations of Activities in a project are not certain.

       (iii) Some of the routes are not available for transportation.

       (iv) All Bi/Aij values are negative and/or infinite.

** Attempt any **four** questions from **Q-2 to Q-7**.

2. Answer the following :   **20**

Krishna Dairy manufactures three products, Cheese, Paneer and Butter, which gives profit of Rs. 12, Rs. 3 and Rs. 1 per kg. Manufacturing 1 kg of cheese requires 10 labor hours, Paneer requires 2 labor hours and butter requires 1 hour of labor. Pasteurization hour requirement is 7 hours, 3 hours and 2 hours respectively, where as packaging hour requirement is 2 hours, 4 hours and 1 hour respectively for Cheese, Paneer and Butter. Company has total 100 hours of labor, 77 hours for pasteurization and 80 hours of packaging.

   (i) Formulate the LP Problem.   **3**

P.T.O.

(ii) Find the solution of the problem. **6**

(iii) Perform sensitivity analysis i.e. find out ranges of the coefficients of objective function and ranges of slack variables. **5**

(iv) Convert the problem into its Dual. **2**

(v) Write the economic interpretation of the problem. **2**

(vi) If Dairy wants to manufacture 'Masti Dahi' for which details are as under, should it be manufactured ? **2**

2 hours of labor; 3 hours of pasteurization; 2 hours of packaging and expected profit is Rs. 60/Kg.

3. Answer the following : **20**

(a) Using the information given here, determine the optimal solution using Trans-shipment method. **10**

Manufacturing Plants	P1		P2	
Capacity	240		160	
Warehouses	W1	W1	W3	
Requirement	80	120	200	
Transportation Costs	Exactly proportional to the distances (Given in miles in the following figure)			
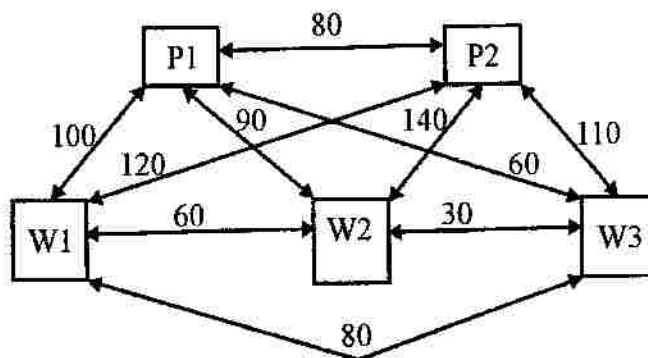
(b) Solve using NW Corner Method. **4**

	D1	D2	D3	D4	Supply
P1	2	3	11	7	6
P2	1	0	6	1	1
P3	5	8	15	9	10
Demand	7	5	3	2	

(c) Solve the following Assignment problem to maximize the sales of company. The figures show sales in '000. **6**

	I	II	III	IV
A	42	35	28	21
B	30	25	20	15
C	30	25	20	15
D	24	20	16	12

4. Answer the following : **20**

(a) Solve the following using Least Cost Method : **4**

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

(b) A Medical Representative of Pfizer has to visit several cities everyday to meet doctors. Find out his optimum schedule so that He has to visit each city once. **8**

	Surat	Baroda	Anand	Nadiad	Ahmedabad
Surat	–	375	600	150	190
Baroda	375	–	300	350	175
Anand	600	300	–	350	500
Nadiad	160	350	350	–	300
Ahmedabad	190	175	500	300	–

(c)   Find the optimal solution of the following Transportation Problem.

	D1	D2	D3	Supply
O1	50	30	220	1
O2	90	45	170	3
O3	250	200	50	4
Demand	4	2	2	

5.   Answer the following :   2(

(a)   (i)   A machine M1, costing Rs. 9000 has a maintenance cost of Rs. 200 in the
             first year of its operation which rises by Rs. 2000 in each of the successive
             years. Assuming that the machine replacement can be done only at the end
             of a year, determine the best age at which the machine should be replaced.   ∠

      (ii)   There is an offer to replace the machine M1 which is a year old, by another
             machine M2 which costs Rs. 8000. The machine M2 needs Rs. 2000 to be
             spent on installation, has no salvage value, and requires Rs. 400 on
             maintenance in the first year followed by an increase of Rs. 800 per annum
             in the yearly expenditure on maintenance. Should the machine M1 be
             replaced by the machine M2 ? If so, when ?   4

(b)   The Hare Krishna Bakery Shop keeps stock of a popular brand of cake. Previous
      experience indicates the daily demand as given below :   ξ

Daily demand	Probability
0	0.01
15	0.15
25	0.20
35	0.50
45	0.12
50	0.02

Consider the following sequence of random numbers :

21, 27, 47, 54, 60, 39, 43, 91, 25, 20

Using this sequence, simulate the demand for the next 10 days. Find out the stock
situation, if the owner of the bakery shop decides to make 30 cakes every day.
Also estimate the daily average demand for the cakes on the basis of simulated
data.

(c) Solve the problem graphically : 4

Max. $Z = 5X_1 + 3X_2$ Subject to, $3X_1 + 5X_2 <= 15$, $5X_1 + 2X_2 <= 10$,

And $X1, X2 >= 0$.

6. Answer the following : 20

(a) Find the optimum replacement policy for 300 bulbs where Cost of replacing individual bulb is Rs. 3 and group replacement costs Rs 1 per bulb. 8

Week	1	2	3	4
Probability of failure	0.15	0.30	0.25	0.30

(b) Consider the data of a project as shown in following table :

Activity	Normal Time (weeks)	Normal Cost (Rs.)	Crash time (Weeks)	Crash cost (Rs.)
1-2	13	700	9	900
1-3	5	400	4	460
1-4	7	600	4	810
2-5	12	800	11	865
3-2	6	900	4	1130
3-4	5	1000	3	1180
4-5	9	1500	6	1800

(i) Draw Network Diagram for the given project. 4

(ii) Crash the project up to maximum possible extent. Indirect cost is Rs. 160 per week. 8

7. Answer the following :

(a) A small project is composed of 7 activities whose time estimates are listed in the table below. ($Z_{0.67} = 0.2486$ & $0.35 = Z_{1.04}$)

Activity	Duration (weeks)		
	a	m	b
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

(i) Draw Network Diagram.

(ii) Find Total, Free & Independent Float & Critical Path of the Network.

(iii) Find Variance & Standard Deviation.

(iv) The probability of project completing 4 weeks earlier than expected time.

(v) The duration of the project that will have 85% chance of being completed.

b) Customer arrives at a Railway Enquiry Counter at a rate of 12 per hour. There is one clerk serving at a rate of 30 per hour. Answer the following : **8**

(i) What is the probability that the system is idle ?

(ii) Find out total length of system.

(iii) How many Customers are waiting for their turn to come ?

(iv) What is the average time that a customer will spend in the whole enquiry process ?

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