P4/RT-Ex-08-598

First Year Diploma in Operations Research for Management
Paper IV - Basics of operations Research I

Con. 2439–08. BB–9343

(3 Hours) [Total Marks : 100

19/5/2008

N.B. : (1) Attempt any **three** questions from **each** section.
(2) Answers to **each** section should be written in **separate** books.
(3) **Figures** to the **right** indicate **full** marks.
(4) **Necessary** explanations at intermediate stages must be given.
(5) Assumptions, wherever **necessary** must be stated **clearly**.
(6) Use of **ordinary** calculator and statistical table is **allowed**.

Section I

1. (a) Solve the following LPP :– **8**

$$\text{Maximise } Z = 30x_1 + 16x_2 + 25x_3$$
$$\text{Subject to } 8x_1 + 4x_2 + 5x_3 \leq 1000$$
$$5x_1 + 3x_2 + 3x_3 \leq 650$$
$$3x_1 + 2x_2 + 3x_3 \leq 420$$
$$x_1, x_2 x_3 \geq 0$$

(b) Write down the Dual problem of the following LPP and find out the optimum solutions of both primal and dual problems. **8**

2. Solve the following problem graphically – **20**

$$\text{Maximise } Z = 20x_1 + 10x_2$$
$$\text{Subject to } x_1 + 2x_2 \leq 40$$
$$3x_1 + x_2 \leq 30$$
$$4x_1 + 3x_2 \geq 60$$
$$x_1, x_2 \geq 0$$

(a) If the objective function coefficients (20 ,10) change to (10, 20), what will be the optimal solution.
(b) If the RHS coefficient change from (40, 30, 60) to (50, 50, 50) respectively find the new optimal solution.
(c) A new constraint $x_1 + x_2 < 45$, be added find the new optimal solution if the present optimal solution is affected.
(d) If product x_3 with cost 5 and resource requirements (3, 2, 5) respectively be introduced, find the Optimal solution.

3. (a) Goods are transported from factories F_1, F_2 and F_3 to the warehouse W_1, W_2, W_3 and W_4 cost of transportation, in Rs. from each factory to each warehouse, in Rs. given in the table below. Also number of demand units and supply units are given– **10**

	W_1	W_2	W_3	W_4	Supply (units)
F_1	3	5	2	4	100
F_2	6	3	7	2	80
F_3	9	4	2	5	40
Demand	70	50	40	60	

Determine how many units from each factory to each warehouse should be transported so as to minimize the to transportation cost.

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(b) Solve the following game – 6

		B	
A	4	3	3
	1	7	1
	–2	–2	12

4. The following table gives completion time, in hours for each worker for each job. 16

	J_1	J_2	J_3	J_4
W_1	3	5	2	4
W_2	6	3	7	2
W_3	9	4	2	5
W_4	8	3	2	5

(a) Determine the optimum assign on solution.

(b) Suppose the completion time of J_4 by W_2 change from 9 hours to 5 hours, obtain the optimum assignment solution.

Section II

5. A project consists of 8 activities. 16
A(3), B(4), C(2), D(3), E(5), F(7), G(8), H(2).
Figures, in brackets, denote durations in days of the activities. The following relationship amongst the activities hold.
(a) A, B and C are the starting activities of the project.
(b) A precedes D, B precedes E and F and C precedes G.
(c) D and F precedes H and
(d) C and F control G
(e) G and H are ending activities.
Draw a network diagram. Find EST, LFT, LST for each activity and determine the critical path and project duration. For each activity find the total float, Free float, Interference float and Independent Float.

6. (a) The following table gives, for each activity of a project. Normal Duration (ND), Crash Duration (CD) in days, Normal Cost (NC), Cost Cash (CC), in Rs. Indirect Cost is Rs. 50 per days :– 8

Activity	1–2	1–3	2–4	2–5	3–4	4–5
ND	7	3	2	9	6	3
CD	5	1	1	4	2	2
NC	100	150	50	100	100	80
CC	200	350	90	400	200	100

(i) Determine the minimum project duration and the corresponding Project Cost,
(ii) Determine the minimum project cost and the corresponding project duration.

(b) In a municipal hospital, patients arrivals are to be considered as Poisson with an average of interarrival time 10 minutes. The doctor's time for examination plus time of dispensing medicine is distributed negative exponentially with an average of 6 minutes. **8**

(i) What are the chances that a new patient will see the doctor without having to wait ?

(ii) For what percentage of time, the doctor will remain idle ?

(iii) Find the average queue length, average number of patients in the system, average waiting time and average time spent in the system.

7. (a) The following table gives the optimistic, most likely and pessimistic project activity duration, in days. **10**

Find the mean time and variance for each activity of the project.

What is the probability that, the project will be completed in 4 days later than expected duration ?

Activity	1–2	1–3	2–4	2–5	3–4	4–5
Optimistic	3	5	1	1	4	4
Most Likely	4	6	3	4	8	5
Pessimistic	5	7	5	7	12	6

(b) A 2 x 2 pay-off matrix for player A is given below. Then will be a riddle point only if– **6**

5	6
p	q

(i) $p \leq q$, $p \geq 5$

(ii) $p \geq q$, $p \leq 5$

(iii) neither of the outer (i) and (ii)

8. (a) For an LPP, the optimum simplex table is as follows :– **10**

Basic	C	X_1	X_2	X_3	S_1	S_2	S_3	b
X_2	–	1/2	1	0	1/3	–1/3	–	–1
X_3	–	5/6	0	1	–1/6	2/3	–	21
S_3	–	–5/3	0	0	–2/3	–1/6	–	15
	Δ	25/2	0	0	15/2	10	0	105

(i) Find the missing numbers.

(ii) Find the original LPP.

(b) Write short notes on :– **6**

(i) Alternative optima in a LPP.

(ii) Saddle Point in a game.

(iii) unbounded solution.