

Printed Pages—5

MA—013

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID: 9932

Roll No.

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B.Tech.

SIXTH SEMESTER EXAMINATION, 2005-2006

PRINCIPLES OF OPERATIONS RESEARCH

Time : 3 Hours

Total Marks : 100

- Note :** (i) Attempt **ALL** questions.
(ii) All questions carry equal marks.
(iii) In case of numerical problems assume data wherever not provided.
(iv) Graph papers will be provided on demand.
(v) Be precise in your answer.

1. Attempt **any four** parts of the following : (5x4=20)

- (a) Rolls of paper having a fixed length and width of 180 cm are being manufactured by a paper mill. These rolls have to be cut to satisfy the following demand :

Width : 80 cm 45 cm 27 cm

No. of rolls : 200 120 130

Obtain the linear programming formulation of the problem to determine the cutting pattern, so that the demand is satisfied and wastage of paper is a minimum.

- (b) Solve graphically the following LPP. Maximize $Z = 7x_1 + 3x_2$ Subject to the constraints :
 $x_1 + 2x_2 \geq 3$, $x_1 + x_2 \leq 4$, $0 \leq x_1 \leq 5/2$, $0 \leq x_2 \leq 3/2$.
- (c) Rewrite in standard form the following LPP
 $z = 2x_1 + x_2 + 4x_3$ subject to the constraints :
 $-2x_1 + 4x_2 \leq 4$, $x_1 + 2x_2 + x_3 \geq 5$, $2x_1 + 3x_3 \leq 2$, $x_1, x_2 \geq 0$
and x_3 unrestricted in sign.

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- (d) Use simplex method to solve the LPP. Maximize $z = 2x_1 + 3x_2$ subject to the constraints : $x_1 + x_2 \leq 6$, $x_1 + 2x_2 \leq 6$, $x_1, x_2 \geq 0$.
- ✓(e) Show that the following system of linear equations has a degenerate solution : $2x_1 + x_2 - x_3 = 2$, $3x_1 + 2x_2 + x_3 = 3$
- (f) Write the dual of the following LPP. Minimize $z = 4x_1 + 6x_2 + 18x_3$ subject to the constraints : $x_1 + 3x_2 \geq 3$, $x_2 + 2x_3 \geq 5$, and $x_j \geq 0, j = 1, 2, 3$.

2. Attempt *any four* parts of the following : (5x4=20)

- (a) Solve the following transportation problem :

From	To			Supply
	A	B	C	
I	6	8	4	14
II	4	9	8	12
III	1	2	6	15
Demand	6	10	15	

- (b) Solve the following assignment problem which minimizes the total man hours :

		Men			
		A	B	C	D
Jobs	1	10	25	15	20
	2	15	30	5	15
	3	35	20	12	24
	4	17	25	24	20

- (c) Use Vogel Approximation Method to obtain an initial basic feasible solution of the transportation problem :

	D	E	F	G	Available
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Demand	200	225	275	250	

- (d) Write a short note on Branch and Bound Method summarizing its iterative procedure.
- ✓(e) Consider the following production data :

Product	Profit per unit (Rs)	Direct labour Requirement (hrs)
1	6	12
2	8	11
3	5	14

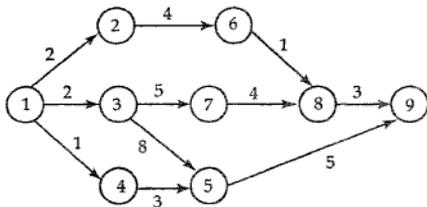
Fixed Cost (Rs)	Direct labour requirement
8,000	upto 10,000 hrs
16,000	10,000 - 20,000 hrs
22,000	20,000 - 30,000 hrs

Formulate an integer programming problem to determine the production schedule so as to maximize the total net profit.

- (f) What is meant by zero-one programming problem ?

3. Attempt *any two* parts of the following : (10x2=20)

(a) Find the critical path and calculate the slack time for the following PERT diagram :



(b) Explain the following terms :

(i) Total float (ii) Independent float

(iii) Inference float (iv) Safety float

(c) In a factory, there are six jobs to perform, each of which should go through two machines A and B, in the order A, B. The processing timings (in hrs) for the jobs are given here. You are required to determine the sequence for performing the jobs that would minimize the total elapsed time T. What is the value of T ?

Job	:	J ₁	J ₂	J ₃	J ₄	J ₅	J ₆
Machine A	:	1	3	8	5	6	3
Machine B	:	5	6	3	2	2	10

4. Attempt *any two* parts of the following : (10x2=20)

(a) The cost of a machine is Rs. 6,100 = 00 and its scrap value is Rs. 100 = 00. The maintenance costs found from experience are as follows :

Year	:	1	2	3	4	5	6	7	8
Maintenance Cost (Rs.)	:	100	250	400	600	900	1,200	1,600	2,000

When should the machine be replaced ?

- (b) A manual stamper currently valued at Rs. 1,000 is expected to last 2 years and costs Rs. 4,000 per year to operate. An automatic stamper which can be purchased for Rs. 3,000 will last 4 years and can be operated at an annual cost of Rs. 3,000. If money carries the rate of interest 10% per annum, determine which stamper should be purchased ?
- (c) The following rates have been observed for certain items :

End of month :	1	2	3	4	5
Probability of failure of date :	0.10	0.30	0.55	.85	1.00

The cost of replacing an individual item is Rs. 1.25. The decision is made to replace all items simultaneously at fixed intervals and also to replace individual items as they fail. Is the cost of group replacement is 50 paise, what is the best interval of group replacement ?

5. Attempt *any two* parts of the following : (10x2=20)
- (a) Summarize the computational procedure for solving a problem by Dynamic Programming.
- (b) Use dynamic Programming to solve the LPP :
 Maximize $z = x_1 + 9x_2$ subject to the constraints :
 $2x_1 + x_2 \leq 25$, $x_2 \leq 11$, $x_1, x_2 \geq 0$
- (c) Define the terms set-up cost, holding cost and shortage or penalty cost as applied to an inventory problem.

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