



**Diploma in Statistical Process Control and Operations Research (DSPCOR)  
Examination, August 2009  
OPERATIONS RESEARCH**

Time : 3 Hours

Max. Marks : 90

**SECTION – I**

*Note : Answer any two questions.*

**(2×15=30)**

1. a) Define :

- i) a linear programming problem
- ii) an optimal solution
- iii) unbounded solution.

b) Solve the following LPP by graphical method.

Minimize  $z = 3x_1 + 2x_2$ , subject to  $5x_1 + x_2 \geq 10$ ,  
 $x_1 + x_2 \geq 6$ ,  $x_1 + 4x_2 \geq 12$ ,  $x_1, x_2 \geq 0$ .

2. a) Find the initial basic feasible solution to the following T.P. using Vogel's approximation method.

		Destination			Availability
		D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	
Source	O <sub>1</sub>	10	9	8	8
	O <sub>2</sub>	12	7	10	7
	O <sub>3</sub>	11	9	7	9
	O <sub>4</sub>	12	14	10	4
Requirement		10	10	8	

b) Explain the term operations research and discuss the models in operations research.



3. a) What are the costs associated with an inventory system and explain one of them.
- b) The demand of a chemical is constant at a rate of 1,00,000 Kg per year. The cost of ordering is Rs. 500. The cost per Kg of the chemical is Rs. 2. The shortage cost is Rs. 5 per Kg per year if the chemical is not available for use. Find out the optimum order quantity and the optimum number of back orders. The inventory carrying cost is 30%.
4. a) Write a brief note on 'Replacement policy of items which deteriorate with time.
- b) Find the sequence that minimizes total elapsed time to complete the following six jobs and also find the minimum time.

<b>Jobs</b>	:	1	2	3	4	5	6
<b>Machine M<sub>1</sub></b>	:	3	12	15	6	10	9
<b>Machine M<sub>2</sub></b>	:	8	10	10	6	12	3

## SECTION – II

Answer **any 4** questions :

**(4×10=40)**

5. Explain the different phases of OR. Illustrate with examples.
6. Explain the procedure of solving LPP by graphical method.
7. The following table shows the time taken by the  $j^{\text{th}}$  job ( $j = 1, 2, \dots, 5$ ) on the  $i^{\text{th}}$  machine ( $i = 1, 2, \dots, 5$ ). Assign 5 jobs to the 5 machines so that the total time taken is minimized.

		<b>Jobs</b>				
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>I</b>		11	5	6	4	12
<b>II</b>		14	12	10	13	11
<b>III</b>		11	2	9	0	8
<b>IV</b>		8	0	10	2	1
<b>V</b>		9	7	8	4	11



- 8. Explain Economic lot size model (Harris model).
- 9. Why is maintenance of inventory essential ? In an inventory policy, what do the terms, i) scheduling period and ii) lead time mean.
- 10. Discuss with an example, the replacement policy for items whose maintenance cost increases with time, taking the discount factor into consideration.
- 11. In the machine shop, 8 different products are being manufactured each requiring time on 2 machines A and B are given below.

Product	I	II	III	IV	V	VI	VII	VIII
Machine A	30	45	15	20	80	120	65	10
Machine B	20	30	50	35	36	40	50	20

- 12. The initial cost of an item is Rs. 15,000 and the maintenance or running costs (in Rs), for different years are given below :

Year	:	1	2	3	4	5	6	7
Running Cost	:	2,500	3,000	4,000	5,000	6,500	8,000	10,000

What is the replacement policy to be adopted if the capital is worth 10% and there is no salvage value ?

SECTION – III

Answer **any 4** questions.

**(4×5=20)**

- 13. A paper mill produces two grades of paper namely X and Y. Because of raw material restrictions, it cannot produce more than 400 tons of grade X and 300 tons of grade Y in a week. There are 160 production hours in a week. It requires 0.2 and 0.4 hours to produce a ton of products X and Y respectively with corresponding profits of Rs. 200 and Rs. 500 per ton. Formulate the above as a LPP to maximize profit.



14. Write the computational procedure of simplex method.
15. For the following transportation problem obtain initial B.F.S. using North-west corner rule :

	$D_1$	$D_2$	$D_3$	$D_4$	$a_i$
$O_1$	1	2	1	4	30
$O_2$	3	3	2	1	50
$O_3$	4	2	5	9	20
$b_j$	20	40	30	10	

16. Given the problem,  $\max z = 2x_1 + 3x_2$  subject to  $x_1 + x_2 \leq 1$ ,  $-3x_1 + x_2 \geq 3$ ,  $x_1, x_2 \geq 0$ , examine graphically, if a feasible solution exists.
17. Write a brief note on the development of operations research.
18. Define the terms slack and surplus variables and illustrate them with an example each.
19. Explain set up cost and lead time.
20. Describe the various types of replacement problems.
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