(Set-1)

M.Sc.-4th (AM)

Operation Research

Full Marks : 70

Time : 3 hours

Answer any **six** questions including **Q. No. 1**

The figures in the right-hand margin indicate marks

Symbols used have their usual meaning

1. Answer the following questions : 2×10

(*a*) What is "no passing" rule in a sequencing algorithm ?

(*b*) State the 'principle of optimality' in dynamic programming.

(*c*) What is a symmetric game ?

(*d*) What is the difference between the pure strategy and the mixed strategy in game theory ?

(*e*) What is all-integer linear programming problem ?

(*f*) State the Kuhn-Tucker sufficient conditions in non-linear programming.

(*g*) Define a quadratic form.

(*h*) What is the need of integer programming ?

(*i*) Give an example of a sequencing model.

(*j*) What is critical path method ?

2. (*a*) Solve the following 2×2 game graphically 8

		Player B			
		B_1	B_2	B_3	P_4
Player A	A_1	2	1	0	− 2
	A_2	1	0	3	2

(*b*) Seven Jobs are to be processed on two machines *A* and *B* in the order $A \rightarrow B$. Each machine can process only one job at a time

The processing times (in hours) are as follows :

Job	:	1	2	3	4	5	6	7
Machine A	:	10	12	13	7	14	5	16
Machine B	:	15	11	8	9	6	7	16

Suggest optimum sequence of processing the jobs and the total elapsed time. 5

3. A vessel is to be loaded with stocks of 3 times. Each unit of item i has the weight w_i and the value v_i. The maximum cargo weight the vessel can take is 5 and the details of the three items are as follows :

i	w_i	v_i
1	1	30
2	3	80
3	2	65

Develop the recursive equation for the above case and find the most valuable cargo load without exceeding the maximum cargo weight by using dynamic programming. 10

4. (*a*) Define a quadratic program and show that it can not have an unbounded solution when Q is a positive definite matrix 5

(*b*) Using Kuhn-Tucker conditions solve the following non-linear programming problem : 5

Minimize $Z = 2x_1^2 + 12x_1x_2 - 7x_2^2$

subject to the conditions

$$2x_1 + 5x_2 \leq 98 ;$$

$$x_1, x_2 \geq 0$$

5. Solve the following problem using branch and bound method : 10

Maximize $Z = 7x_1 + 9x_2$

subject to the constraints

$$-x_1 + 3x_2 \leq 6 ;$$

$$7x_1 + x_2 \leq 35 ;$$

$$x_2 \leq 7 ;$$

$x_1, x_2 \geq 0$ and are integers

6. (*a*) Solve the following problem using dynamic programming : 5

Minimize $Z = y_1^2 + y_2^2 + y_3^2$
subject to the constraints

$$y_1 + y_2 + y_3 \geq 15$$

and $y_1, y_2, y_3 \geq 0.$

(*b*) Describe the basic features and essential characteristics of dynamic programming problem. 5

7. Solve the following quadratic programming problem by Wolfe's method : 10

Maximize $Z = 2x_1 + 3x_2 - 2x_1^2$
subject to the constraints

$$x_1 + 4x_2 \leq 4 ;$$
$$x_1 + x_2 \leq 2 ;$$
$$x_1, x_2 \geq 0.$$

8. **Write short notes on :** 10

(*i*) **Network programming**

(*ii*) **Uses of Kuhn-Tucker conditions.**