6. Write short notes on the following :

(a) The economic order quantity for an inventory model.

(b) Transportation problem stated as a linear programming problem.

(c) Two-person zero sum game. (6,6,6)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1343 **I**

Unique Paper Code : 2373012001

Name of the Paper : Optimization Techniques

Name of the Course : **B.Sc. (Hons) Statistics (NEP)**

Semester : III

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Q1** is compulsory.
3. Attempt **five** questions in all.
4. Non-Programmable scientific calculator is allowed.

1. (a) Fill in the blanks :

(i) Assignment problem can be solved by _____ method.

(ii) When a solution of an LPP is optimal but infeasible, we can solve it by _____ .

(iii) The cost coefficient of surplus variable in objective function is _____ .

(iv) In a minimization problem of a simplex table, if $Z_j - C_j = 0$ for at least one non-basic variable, then there will be _____ solution.

(v) Players will choose _____ if maximin value < minimax value.

(vi) The time gap between placing of an order and its actual arrival in the inventory is called _____ . (1×6)

(b) Prove that dual of the dual is primal, using following primal LPP:

Max $Z = 2x_1 + 4x_2 + 3x_3$

subject to constraints:

$x_1 + 4x_2 + 3x_3 \leq 240$

$2x_1 + x_2 + 5x_3 \leq 300$

$x_1, x_2, x_3 \geq 0$ (4)

5. (a) The owner of a small garment shop has four machinists available to assign to jobs for the day. Five jobs are offered with expected profit for each machinist on each job as follows :

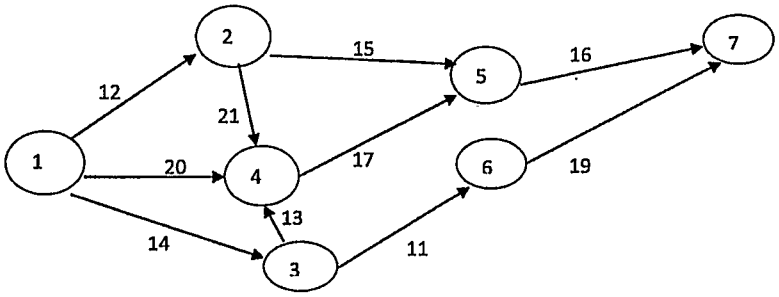
Machinist \ Jobs	A	B	C	D	E
I	62	78	50	101	82
II	71	84	61	73	59
III	87	92	111	71	81
IV	48	64	87	77	80

Solve the problem for optimal assignment of machinists to jobs that will result in a maximum profit.

(b) A manufacturing company purchases 9000 parts of a machine for its annual requirements, ordering one-month usage at a time, Each part costs Rs. 20. The ordering cost per order is Rs. 15 and the carrying charges are 15% of the average inventory per year. Suggest a more economical purchasing policy for the company. How much would this policy save the company per year? (9,9)

Solve the above problem to get the optimal transportation schedule in order to minimize the transportation cost.

(b) A hotel manager had to drive daily between his residence and distant place of work. Due to heavy traffic on roads during the peak hours it became difficult for him to drive. He decided to determine the shortest route to the work place from his residence. The following network gives the permissible routes and their distances in kms. between his residence (node 1) and six places (node 2 to node 7).



Determine the shortest route and the shortest distance from his residence (node 1) to the work place (node 7). (9,9)

(c) Explain the principle used for getting the saddle point (pure strategies) in a two-person-zero sum-game. Name the two techniques applied to solve the problem when saddle point does not exist. (4)

(d) Explain why assignment problem can be considered as a special case of transportation problem. (4)

2. (a) The firm buys castings of P and Q type of parts and sells them as finished product after machining, boring and polishing. The purchasing cost for castings are Rs. 3 and Rs. 4 each for parts P and Q and selling costs are Rs. 8 and Rs. 10 respectively. The per hour capacity of machines used for machining, boring and polishing for two products is given below:

Capacity (per hour)	Parts	
	P	Q
Machining	30	50
Boring	30	45
Polishing	45	30

The running costs for machining, boring and polishing are Rs. 30, Rs. 22.5 and Rs. 22.5 per hour respectively. Formulate the linear programming problem and find out the product mix that maximizes the profit.

(b) Solve the following LPP

Max $Z = 107x_1 + x_2 + 2x_3$

subject to constraints :

$$14x_1 + x_2 - 6x_3 + 3x_4 = 7$$

$$16x_1 + x_2 - 6x_3 \leq 5$$

$$3x_1 - x_2 - x_3 \leq 0$$

$$x_1, x_2, x_3, x_4 \geq 0 \qquad (9,9)$$

3. (a) Use dual simplex method to solve the following LPP:

Max $Z = 3x_1 + x_2$

subject to constraints :

$$x_1 + x_2 \geq 1$$

$$2x_1 + 3x_2 \geq 2$$

$$x_1, x_2 \geq 0$$

(b) Solve the 6×6 game :

Player A \ Player B	B1	B2	B3	B4	B5	B6
A1	0	0	0	0	0	0
A2	4	2	0	2	1	1
A3	4	3	1	3	2	2
A4	4	3	7	-5	1	2
A5	4	3	4	-1	2	2
A6	4	3	3	-2	2	2

4. (a) A transport company has trucks available at four different sites A, B, C and D and the number of trucks required at the sites is 5, 10, 7 and 3 respectively. The company has customers W, X and Z which require 5, 8 and 10 trucks respectively. The unit transportation cost (in ₹) for getting trucks to the customers is given below:

From \ To	W	X	Y
A	7	3	6
B	4	6	8
C	5	8	4
D	8	4	3