Destination					
Origin	P	Q	R	S	Available
A	6	1	9	3	70
B	11	5	2	8	55
C	10	12	4	7	90
Required	85	35	50	45	215

It not, then modify it to obtain optimal solution.

(b) In a machine shop, a supervisor wishes to assign five jobs among six machines. Any one of the jobs can be processed completely by any one of the machines as given below.

Jobs / Machines	A	B	C	D	E	F
1	13	13	16	23	19	9
2	11	19	26	16	17	18
3	12	11	4	9	6	10
4	7	15	9	14	14	13
5	9	13	12	8	14	11

The assignment of jobs to machine be on a one to one basis. Assign the jobs to machines so that the total cost is minimum. Find the minimum total cost. 7

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PG Even Semester Examination, September, 2023

STATISTICS

(4th Semester)

Course No: STSCC-403

(Industrial Statistics and Optimization Technique-I)

FM: 70
Pass Marks : 28
Time: 3 Hours

The figures in the right margin indicate full marks for the question.
Answer five questions, taking one from each unit.

UNIT-I

1. A factory manufactures two products each requiring the use of three machines. The first machine can be used at most 70 hours, the second machine at most 90 hours. The first product requires 2 hours on Machine-I, 1 hour on machine-II and 1 hour on machine-III. The second product requires 1 hour each on machines I and II and 3 hours on machine III. If the profit is Rs. 4,000 per unit for the first product and Rs. 6,000 per unit for the second product, how many units of each product should be manufactured to maximise profit?

   (a) Formulate this as a linear programming problem and solve it graphically. 4+3=7

   (b) Solve it using simplex method. 7

2. (a) Solve the following linear programming problem using either Big-M method or Two-phase method.

Minimuze $Z = x_1 + x_2$

Subject to the constraints

$$2x_1 + x_2 > 4$$
$$x_1 + 7x_2 > 7$$
$$x_1 > 0, x_2 > 0$$ 7

(b) Solve the following linear programming problem using duality.

Minimize $Z = 2x_1 + x_2 + 5x_3$

Subject to the constraints

$$9x_1 + 4x_2 + 2x_3 > 6$$
$$6x_1 + 4x_2 + 2x_3 > 8$$
$$x_1 + x_2 + x_3 > 3$$
$$x_1 > 0, x_2 > 0, x_3 > 0$$ 7

UNIT-II

3. (a) Define 'network'. What do you mean by network analysis? What are the main objectives of network analysis. 1+2+4=7

(b) Explain the basic differences between PERT and CPM? 3

(c) Explain the differences between activity and event in a network with an example. 4

Monthly Sales	Probability
0	0.02
1	0.05
2	0.30
3	0.27
4	0.20
5	0.10
6	0.06

The cost of carrying inventory is Rs. 10.00 per unit per month. The current policy is to maintain a stock of four items at the beginning of each month. Assuming that the cost of shortage is proportional to both time and quantity shortage, obtain the inputed cost of a shortage of one item for one unit of time. 6

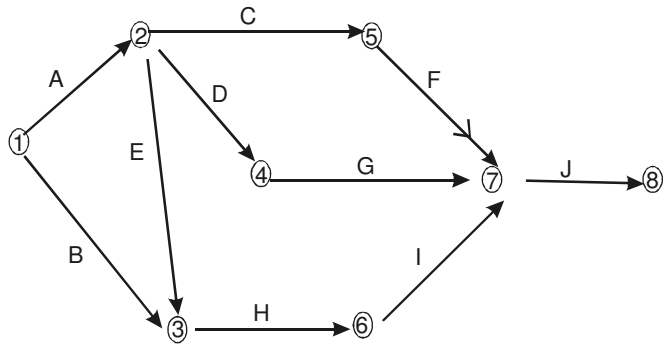
UNIT-V

9. (a) State and prove the necessary and sufficient condition for the existence of feasible solution of a transportation problem. 8

(b) Explain Hungarian method of solving cost minimization assignment problem. 6

10. (a) Given that x_{13}= 50 units, x_{14}= 20 units, x_{21}= 55 units, x_{31}= 30 units, x_{32}= 35 units and x_{34}= 25 units. Examine whether this is an optimal solution to the following transportation problem. 7

4. Consider the following PERT / CPM network of a project.



Estimate of the optimistic, most probable and pessimistic times (in days) for the activities are as follows :

Activity	Optimistic	Most Probable	Pessimistic
A	4	5	12
B	1	1.5	5
C	2	3	4
D	3	4	11
E	2	3	4
F	1.5	2	2.5
G	1.5	3	4.5
H	2.5	3.5	7.5
I	1.5	2	2.5
J	1	2	3

(a) Find the expected time for each activity.

(b) Find the critical path.

(c) Find the expected project completion time. 5+5+4=14

UNIT-III

5. (a) Define inventory. What are the advantages and disadvantages of having inventories? 2+4=6

(b) Write down the basic assumptions of fundamentals EOQ (Economic order quantity) problem with no shortages. Hence derive Wilson's optimum lot size formula. 8

6. (a) Derive the economic lot size model with uniform rate of demand, finite rate of production and having no shortages. 8

(b) Describe briefly the factors that affect inventory control. 6

UNIT-IV

7. (a) Explain the significance of buffer stock and recorder level in inventory decisions. 6

(b) Obtain the expression for average cost for a probabialistic discrete inventory model with instantaneous demand and no set up cost. Write down the assumptions of this model. 8

8. (a) Write a short note on inventory control systems. 5

(b) Mention the difference between continuous review system and periodic review system. 3

(c) The probability distribution of monthly scales of a certain items is as follows :