AE-106

April-2016

B.Sc., Sem.-VI

STA – 310 : Statistics

(Operations Research)

Time : 3 Hours]   **[Max. Marks : 70**

Instructions : (1) **All** questions are compulsory. Each question carries equal marks.

              (2) Statistical tables and graph papers will be provided on request.

              (3) Use of scientific calculator is allowed.

1. (a) Discuss, in brief, the role of Operations Research models in decision making.

OR

What is Linear Programming ? State its mathematical form.

    (b) Define :

       (i) Objective function

       (ii) Feasible solution

       (iii) Optimum solution

       (iv) Slack and surplus variables

       (v) Basic feasible solution

       (vi) Artificial variables

       (vii) Dual linear programming problem

OR

State different methods of solving linear programming problem. Explain, in detail, graphical method.

2. (a) Explain, in brief, transportation problem. Also, state necessary and sufficient condition for the transportation problem to have the feasible solution. Hence, or otherwise, define unbalanced transportation problem.

OR

The following is the initial basic feasible solution to the 3 origin 4 destination problem by Vogel's approximation method.

$x_{11} = 200$, $x_{12} = 50$, $x_{22} = 175$, $x_{24} = 125$, $x_{33} = 275$, $x_{34} = 125$

The cost of transportation are as follows :

$c_{11} = 11$, $c_{12} = 13$, $c_{13} = 17$, $c_{14} = 14$, $c_{21} = 16$, $c_{22} = 18$, $c_{23} = 14$, $c_{24} = 10$, $c_{31} = 21$, $c_{32} = 24$, $c_{33} = 13$, $c_{34} = 10$.

Supply at origins are 250, 300 and 400 respectively and demands of destinations are 200, 225, 275 and 250 respectively. Then, using this information, find optimal solution to this problem.

(b) Explain assignment problem, in brief. Give the Hungarian method of solving assignment problem.

OR

A department has five employees with five jobs to be performed. The time (in hours) each employee will take to perform is given in the following table. Solve the following assignment problem.

JOBS	EMPLOYEES				
	A	B	C	D	E
I	21	20	18	10	15
II	11	18	23	14	8
III	7	7	7	12	15
IV	17	12	14	16	12
V	17	9	15	14	16

3. (a) Write a note on replacement problem. State its different models and uses.

OR

Define sequencing problem. Describe Johnson's procedure to determine an optimum sequence for processing n items on 2 machines.

(b) Describe the replacement policy for items that deteriorate with time under increase in maintenance cost while value of money remains same for the period under consideration.

OR

The five jobs are to perform on machine X first and then Y. The time taken in hours by each job on each machine is given below. Determine the sequence for performing the jobs in order to minimize the total elapsed time T. Find the value of T.

Job	1	2	3	4	5
Machine X	12	4	20	14	22
Machine Y	6	14	16	18	10

4. (a) Define terms : Event, Activity, predecessor activity, dummy activity, Network, float, free float.

OR

A project schedule is given as under :

Activity	1-2	1-3	2-4	3-4	3-5	4-9	5-6	5-7	6-8	7-8	8-10	9-10
Time	4	1	1	1	6	5	4	8	1	2	5	7

Find :

(i) EST   (ii) EFT

(iii) LST   (iv) LFT

(v) critical path and time.

(b) Explain PERT and CPM. State their uses as well as difference between.

OR

Define most likely Time, optimistic Time, pessimistic Time, Earliest Time and Latest Time.

Draw project network for the following:

Activity	A	B	C	D	E	F
Optimistic Time (days)	2	9	5	2	6	8
Most likely (days)	5	12	14	5	9	17
Pessimistic Time (days)	14	15	17	8	12	20

5. Answer the following questions :

(a) State the role of artificial slack variable.

(b) In transportation problem, degeneracy, if occurs at any stage, is because of due to non-existence of feasible solution. Do you agree ? Justify your answer.

(c) How to convert profit maximization transportation problem into cost minimization transportation problem ?

(d) State the assumptions in solving a sequencing problem.

(e) State the nature of solution to primal linear programming problem, when its dual has unbounded solution.

(f) State span of time between optimistic and pessimistic time estimates of an activity, in PERT.

(g) Do you agree that assignment problem is a special case of transportation problem ? Justify.

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