Total No. of Questions : 4]

SEAT No. :

P 850

ss[Total No. of Pages : 4

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T.Y. B.Sc.

STATISTICS (Principal)

ST - 344 : Operations Research

(2013 Pattern) (Paper - IV) (Semester - IV)

Time : 2 Hours] *[Max. Marks :40*

Instructions to the candidates:

1) *All questions are compulsory.*
2) *Figures to the right indicate full marks.*
3) *Use of scientific calculator is allowed.*
4) *Symbols and abbreviations have their usual meaning.*

Q1) a) Choose the correct alternative in each of the following : **[1each]**

i) If the primal linear programing problem (LPP) has infeasible solution, the solution of its dual is

1) infeasible 2) unbounded

3) unique optimal 4) not optimal

ii) The method used for obtaining optimal solution of a Transportation Problem (TP) is

1) Vogel's approximation method

2) Least cost method

3) Hungarian method

4) Modified distribution (MODI) method

iii) The solution to a TP with m sources and n destinations is non degenerate if the number of positive allocations is

1) $m + n$ 2) $m + n - 1$

3) $m \times n$ 4) $m + n + 1$

P.T.O

iv) In PERT, variance of the project is based on

1) critical activities 2) non - critical activities

3) all activities 4) dummy activities

b) State whether each of the following is true or false. **[1each]**

i) The dual of a dual is primal.

ii) Assignment problem can be treated as a particular case of transportation problem.

c) Define each of the following. **[1each]**

i) Artificial variable

ii) Surplus variable

d) What is an unbalanced TP? How to convert it into a balanced TP? **[2]**

Q2) Attempt any <u>two</u> of the following : **[5 each]**

a) A firm engaged in producing two models A and B performs three operations; assembly, painting and testing. The relevant data are as follows.

Total number of hours available each week are :

Assembly - 150 Painting - 80 Testing - 24

Model	Unit sale Price (in Rs.)	Hours Assembly	required for Painting	each unit Testing
A	50	1	0.5	0.2
B	80	1.25	0.5	0.1

The firm wishes to determine its weekly product - mix 50 as to maximize revenue. Formulate it as a LPP.

b) Explain the following terms with regards to LPP.

i) feasible solution ii) optimal solution

iii) infeasible solution iv) unbounded solution

v) alternate solution

c) Write dual of the following LPP

Minimize $z = 2x_1 + 3x_2 + x_3$

Subject to $x_1 - x_2 + x_3 \leq 5$

$2x_1 + x_2 = 7$

$x_1 + x_2 - x_3 \geq 8$

$x_1, x_2, x_3 \geq 0$

Q3) Attempt any <u>two</u> of the following : **[5 each]**

a) Explain the term "simulation". Write its merits and demerits.

b) A car hire company has one car in each of four depots D_1, D_2, D_3 and D_4. A Customer in each of four regions R_1, R_2, R_3 and R_4 requires a car. The distance in km between depots and regions is as follows.

Depo \ Region	R_1	R_2	R_3	R_4
D_1	160	120	50	55
D_2	130	120	50	35
D_3	190	160	80	80
D_4	200	175	110	105

How should cars be assigned to the customers so as to minimise the total distance travelled?

c) Explain the following terms as regards to CPM :

i) earliest start time ii) earliest finish time

iii) latest start time iv) latest finish time

v) critical path

Q4) Attempt any one of the following :

a) i) Explain how simulation can be used to obtain probabilities of events related to gamma distribution. **[3]**

ii) Following table gives per unit cost of transportation (in Rs.) from sources to destinations along with availability and requirement.

destination / Sources	D_1	D_2	D_3	D_4	Availability
S_1	15	10	17	18	20
S_2	16	13	12	13	60
S_3	12	17	20	11	70
Requirement	30	30	40	50	

Obtain IBFS using VAM. Further, find optimal solution. **[7]**

b) i) Explain the following terms in PERT analysis **[4]**

1) Pessimistic time estimate

2) Optimistic time estimate

3) Most likely time estimate

4) Variance of the project length

ii) Draw a network diagram from following activities. Find critical path.

Activity	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Predecessor	-	-	-	B	B	A, E	C, D	G	H	I	C, D	C, D	C, D	J	M
Time (days)	2	2	4	6	1	1	3	45	10	7	6	2	2	1	2

[6]