



PBE-P-3050

Seat No. _____

M. C. A. (Sem. III) (CBCS) Examination

November / December - 2018

P-3050 : Operation Research

Time : $2\frac{1}{2}$ Hours]

[Total Marks : 70

1 The following questions from unit-1

(a) Attempt the following objective questions 4

- (1) What is Objective Function in Linear Programming?
- (2) Define: Infeasible Solution.
- (3) What is Basic Feasible Solution ?
- (4) LPP stands for ?

(b) Attempt any one out of two from the following : 2

- (1) Explain Alternative or Multiple optimal solution in LPP.
- (2) Use Graphical Method to solve following LP problem.

$$\text{Maximize } Z=6x_1-4x_2$$

Subject to constraints:

$$2x_1 + 4x_2 \leq 4$$

$$4x_1 + 8x_2 \geq 16$$

$$x_1, x_2 \geq 0$$

(c) Attempt any one out of two from the following: 3

- (1) Explain General Graphical Model of LP Problem
- (2) Write down the steps of Simplex Method of LP Problem solving method

(d) Attempt any one out of two from the following: 5

- (1) Use the Two-phase method to solve the following LPP.

$$\text{Min } Z= -2x_1 - x_2$$

Subject to constraints:

$$x_1 + x_2 \geq 2$$

$$x_1 + x_2 \leq 4$$

$$x_1 + x_2 \geq 0$$

- (2) Use the simplex method to solve the following LPP.

$$\text{Max } Z=3x_1 + 5x_2 + 4x_3$$

Subject to constraints:

$$2x_1 + 3x_2 \leq 8$$

$$2x_2 + 5x_3 \leq 10$$

$$3x_1 + 2x_2 + 4x_3 \leq 15$$

$$x_1, x_2, x_3 \geq 0$$

2 The following questions from unit-2

- (a) Attempt the following objective questions. 4
- (1) Define the formula of Lower limit.
 - (2) Addition of new Constraints in row is possible or not ?
 - (3) When an additional variable is added in the LP Model, the existing optimal solution can further be improved if..
 - (4) A change in the objective function for a non-basic variable can affect which variable ?
- (b) Attempt any one out of two from the following 2
- (1) Explain change in the coefficient of a non-basic variable.
 - (2) Discuss the change in the coefficient a_{ij} for the given LP problem: Max $Z=c x$, subject to $A x=b, x \geq 0$.
- (c) Attempt any one out of two from the following : 3
- (1) Discuss the effect on optimality by adding a new variable to the following LP problem with column coefficient $(3,3,3)^T$ and coefficient, 5 in the objective function.
Minimize $Z=3x_1 + 8x_2$
Subject to constraints:
 $x_1 + x_2 = 200$
 $x_1 \leq 80$
 $x_2 \geq 60$
and $x_1, x_2 \geq 0$
 - (2) Explain how change in input-output coefficient can affect a problem's optimal solution ?
- (d) Attempt any one out of two the following 5
- (1) Find the optimal solution to the LP problem.
Max $Z=15x_1 + 45x_2$
Sub. To $x_1 + 16x_2 \leq 250$
 $5x_1 + 2x_2 \leq 162$
 $x_2 \leq 50$
and $x_1, x_2, \geq 0$
If max $Z = \sum c_j x_j, j = 1, 2$ and c_2 is kept fixed at 45, determine how much can c_1 be changed without affecting the optimal solution of the problem.
 - (2) Explain Sensitivity Analysis.

3 The following questions from unit-3

- (a) Attempt the following objective questions 4
- (1) VAM stands for ?
 - (2) Define: Close loop in Transportation Problem.
 - (3) Define : Dummy Row and Dummy Column
 - (4) Which equation is using for finding value for occupied cell in MODI method?
- (b) Attempt any one out of two from the following: 2
- (1) Write down the steps of NWCM method.

- (2) Use LCM method to obtain basic feasible solution.

	D ₁	D ₂	D ₃	D ₄	Supply
P ₁	2	3	11	7	6
P ₂	1	0	6	1	1
P ₃	5	8	15	9	10
Demand	7	5	3	2	17

- (c) Attempt any one out of two from the following 3

- (1) Explain General Mathematical model of Transportations Problem.

- (2) Use VAM method to obtain basic feasible solution.

	D ₁	D ₂	D ₃	D ₄	Supply
R ₁	21	16	15	3	11
R ₂	17	18	14	23	13
R ₃	32	27	18	41	19
Demand	6	10	12	15	

- (d) Attempt any one out of two from the following: 5

- (1) Explain the Steps of MODI Method, with flowchart.

- (2) Use data to obtain an optimal solution using MODI Method.

	D ₁	D ₂	D ₃	D ₄	Supply
S ₁	2	4	6	11	50
S ₂	10	8	7	5	70
S ₃	13	3	9	12	30
S ₄	4	6	8	3	50
Demand	25	35	105	20	

Apply Vogel's Approximation method to obtain basic feasible solution.

- 4 The following questions from unit-4

- (a) Attempt the following objective questions 4

- (1) Hungarian Method is developed by whom?

- (2) Define: Enumeration Method.

- (3) In minimization case of Hungarian Method what would be our first step for solution ?

- (4) Which method used for solving an Assignment problem ?

- (b) Attempt any one out of two from the following: 2

- (1) What is Assignment Problem ? Give two Applications.

- (2) Explain maximization case in Assignment problem.

- (c) Attempt any one out of two from the following 3

- (1) Use Assignment problem to finding solution for Maximization case.

	P	Q	R	S	T
A	32	38	40	28	40
B	40	24	28	21	36
C	41	27	33	30	37
D	22	38	41	36	36
E	29	33	40	35	39

- (2) Explain Solution Methods of Assignment Problem.
- (d) Attempt any one out of two from the following 5
- (1) Five men are available to do five different jobs. From past records, the time (in hours) that each man takes to do each job is known and given in the following table.

Men/job	A	B	C	D	E
A	2	9	2	7	1
B	6	8	7	6	1
C	4	6	5	3	1
D	4	2	7	3	1
E	5	3	9	5	1

Find the Assignment of men to jobs that will minimize the total time taken.

- (2) Write down the steps of the Hungarian Method for (Minimization case).
- 5 The following questions from unit-5 4
- (a) Attempt the following objective questions 4
- (1) What is Total float ?
- (2) Define: Activity.
- (3) Define: Free float.
- (4) Define: AON.
- (b) Attempt any one out of two from the following: 2
- (1) What is Network ?
- (2) Explain Dummy/Redundant Activity.
- (c) Attempt any one out of two from the following: 3
- (1) Explain Burst Event and Merge Event.
- (2) Listed in the table are the activities and sequencing necessary for a maintenance job on the heat exchangers in a refinery.

Activity	Description	Predecessor Activity
A	Dismantle pipe Connection	-
B	Dismantle heater, closure, and floating front.	A
C	Remove the bundle	B
D	Clean bolts	B

E	Clean heater and floating Head front	B
F	Clean tube bundle	C
G	Clean shell	C
H	Replace tube bundle	F, G
I	Prepare shell pressure test	D, E, H
J	Prepare tube pressure test and reassemble	I

Draw a Network diagram for the project.

(d) Attempt any one out of two from the following: 5

- (1) An established company has decided to add a new product to its line. It will buy the product from a manufacturing concern, package it, and sell it to a number of distributors selected on a geographical basis. Market research has indicated the volume expected and the size of sales force required. The steps shown in the following table are to be planned.

Activity	Description	Immediate predecessors	Time(days)
A	Organize sales office	-	6
B	Hire salesmen	A	4
C	Train salesmen	B	7
D	Select advertising agency	A	2
E	Plan advertising campaign	D	4
F	Conduct advertising campaign	E	10
G	Design package	-	2
H	Setup packaging facilities	G	10
I	Package initial stocks	J, H	6
J	Order stock from Manufacturer	-	13
K	Select distributor	A	9
L	Sell to distributor	C, K	3
M	Ship stocks to distributors	I, L	5

- a) Draw the network diagram of activities for the project.
b) Indicate the critical path, and calculate the total float and free float for each activity.

For each non-critical activity find the total float and free float.

- (2) Explain Forward pass method and Backward pass method.