PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2024
(Fifth Semester)

Branch – **STATISTICS**

OPERATIONS RESEARCH - I

Time: Three Hours Maximum: 50 Marks

SECTION-A (5 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (5 x 1 = 5)

1. Minimization of objective function in LPP means _____
   (a) least value chosen among allowable decisions
   (b) greatest value chosen among allowable decisions
   (c) both (a) and (b)
   (d) None of the above
2. In converting a greater-than-or-equal constraint for use in a simplex table, we must add _____.
   (a) a slack variable & an artificial variable
   (b) a surplus variable & an artificial variable
   (c) an artificial variable
   (d) none of the above
3. For any primal and its dual
   (a) optimum value of the objective funjction is same
   (b) both primal and dual cannot be feasible
   (c) primal will have an optimum solution if and only if dual does too
   (d) all the above
4. The initial solution of a T.P. obtained by _____
   (a) North-West corner rule would invariably be optimum.
   (b) Least cost method does not provide the least cost solution to a T.P.
   (c) VAM would invariably be very near to optimum solution.
   (d) MODI method is infeasible.
5. In an assignment problem involving four workers and three jobs, total number of assignments possible are _____
   (a) 4 (b) 3 (c) 7 (d) 12

SECTION - B (15 Marks)
Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks (5 x 3 = 15)

6. (a) A farm engaged in breeding pigs. The pigs are fed on various products grown on the farm. In view of the need to ensure certain nutrient constituents (call them X, Y and Z), it is necessary to buy two additional products, say, A and B. One unit of product A contains 36 units of X, 3 units of Y and 20 units of Z. One unit of product B contains 6 units of X, 12 units of Y and 10 units of Z. The minimum requirement of X, Y and Z is 108 units, 36 units and 100 units respectively. Product A costs Rs. 20 per unit and product B Rs. 40 per unit. Formulate the above as a linear programming problem to minimize the total cost and solve the problem by using graphic method.

   (OR)

   (b) Explain the nature of operations research and its limitation.
7. (a) Explain the use of artificial variable in LPP

   (OR)

   (b) Use Big – M method to solve

   Maximize $Z = 3x_1 + 2x_2$

   Subject to constraints:

   $2x_1 + x_2 \le 2$

   $3x_1 + 4x_2 \ge 12$ and $x_1, x_2 \ge 0$

Cont

8. (a) Formulate the dual of the LPP
Maximize $z=4x_1+2x_2$
Subject to $x_1+x_2 \geq 3$
$x_1-x_2 \geq 2$
$x_1, x_2 \geq 0$

(OR)

(b) Give the applications of duality theory.

9. (a) Find the initial Basic feasible solution for the following transportation problem by least cost method.

	Destination				
	D_1	D_2	D_3	D_4	Supply
O_1	1	2	1	4	30
O_2	3	3	2	1	50
O_3	4	2	5	9	20
Demand	20	40	30	10	

(OR)

(b) Enumerate the steps involved in solving a transportation problem using North West corner Rule.

6. (a) Explain the steps in the Hungarian Method used for solving assignment problems.

OR

(b) A department head has four tasks to be performed and three subordinates, the subordinates differ in efficiency. The estimates of the time, each subordinate would take to perform, is given below in the matrix. How should he allocate the tasks one to each man, so as to minimize the total man-hours?

Task	Men		
	1	2	3
I	9	26	15
II	13	27	6
III	35	20	15
IV	18	30	20

SECTION -C (30 Marks)

Answer **ALL** questions
ALL questions carry **EQUAL** Marks (5 x 6 = 30)

11. (a) A complete unit of a certain product of four units of component A and three units of component B. The two components (A and B) are manufactured from two different raw materials of which 100 units and 200 units, respectively, are available. Three departments are engaged in the production (process with each department using a different method for manufacturing the components per production run and the recoulting units of each component are given below:

Department	Input per run (units)		Output per run (units)	
	Raw material I	Raw material II	Component A	Component B
1	7	5	6	4
2	4	8	5	8
3	2	7	7	3

Formulate this problem as a linear programming model so as to determine the number of production runs for each department which will maximize the total number of complete units of the final product.

OR

(b) Explain briefly the General methods for solving OR models

12. (a) Use Simplex method to

Maximize $Z = 2x_1 - x_2 + x_3$

Subject to $3x_1 + x_2 + x_3 \leq 60$

$x_1 - x_2 + 2x_3 \leq 10$

$x_1 + x_2 - x_3 \leq 20$ and $x_1, x_2, x_3 \geq 0$

OR

(b) Explain the concept of slack, surplus and artificial variables.

13. (a) Explain the steps in the process of formulation of primal to dual.

OR

(b) Solve the following LPP by Dual simplex method

Minimum $z = x_1 + x_2$

subject to $2x_1 + x_2 \geq 4$

$x_1 + 7x_2 \geq 7$

$x_1, x_2 \geq 0$

14. (a) Solve the following transportation problem using the Vogel's approximation method

Source	Destination				Available
	1	2	3	4	
1	20	22	17	4	120
2	24	37	9	7	70
3	32	37	20	15	50
Requirement	60	40	30	110	240

OR

(b) Solve the following transportation problem using by MODI method:

Source	Destination				Available
	1	2	3	4	
1	21	16	25	13	11
2	17	18	14	23	13
3	32	27	18	41	19
Requirement	6	10	12	15	43

15. (a) Solve the following assignment problem.

Tasks	Men E	F	G	H
A	18	26	17	11
B	13	28	14	26
C	38	19	18	15
D	19	26	24	10

OR

(b) Solve the following sequencing problem when passing out is not allowed:

Item	Machine (processing time in Hours			
	A	B	C	D
I	15	5	4	15
II	12	2	10	12
III	16	3	5	16
IV	17	3	4	17

Z-Z-Z

END