PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2022
(Fifth Semester)

Branch – **STATISTICS**

OPERATIONS RESEARCH-1

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (10 x 1 = 10)

1. Which there is no non-negative replacement ratio in solving a Linear Programming Problem then the solution is _____.
   (i) feasible (ii) bounded (iii) unbounded (iv) infinite
2. Find a mixed strategy game can be solved by _____
   (i) Simplex method (ii) Graphical method (iii) Hungarian method (iv)Degeneracy
3. Which variables are fictitious and cannot have any physical meaning?
   (i) Optimal variable (ii) Decision variable
   (iii) Artificial variable (iv) None of the above
4. Define simplex algorithm, which method is used to deal with the situation where an infeasible starting basic solution is given?
   (i) M-method (ii) Slack variable (iii) Simplex method (iv) None of the above
5. Where graphic method can be applied to solve a LPP when there are only _____ variable
   (i) One (ii) More than One (iii) Two (iv) Three
6. Find the feasible region of a LPP is empty, the solution is _____
   (i) Infeasible (ii) Unbounded (iii) Alternative (iv) None of the above
7. Mention any column or raw of a simplex table is called a _____
   (i) Vector (ii) Key column (iii) Key Raw (iv) None of the above
8. Mention VAM stands for _____
   (i) Vogel's Approximation Method (ii) Vogel's Approximate Method
   (iii) Vangelis Approximation Method (iv) Vogel's Approximation Method
9. Which method of formal calculations often termed as Linear Programming was developed later in which year?
   (i) 1947 (ii)1988 (iii) 1957 (iv) 1944
10. To make an unbalanced assignment problem balanced, what are added with all entries as zeroes?
    (i) Dummy rows (ii) Dummy columns (iii) Both A and B (iv)Dummy entries

SECTION - B (35 Marks)
Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks (5 x 7 = 35)

11. a) Define Operation Research and its types of Operation Research.

OR

b) Solve the following problem graphically: Minimise and Maximise $Z = 3x + 9y$
subject to the constraints:

$$x + 3y \leq 60$$
$$x + y \geq 10$$
$$x \geq 0, y \geq 0$$

12. a) Calculate the simplex method to solve the following LP problem.
Maximize $Z = 3x_1 + 5x_2 + 4x_3$
subject to the constraints
$2x_1 + 3x_2 \leq 8$
$2x_2 + 5x_3 \leq 10$
$3x_1 + 2x_2 + 4x_3 \leq 15$ and $x_1, x_2, x_3 \geq 0$

OR

Cont...

b) Solve the following two-phase simplex Method: Minimize $z = 4x_1 + 3x_2$

subject to the constraints:

$$2x_1 + x_2 \geq 10, \quad -3x_1 + 2x_2 \leq 6$$

$$x_1 + x_2 \geq 6, \quad \text{and} \quad x_1 \geq 0, \; x_2 \geq 0$$

13. a) Write the dual to the following LP problem. Maximize $z = x_1 - x_2 + 3x_3$

subject to the constraints

$$x_1 + x_2 + x_3 \leq 10, \quad 2x_1 - x_2 - x_3 \leq 2, \quad 2x_1 - 2x_2 - 3x_3 \leq 6 \quad \text{and} \quad x_1, x_2, x_3 \geq 0$$

OR

b) Explain the types of Integer Programming Problems.

14. a) Explain the steps involved in solving a transportation problem using Row minima method.

OR

b) Apply MODI method to obtain optimal solution of transportation problem using the data.

	D_1	D_2	D_3	D_4	Demand
S_1	19	30	50	10	7
S_2	70	30	50	60	9
S_3	40	8	70	20	18
Supply	5	8	7	14	

15. a) Explain the steps involved in solving a assignment problem using Hungarian method.

OR

b) Show there are 5 jobs, each of which has to go through the machines A and B in the order AB. The processing times (in hours) are given as

Job	J1	J2	J3	J4	J5
Machine A	2	4	5	7	1
Machine B	3	6	1	4	8

Determine a sequence of these jobs that will minimise the total elapsed time T. Also find the minimum elapsed time and idle time for each of the machines.

SECTION - C (30 Marks)

Answer any **THREE** Questions

ALL Questions Carry **EQUAL** Marks (3 x 10 = 30)

16. Solve the following LP problem using graphical method. Minimize $z = 3x_1 + 2x_2$

subject to the constraints

(i) $5x_1 + x_2 \geq 10$, (ii) $x_1 + x_2 \geq 6$, (iii) $x_1 + 4x_2 \geq 12$ and $x_1, x_2 \geq 0$.

17. Solve the following LPP using Big -M Method. Minimize $z = 4x_1 + 3x_2$ Subject to constraints:

$2x_1 + x_2 \geq 10$, $-3x_1 + 2x_2 \leq 6$, $x_1 + x_2 \geq 6$, and $x_1, x_2 \geq 0$.

18. Solve the following LPP using dual-simplex method Maximize $z = -2x_1 - x_2$

Subject to constraints: $-3x_1 - x_2 \leq -3$, $-4x_1 - 3x_2 \leq -6$, $-x_1 - 2x_2 \leq -3$, and $x_1, x_2 \geq 0$.

19. solve the following transportation problem using Modi method.

Factory/Warehouse	W_1	W_2	W_3	Demand
F_1	16	20	12	200
F_2	14	8	18	160
F_3	26	24	16	90
Supply	180	120	150	450

20. Solve the following n jobs and Three machines problem in the order Machine A, B, C. Also find the total elapsed time and idle time for all the machines.

Jobs	1	2	3	4	5
Machine A	5	7	6	9	5
Machine B	2	1	4	5	3
Machine C	3	7	5	6	7

Z-Z-Z END