PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2024
(Fifth Semester)

Branch – **MATHEMATICS**

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 For maximization LPP, the objective function coefficient for an artificial variable is
   (i) +M   (ii) +1
   (iii) -M   (iv) 0

2 Branch and bound method divides the feasible solution space into
   (i) enumerating (ii) branching
   (iii) bounding   (iv) enumerating and branching

3 The minimum number of lines covering all zeros in a reduced cost matrix of order n can be
   (i) at most n   (ii) at least n.
   (iii) n-1   (iv) n+1

4 In sequencing algorithm
   (i) a service facility process one job at a time
   (ii) all the service facilities are
        not of different type
   (iii) all the jobs must be processed on a first come first service basis
   (iv) the selection of an appropriate order for a series of jobs is to be done on a finite service facility.

5 The total float for an activity in network is equal to ____
   (i) EF-LS   (ii) LF-LS
   (iii) LF-EF   (iv) EF-ES

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

6 a Write the algorithm for Big-M method.
                          OR
   b Write the dual of the following linear programming problem:
      Minimize $z = 4x_1 + 6x_2 + 18x_3$ subject to the constraints

      $x_1 + 3x_2 \geq 3, \ x_2 + 2x_3 \geq 5;$

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

7 a Write the concepts and uses of Branch and bound method.
                          OR
   b Consider the following production data:

Product	Profit per unit(Rs.)	Direct labour requirement (hours)
1	6	12
2	8	11
3	5	14

Table :2

Fixed cost (Rs.)	Direct labour requirement
8000	Upto 10000 hours
16000	10000-20000 hours
22000	20000-30000 hours

Formulate this as an integer LPP to determine the production schedule to maximize the total net profit.

8 a Find the starting solution in the following transportation problem using Matrix minima method.

	D1	D2	D3	D4	Supply
O1	1	2	3	4	6
O2	4	3	2	0	8
O3	0	2	2	1	10
Demand	4	6	8	6	

OR

b Determine the optimum assignment Schedule for the following data:

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

9 a What are the assumptions to be made to solve the sequencing problem?

OR

b A book binder has one printing press, one binding machine and a manuscripts of a number of different books. The time required to perform the printing and binding operations for each book is given below. Determine the order in which book should be processed in order to minimise the total time required to turn out all the books.

Book	1	2	3	4	5	6
Printing time (hours)	30	120	50	20	90	100
Binding time (hours)	80	100	90	60	30	10

10 a Define the following: optimistic time, pessimistic time and most likely time.

OR

b The activities along with their dependency relationships are given below. Draw an arrow diagram.

Activity	A	B	C	D	E	F	G
Immediate predecessor	-	-	B	B	B	E	A,D,C

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

11 a   Use two phase simplex method to solve the LPP,
Maximize $z = 5x_1 - 4x_2 + 3x_3$

subject to

$2x_1 + x_2 - 6x_3 = 20;$

$6x_1 + 5x_2 + 10x_3 \leq 76;$

$8x_1 - 3x_2 + 6x_3 \leq 50;$

$x_1, x_2, x_3 \geq 0$

OR

b   Use simplex method to solve the LPP,
Maximize $z = 4x_1 + 10x_2$

subject to

$2x_1 + x_2 \leq 50;$

$2x_1 + 5x_2 \leq 100;$

$2x_1 + 3x_2 \leq 90;$

$x_1, x_2 \geq 0$

12 a   Use branch and bound method to solve the LPP,

Maximize $z = 7x_1 + 9x_2$

subject to

$-x_1 + 3x_2 \le 6$;

$7x_1 + x_2 \le 35$;

$x_2 \le 7$;

$x_1, x_2 \ge 0$ and are integers

OR

b   Solve the following integer LPP using cutting plane algorithm

Maximize $z = 3x_1 + x_2 + 3x_3$

subject to

$-x_1 + 2x_2 + x_3 \le 4$;

$4x_2 - 3x_3 \le 2$;

$x_1 - 3x_2 + 2x_3 \le 3$;

$x_1, x_2, x_3 \ge 0$.

13   a   Find the starting solution in the following transportation problem using VAM, also obtain the optimum solution by MODI Method.

	I	II	III	IV	V	SUPPLY
A	20	18	18	21	19	100
B	21	22	23	20	24	125
C	18	19	21	18	19	175
Demand	60	80	85	105	70	

OR

b   Four operators are available to a manager who has to get jobs done by assigning one job to each operator. Given the times needed by different operators for different jobs below:

	A	B	C	D
P	14	42	56	0
Q	64	82	91	55
R	44	66	77	33
S	74	90	98	66

Determine the optimum Assignment Schedule.

14   a) In a factory, there are 7 jobs to perform, each of which should go through three machines A , B , and C in the order. The processing timings (in hours) for the job are given here. you are required to determine the sequence for performing the jobs that would minimize the total elapsed time, T and idle time for each machine. What is the value of T?

Job	J1	J2	J3	J4	J5	J6	J7
Machine A	3	8	7	4	9	8	7
Machine B	4	3	2	5	1	4	3
Machine C	6	7	5	11	5	6	12

OR

b   Use graphical method to calculate the minimum time needed to process job 1 and 2 on 5 machines A,B,C,D,E and F. For each machine find job which should be done first also calculate the total time need to complete both jobs.

JOB 1	Sequence	A	B	C	D	E
	Time (hours)	3	4	2	6	2
JOB 2	Sequence	B	C	A	D	E
	Time (hours)	5	4	3	2	6

15 a)The utility data for a network are given below. Determine the total, free, independent and interfering floats and identify the critical path.

Activity	0-1	1-2	1-3	2-4	2-5	3-4	3-6	4-7	5-7	6-7
Duration	2	8	10	6	3	3	7	5	2	8

OR

b)

Activity	1-2	1-3	1-4	3-4	3-5	5-7	5-6
Normal time(days)	4	7	6	5	7	6	5

(a) Draw the project network and identify all the paths through it.
(b) Determine the expected project length and total float for each activity.

Z-Z-Z   END