PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BCom DEGREE EXAMINATION MAY 2022
(Second Semester)

Branch – COMMERCE (BUSINESS ANALYTICS)

OPTIMIZATION TECHNIQUES

Time: Three Hours   Maximum: 50 Marks

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

1 The Z_j row in a simplex table for maximization represents _____
   (i) Gross profit   (ii) Net profit
   (iii) Profit per unit   (iv) Constraints

2 The purpose of the transportation approach for locational analysis is to _____ total shipping costs.
   (i) Maximize   (ii) Equalize
   (iii) Minimize   (iv) None of the above

3 In game theory, the outcome or consequence of a strategy is referred to as the ___
   (i) Payoff   (ii) Penalty
   (iii) Reward   (iv) Endgame

4 PERT analysis is based on _____
   (i) Optimistic time   (ii) Pessimistic time
   (iii) most likely time   (iv) All the above

5 In sequencing problem the order of completion of jobs is called _____
   (i) completion sequence   (ii) Job sequence
   (iii) processing order   (iv) Job order

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

6 a A company manufactures two products A and B. These products are processed in the same machine. It takes 10 minutes to process one unit of product A and 2 minutes for each unit of product B and the machine operates for a maximum of 35 hours in a week. Product A requires 1 kg and B requires 0.5 kg of raw material per unit, the supply of which is 600 kg per week. Market constraint on product B is known to be minimum of 800 units every week. Product A costs Rs.5 per unit and sold at Rs.10, Product B costs Rs.6 per unit and can be sold in the market at a unit price of Rs.8. Determine the number of units of A and B per week to maximize the profit.

OR

   b Use simplex method to solve the LPP: Max $Z = 3x_1 + 2x_2$ subject to, $x_1 + x_2 \leq 4$, $x_1 - x_2 \leq 2$, $x_1, x_2 \geq 0$

7 a Determine an initial basic feasible solution to the following transportation problem using North West Corner Rule.

	D_1	D_2	D_3	D_4	Supply
O_1	6	4	1	5	14
O_2	8	9	2	7	16
O_3	4	3	6	2	5
Required	6	10	15	4	35

OR

b   From the following cost matrix, establish (a) optimal job assignment (b) the cost of assignments.

Job

$$\text{Machine} \begin{array}{c} \\ A \\ B \\ C \\ D \\ E \end{array} \begin{bmatrix} 10 & 3 & 3 & 2 & 8 \\ 9 & 7 & 8 & 2 & 7 \\ 7 & 5 & 6 & 2 & 4 \\ 3 & 5 & 8 & 2 & 4 \\ 9 & 10 & 9 & 6 & 10 \end{bmatrix}$$

$$\begin{array}{ccccc} 1 & 2 & 3 & 4 & 5 \end{array}$$

8   a   Solve the following pay-off matrix. Also determine the optimal strategies and value of the game.

B

$$A \begin{bmatrix} 5 & 1 \\ 3 & 4 \end{bmatrix}$$

OR

b   Find the solution of the game problem using saddle point.

| Player A \ Player B	B1	B2	B3	B4
A1	20	15	12	35
A2	25	14	8	10
A3	40	2	10	5
A4	-5	4	11	0

9   a   Determine the optimum project duration and cost for the following data.

Activity	Normal Time (days)	Normal Cost (Rs)	Crash Time (days)	Crash Cost (Rs)
1-2	8	100	6	200
1-3	4	150	2	350
2-4	2	50	1	90
2-5	10	100	5	400
3-4	5	100	1	200
4-5	3	80	1	100

Indirect cost is Rs.70 per day.

OR

b   Determine the critical path, the critical activities and the project completion time using CPM network method.
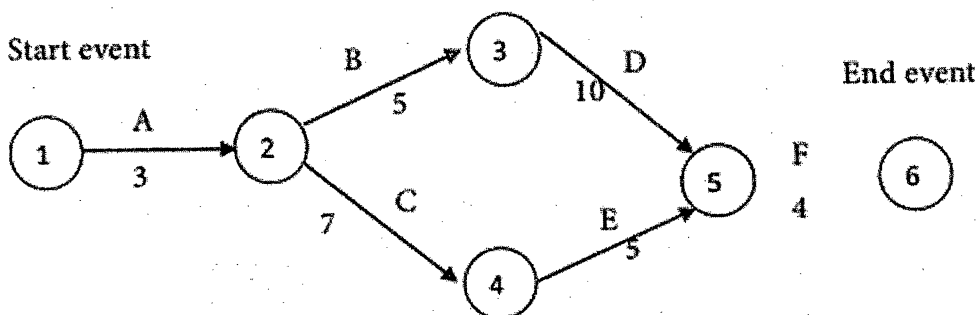
10   a   Find the sequence that minimizes the total elapsed time required to complete the following tasks on two machines

Task	A	B	C	D	E	F	G	H	I
Machine I	2	5	4	9	6	8	7	5	4
Machine II	6	8	7	4	3	9	3	8	11

(OR)

b Find the sequence that minimises the total time required in performing the following jobs on three machines in the order ABC. Processing times (in hours) are given in the following table

Job	1	2	3	4	5
Machine A	8	10	6	7	11
Machine B	5	6	2	3	4
Machine C	4	9	8	6	5

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

11 a Solve the following LPP using Dual Simplex method. Min $Z = 2x_1 + 2x_2 + 4x_3$ subject to, $2x_1 + 3x_2 + 5x_3 \geq 2$, $3x_1 + x_2 + 7x_3 \leq 3$, $x_1 + 4x_2 + 6x_3 \leq 5$, $x_1, x_2, x_3 \geq 0$

(OR)

b Solve the LPP using Big M method Max $Z = 3x_1 - x_2$ subject to $2x_1 + x_2 \leq 2$, $x_1 + 3x_2 \geq 3$, $x_2 \leq 4$, $x_1, x_2 \geq 0$

12 a Solve the following Transportation problem

		Destination				
		P	Q	R	S	Supply
Source	A	21	16	25	13	11
	B	17	18	14	23	13
	C	32	17	18	41	19
	Demand	6	10	12	15	43

(OR)

b The owner of a small machine shop has four mechanics available to assign jobs for the day. Five jobs are offered with expected profit for each mechanic on each jobs, which are as follows.

Job

$$\text{Mechanic} \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \end{array} \begin{bmatrix} 62 & 78 & 50 & 111 & 82 \\ 71 & 84 & 61 & 73 & 59 \\ 87 & 92 & 111 & 71 & 81 \\ 48 & 64 & 87 & 77 & 80 \end{bmatrix}$$

By using the assignment method, find the assignment of mechanics to the job that will result in maximum profit. Summarize which job should be declined?

13 a Solve the following 2 X 3 game graphically. Player A $\begin{bmatrix} 1 & 3 & 11 \\ 8 & 5 & 2 \end{bmatrix}$ Player B

(OR)

b Using dominance property, obtain the optimum strategies for both the players and determine the value of the game.

PLAYER B

PLAYER A		I	II	III	IV	V
	I	2	4	8	3	4
	II	5	6	7	3	8
	III	6	7	8	9	7
	IV	4	2	4	8	3

19 a The following table shows the job of a network along with their time estimates.

Job	1-2	1-6	2-3	2-4	3-5	4-5	6-7	5-8	7-8
a (days)	1	2	2	2	7	5	5	3	8
m (days)	7	5	14	5	10	5	8	3	17
b (days)	13	14	26	8	19	17	29	9	32

Draw the project network and illustrate the probability of the project completing in 40 days.

(OR)

b Draw the network diagram and determine the critical path for the following project:

Activity	1-2	1-3	1-4	2-5	3-6	3-7	4-7	5-8	6-8	7-9	8-9
Time estimate (Weeks)	5	6	3	5	7	10	4	2	5	6	4

20 a A book binder has one printing press, one binding machine and manuscripts of 7 different books. The times required for performing printing and binding operations for different books are shown below. Decide the optimum sequence of processing of books in order to minimize the total time required to bring out all the books.

Book	1	2	3	4	5	6	7
Printing time (hours)	20	90	80	20	120	15	65
Binding time (hours)	25	60	75	30	90	35	50

(OR)

b Strong Book Binder has one printing machine, one binding machine, and the manuscripts of a number of different books. Processing times are given in the following table:

Book	Time In Hours	
	Printing	**Binding**
A	5	2
B	1	6
C	9	7
D	3	8
E	10	4

Determine the order in which books should be processed on the machines, in order to minimize the total time required.

Z-Z-Z   END