USN

Seventh Semester B.E. Degree Examination, Jan./Feb. 2023
Operation Research

Time: 3 hrs.   Max. Marks:100

Note: *Answer any FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. Explain phases of OR.   **(05 Marks)**
   b. A Toy company manufactures two types of doll, a basic version – doll A and a deluxe version – doll B. Each doll of type 'B' takes as long as to produce as one of type 'A' and the company would have time to make a maximum of 2000 per day. The supply of plastic insufficient to produce 1500 doll/day (Both A and B combined). A deluxe version requires a fancy dress which is available for only 600 dolls/day. If the company makes a profit of Rs.3/- and Rs.5/- per doll respectively on doll A and doll B. Then, how many of each doll should be produced per day in order to maximize the total profit.
   Formulate the above problem and solve graphically to find the number of each type of dolls to be produced in order to maximize the total profit.   **(15 Marks)**

2 a. Solve below given LPP by Big-M method and find alternate solution, if any.
   Max $z = 6x_1 + 4x_2$
   Subject to constraints,
   $$2x_1 + 3x_2 \leq 30$$
   $$3x_1 + 2x_2 \leq 24$$
   $$x_1 + x_2 \geq 3$$
   $$x_i \geq 0 \text{ where } i = 1, 2$$
                                                                            (10 Marks)
   b. Solve the below given LPP by dual simplex method.
   Min $z = 2x_1 + x_2$
   Subject to constraints,
   $$3x_1 + x_2 \geq 3$$
   $$4x_1 + 3x_2 \geq 6$$
   $$x_1 + 2x_2 \geq 3$$
   $$x_i \geq 0 \text{ where } i = 1, 2$$
                                                                            (10 Marks)

3 a. The transformation cost from 3rd source to 3rd destination is not known. Find the allocation to minimize the transportation cost. Also comment on the solution obtained.

Source \ Destination	D_1	D_2	D_3	Capacity
S_1	2	2	3	10
S_2	4	1	2	15
S_3	1	3	X	40
Requirement	20	15	30	

                                                                            (10 Marks)

b. Solve the below given assignment problem, determine the optimal assignment that minimize the total cost and find alternate solution if any.

Jobs	Machines			
	1	2	3	4
1	2	3	4	5
2	4	5	6	7
3	7	8	9	8
4	3	5	8	4

(10 Marks)

4 Solve the below given integer programming problem :

Maximize $z = 4x_1 + 6x_2 + 2x_3$

Subject to constraints,

$$4x_1 - 4x_2 \leq 5$$
$$-x_1 + 6x_2 \leq 5$$
$$-x_1 + x_2 + x_3 \leq 5$$

$x_1, x_2, x_3 \geq 0$ and x_1, x_3 are integers. (20 Marks)

PART – B

5 a. Define the following :
   (i)   Slackness.
   (ii) Crash time.
   (iii) Critical path. (06 Marks)

b. The below project has 7 activities and their precedence relationship are shown in below table. The time estimates are also given below, find
   (i)   Draw the Network diagram.
   (ii) EST, LST, EFT, LFT and slackness for each activity.
   (iii) Find the critical path.

Activity	Preceeding activity	Optimistic time	Most likely time	Pessimistic time
A	-	4	6	8
B	A	6	10	12
C	A	8	18	24
D	B	9	9	9
E	C	10	14	18
F	A	5	5	5
G	D, EF	8	10	12

(14 Marks)

6 a. Discuss the parameters used to describe the queueing system. (06 Marks)

b. Arrivals at a telephone booth are considered to be Poisson with an average time of 10 minutes between one arrival to the next. The length of a phone call assumed to be distributed exponential with mean 3 minutes then,
   (i)   What is the probability that a person arriving at the booth will have to wait?
   (ii) What is the average length of the queues that form from time to time?
   (iii) The telephone department will install a second booth, when convinced that an arrival would expect to have to wait at least 3 minutes for the phone. By how must the flow of arrival be increased in order to justify a second booth? (14 Marks)

7 a. Explain the characteristics of Game theory. **(05 Marks)**

b. Player 'A' and 'B' plays a game in which each has 3 coins 5 paise, 10 paise and 20 paise. Each player select a coin without the knowledge of other player. If the sum of coins is an odd amount, player A wins player B's coin. If the sum of coins is an even amount, then player B wins player A's coin. Find best strategy for each player and value of game. **(07 Marks)**

c. Solve below game graphically,

		B's strategy	
		I	II
A's strategy	I	1	−3
	II	3	5
	III	−1	6
	IV	4	1

(08 Marks)

8 a. List the assumptions made in sequencing. **(05 Marks)**

b. There are 5 jobs, each of which is to be processed through 3 machines A, B and C in the order A B C. The processing times are given in the Table below. Determine the optimum sequence for 5 jobs and the total elapsed time 'T'. Also, find the Idle time for each machine and waiting time for each jobs.

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

(07 Marks)

c. Use Graphical method to minimize the time required to process the following jobs on machines. For each machine specify the job which should be done first. Also calculate the total elapsed time to complete both jobs.

Job 1	Sequence	A	B	C	D	E
	Time (Hrs)	6	8	4	12	4
Job 2	Sequence	B	C	A	D	E
	Time (Hrs)	10	8	6	4	12

(08 Marks)

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