

**N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI****END-OF-SEMESTER EXAMINATIONS: MAY-2023****COURSE NAME: B.C.A****MAXIMUM MARKS: 70****SEMESTER: IV****TIME: 3 HOURS****PART - III****COMPUTER BASED OPTIMIZATION TECHNIQUES****SECTION - A****(10 X 1 = 10 MARKS)****ANSWER THE FOLLOWING QUESTIONS.****MULTIPLE CHOICE QUESTIONS.****(K1)**

1. A basic solution to the system is called \_\_\_\_\_ if one or more of the basic variables vanish
  - a) Degenerate
  - b) Sample
  - c) Non-Degenerate
  - d) None
2. A necessary and sufficient condition for the existence of a feasible solution to a transportation problem is \_\_\_\_\_.
  - a)  $\sum_{i=1}^m a_i = 0$
  - b)  $\sum_{i=1}^m a_i \neq \sum_{j=1}^n b_j$
  - c)  $\sum_{i=1}^m a_i = \sum_{j=1}^n b_j$
  - d)  $\sum_{i=1}^m b_i = 0$
3. Ordering of raw material for production purposes is known as \_\_\_\_\_.
  - a) Set-up cost
  - b) Ordering cost
  - c) Production cost
  - d) Holding cost
4. In Sequencing problems  $M_{ij}$  and  $X_{ij}$  denotes \_\_\_\_\_.
  - a) Processing time & Idle time
  - b) Idle time & Elapsed time
  - c) Elapsed time & Processing time
  - d) None of these
5. After the network is drawn in a logical sequence while numbering the events, the event numbers should be \_\_\_\_\_.
  - a) Positive
  - b) Negative
  - c) Zero
  - d) Unique

**ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES. (K2)**

6. Define Objective function.
7. What are the different methods of solving Transportation Problems?
8. What are various types of Inventories?
9. Write down the formula for problems with  $n$  jobs and 2 machines.
10. Define Activity.

**SECTION – B** **(5 X 4 = 20 MARKS)****ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K3)**

11. a) Reduce the following L.P problem to the standard form: Determine  $x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$  so as to maximize  $z = 2x_1 + x_2 + 4x_3$  subject to the constraints:  
 $-2x_1 + 4x_2 \leq 4, x_1 + 2x_2 + x_3 \geq 5, 2x_1 + 3x_3 \leq 2.$

**(OR)**

- b) Use Penalty (or Big M ) method to minimize  $z = 4x_1 + 3x_2$  subject to the constraints  
 $2x_1 + x_2 \geq 10, -3x_1 + 2x_2 \leq 6, x_1 + x_2 \geq 6$  where  $x_1 \geq 0$  &  $x_2 \geq 0.$

**(CONTD.....2)**

12.a) Determine an initial basic feasible solution to the following transportation problem using north-west corner rule:

	<b>D<sub>1</sub></b>	<b>D<sub>2</sub></b>	<b>D<sub>3</sub></b>	<b>D<sub>4</sub></b>	<b>Available</b>
<b>O<sub>1</sub></b>	6	4	1	5	14
<b>O<sub>2</sub></b>	8	9	2	7	16
<b>O<sub>3</sub></b>	4	3	6	2	5
<b>Required</b>	6	10	15	4	35

**(OR)**

b) For professors is each capable of teaching any one of four different courses. Class preparation time in hours for different topics varies from professor to professor and is given in the table below. Each professor is assigned only one course. Determine an assignment schedule so as to minimize the total course preparation time for all courses:

Professor/Subject	Linear Programmes	Queueing Theory	Dynamic Programme	Regression Analysis
A	2	10	9	7
B	15	4	14	8
C	13	14	16	11
D	4	15	13	9

13.a) An oil engine manufacturer purchases lubricants at the rate of Rs. 42 per piece from a vendor. The Requirement of these lubricants is 1800 per year. What should be the order quantity per order, if the cost per placement of an order is Rs.16 and inventory carrying charge per rupee per year is only 20 paise?

**(OR)**

b) Find the optimum order quantity for a product for which the price breaks are as follows:

Quantity	Unit Cost (Rs.)
$0 \leq Q_1 < 500$	10.00
$500 \leq Q_2$	9.25

The monthly demand for the product is 200 units, the cost of storage is 2% of the unit cost and the cost of ordering is Rs.350.00

14.a) We have five jobs, each of which must go through the two machines A and B in the order AB. Processing times (in hours) are given in the table below:

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

Determine a sequence for the five jobs that will minimize the elapsed time.

**(OR)**

b) A machine shop has four machines **A, B, C, D**. Two jobs must be processed through each of these machines. The time (in hours) taken on each of the machines and the necessary sequence of jobs thorough the shop are given below:

Job 1	Sequence	A	B	C	D
	Time	2	4	5	1
Job 2	Sequence	D	B	A	C
	Time	6	4	2	3

Use graphic method to obtain the total minimum elapsed time.

**(CONTD.....3)**

15.a) The following table gives the activities of a construction project and duration:

Activity	1-2	1-3	2-3	2-4	3-4	4-5
Duration(Days)	20	25	10	12	6	10

- i) Draw the network for the project.
- ii) Find the critical path.

**(OR)**

b) A mother notes that when her teenaged son uses the telephone, he takes not less than 10 minutes for a call and sometimes as much as one hour. Twenty minute calls are more frequent than calls for any other duration. If son's phone call were an activity in a PERT project:-

- i) What would be the phone call's expected duration?
- ii) What would be its variance?
- iii) In scheduling the project, how much would be allocated for the phone calls?

**SECTION - C**

**(4 X 10 = 40 MARKS)**

**ANSWER ANY FOUR OUT OF SIX QUESTIONS**

**(16<sup>th</sup> QUESTION IS COMPULSORY AND ANSWER ANY THREE QUESTIONS  
(FROM Qn. No: 17 to 21) (K4 (Or) K5)**

16. Obtain the optimum basic feasible solution to the following Transportation problems:

Factory	Warehouse				Factory Capacity
	W1	W2	W3	W4	
<b>F1</b>	<b>19</b>	<b>30</b>	<b>50</b>	<b>10</b>	<b>7</b>
<b>F2</b>	<b>70</b>	<b>30</b>	<b>40</b>	<b>60</b>	<b>9</b>
<b>F3</b>	<b>40</b>	<b>8</b>	<b>70</b>	<b>20</b>	<b>18</b>
<b>Warehouse requirements</b>	<b>5</b>	<b>8</b>	<b>7</b>	<b>14</b>	

17. Obtain all the basic solutions to the following system of linear equation:

$$x_1 + 2x_2 + x_3 = 4$$

$$2x_1 + x_2 + 5x_3 = 5.$$

18. A manufacturing company purchases 9000 parts of a machine for its annual requirements, ordering one month usage at a time. Each part costs Rs.20. The ordering cost per order is Rs.15 and the carrying charges are 15% of the average inventory per year. You have been assigned to suggest a more economical purchasing policy for the company. What advice would you offer and how much would it save the company per year?

19. Solve the following sequencing problem when passing out is not allowed:

Item	Machine(Processing time in hours)			
	A	B	C	D
<b>I</b>	<b>15</b>	<b>5</b>	<b>4</b>	<b>15</b>
<b>II</b>	<b>12</b>	<b>2</b>	<b>10</b>	<b>12</b>
<b>III</b>	<b>16</b>	<b>3</b>	<b>5</b>	<b>16</b>
<b>IV</b>	<b>17</b>	<b>3</b>	<b>4</b>	<b>17</b>

**(CONTD.....4)**

20. A project schedule has the following characteristics:

<b>Activity time</b>	<b>Most Optimistic time</b>	<b>Most likely time</b>	<b>Most pessimistic time</b>
1-2	1	2	3
2-3	1	2	3
2-4	1	3	5
3-5	3	4	5
4-5	2	3	4
4-6	3	5	7
5-7	4	5	6
6-7	6	7	8
7-8	2	4	6
7-9	4	6	8
8-10	1	2	3
9-10	3	5	7

Construct a PERT network and find out

- i) The earliest possible time to complete the different stages of the project.
- ii) The latest allowable time for them
- iii) The critical path

21. Solve the following transportation problem:

<b>From</b>	<b>To</b>			<b>Available</b>
	<b>A</b>	<b>B</b>	<b>C</b>	
<b>I</b>	<b>50</b>	<b>30</b>	<b>220</b>	<b>1</b>
<b>II</b>	<b>90</b>	<b>45</b>	<b>170</b>	<b>3</b>
<b>III</b>	<b>250</b>	<b>200</b>	<b>50</b>	<b>4</b>
<b>Requirements</b>	<b>4</b>	<b>2</b>	<b>2</b>	

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**ETHICAL PAPER**