



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.C.A. DEGREE EXAMINATION – COMPUTER APPLICATIONS

FIRST SEMESTER – NOVEMBER 2022

UCS 1301 – OPERATIONS RESEARCH

Date: 01-12-2022

Dept. No.

Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

SECTION A

Answer ALL the Questions

1. Answer the following. (5 x 1 = 5)	
a)	What is operations research? K1 CO1
b)	List the condition for solving transportation problem. K1 CO1
c)	Define Replacement models. K1 CO1
d)	Define dummy activity. K1 CO1
e)	State the inventory models. K1 CO1
2. Multiple Choice Questions. (5 x 1 = 5)	
a)	Which one is the scope of OR? 1. Finance and accounting 2. Marketing 3. Production 4. All the above K1 CO1
b)	Transportation problem said to be unbalanced when____. 1. Production equal to demand 2. Production not equal to demand 3. Production more than demand 4. Both 2 & 3 K1 CO1
c)	To find the sequence of the jobs which minimizes the total time taken for the completion of the job is called____ 1. Sequencing problem 2. Replacement problem 3. Assignment problem 4. None of the above K1 CO1
d)	_____ is the minimum time taken to complete the project. 1. Optimistic 2. Most likely 3. Pessimistic 4. Good K1 CO1
e)	The period of time between two consecutive placement of orders is called____ 1. Order cycle 2. Lead time 3. Holding cost 4. Production cost K1 CO1
3. True or False. (5 x 1 = 5)	
a)	A set of all values of the variables satisfy all the constraints it is called feasible solution. K2 CO1
b)	Transportation problem deals with the transportation of commodity from different sources to different destinations. K2 CO1

c)	When a machine loses its efficiency gradually the maintenance becomes very expensive.	K2	CO1
d)	CPM expands Critical Path Method.	K2	CO1
e)	Inventory control is not useful to reduce the cost of transportation and storage.	K2	CO1
4.	Match the following.	(5 x 1 = 5)	
a)	Management – 1. North-West corner rule	K2	CO1
b)	Transportation problem – 2. Programme Evaluation and Review Technique	K2	CO1
c)	Sequencing problem – 3. Cost associated with carrying the inventory	K2	CO1
d)	PERT - 4. Scope of OR	K2	CO1
e)	Holding cost - 5. Find the sequence of the jobs	K2	CO1

SECTION B

Answer any TWO of the following in 100 words (2 x 10 = 20)

5.	Solve graphically Maximize $Z = 40x_1 + 100x_2$ subject to the constraints $2x_1 + x_2 \leq 500$ $2x_1 + 5x_2 \leq 1000$ $x_1, x_2 \geq 0$	K3	CO2																														
6.	Obtain an initial basic feasible solution to the following transportation Problem using the north-west corner rule. <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>D</td> <td>E</td> <td>F</td> <td>G</td> <td>Supply</td> </tr> <tr> <td>A</td> <td>11</td> <td>13</td> <td>17</td> <td>14</td> <td>250</td> </tr> <tr> <td>B</td> <td>16</td> <td>18</td> <td>14</td> <td>10</td> <td>300</td> </tr> <tr> <td>C</td> <td>21</td> <td>24</td> <td>13</td> <td>10</td> <td>400</td> </tr> <tr> <td>Demand</td> <td>200</td> <td>225</td> <td>275</td> <td>250</td> <td></td> </tr> </table>		D	E	F	G	Supply	A	11	13	17	14	250	B	16	18	14	10	300	C	21	24	13	10	400	Demand	200	225	275	250		K3	CO2
	D	E	F	G	Supply																												
A	11	13	17	14	250																												
B	16	18	14	10	300																												
C	21	24	13	10	400																												
Demand	200	225	275	250																													
7.	Determine the optimal sequencing to complete the following tasks on two machines. <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td><i>Task</i></td> <td>A</td> <td>B</td> <td>C</td> <td>D</td> <td>E</td> <td>F</td> <td>G</td> <td>H</td> <td>I</td> </tr> <tr> <td><i>Machine 1</i></td> <td>2</td> <td>5</td> <td>4</td> <td>9</td> <td>6</td> <td>8</td> <td>7</td> <td>5</td> <td>4</td> </tr> <tr> <td><i>Machine 2</i></td> <td>6</td> <td>8</td> <td>7</td> <td>4</td> <td>3</td> <td>9</td> <td>3</td> <td>8</td> <td>11</td> </tr> </table>	<i>Task</i>	A	B	C	D	E	F	G	H	I	<i>Machine 1</i>	2	5	4	9	6	8	7	5	4	<i>Machine 2</i>	6	8	7	4	3	9	3	8	11	K3	CO2
<i>Task</i>	A	B	C	D	E	F	G	H	I																								
<i>Machine 1</i>	2	5	4	9	6	8	7	5	4																								
<i>Machine 2</i>	6	8	7	4	3	9	3	8	11																								
8.	Solve the following assignment problem <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>I</td> <td>II</td> <td>III</td> <td>IV</td> </tr> <tr> <td>A</td> <td>10</td> <td>5</td> <td>13</td> <td>15</td> </tr> <tr> <td>B</td> <td>3</td> <td>9</td> <td>18</td> <td>3</td> </tr> <tr> <td>C</td> <td>10</td> <td>7</td> <td>3</td> <td>2</td> </tr> <tr> <td>D</td> <td>5</td> <td>11</td> <td>9</td> <td>7</td> </tr> </table>		I	II	III	IV	A	10	5	13	15	B	3	9	18	3	C	10	7	3	2	D	5	11	9	7	K3	CO2					
	I	II	III	IV																													
A	10	5	13	15																													
B	3	9	18	3																													
C	10	7	3	2																													
D	5	11	9	7																													

SECTION C

Answer any TWO of the following in 100 words

(2 x 10 = 20)

9.	<p>A machine costs Rs. 12,200. The scrap value is Rs.200. The maintenance costs of the machine are given below:</p> <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <thead> <tr> <th style="width: 10%;">Year</th> <th style="width: 10%;">1</th> <th style="width: 10%;">2</th> <th style="width: 10%;">3</th> <th style="width: 10%;">4</th> <th style="width: 10%;">5</th> <th style="width: 10%;">6</th> <th style="width: 10%;">7</th> <th style="width: 10%;">8</th> </tr> </thead> <tbody> <tr> <td>Maintenance cost</td> <td style="text-align: center;">200</td> <td style="text-align: center;">500</td> <td style="text-align: center;">800</td> <td style="text-align: center;">1200</td> <td style="text-align: center;">1800</td> <td style="text-align: center;">2500</td> <td style="text-align: center;">3200</td> <td style="text-align: center;">4000</td> </tr> </tbody> </table> <p>When should the machine be replaced?</p>	Year	1	2	3	4	5	6	7	8	Maintenance cost	200	500	800	1200	1800	2500	3200	4000	K4	CO3
Year	1	2	3	4	5	6	7	8													
Maintenance cost	200	500	800	1200	1800	2500	3200	4000													

10.	<p>A marketing manager has 5 salesmen and 5 sales districts. Considering the capabilities of the salesman and the nature of districts, the marketing manager estimates that sales per month (in hundred rupees) for each salesman in each district would be as follows:</p> <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <thead> <tr> <th rowspan="2" style="width: 15%;">Salesman</th> <th colspan="5" style="text-align: center;">Sales District</th> </tr> <tr> <th style="width: 10%;">A</th> <th style="width: 10%;">B</th> <th style="width: 10%;">C</th> <th style="width: 10%;">D</th> <th style="width: 10%;">E</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">32</td> <td style="text-align: center;">38</td> <td style="text-align: center;">40</td> <td style="text-align: center;">28</td> <td style="text-align: center;">40</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">40</td> <td style="text-align: center;">24</td> <td style="text-align: center;">28</td> <td style="text-align: center;">21</td> <td style="text-align: center;">36</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">41</td> <td style="text-align: center;">27</td> <td style="text-align: center;">33</td> <td style="text-align: center;">30</td> <td style="text-align: center;">37</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">22</td> <td style="text-align: center;">38</td> <td style="text-align: center;">41</td> <td style="text-align: center;">36</td> <td style="text-align: center;">36</td> </tr> <tr> <td style="text-align: center;">5</td> <td style="text-align: center;">29</td> <td style="text-align: center;">33</td> <td style="text-align: center;">40</td> <td style="text-align: center;">35</td> <td style="text-align: center;">39</td> </tr> </tbody> </table> <p>What is the maximum sale that may be expected if an optimum assignment is made?</p>	Salesman	Sales District					A	B	C	D	E	1	32	38	40	28	40	2	40	24	28	21	36	3	41	27	33	30	37	4	22	38	41	36	36	5	29	33	40	35	39	K4	CO3
Salesman	Sales District																																											
	A	B	C	D	E																																							
1	32	38	40	28	40																																							
2	40	24	28	21	36																																							
3	41	27	33	30	37																																							
4	22	38	41	36	36																																							
5	29	33	40	35	39																																							

11.	<p>The annual demand for an item is 3200 units. The unit cost is Rs.6. The inventory carrying cost is 25% per annum per unit. The cost of one procurement is Rs.150.</p> <p>Determine</p> <ul style="list-style-type: none"> (i) EOQ (ii) Number of orders per year (iii) Time between two consecutive orders (iv) Total annual cost 	K4	CO3
-----	--	----	-----

12.	<p>A small Project consisting of 12 activities have the following information regarding duration of the various activities.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <thead> <tr> <th style="width: 10%;">Operations</th> <th style="width: 5%;">0,1</th> <th style="width: 5%;">0,2</th> <th style="width: 5%;">0,3</th> <th style="width: 5%;">1,4</th> <th style="width: 5%;">2,3</th> <th style="width: 5%;">2,6</th> <th style="width: 5%;">3,4</th> <th style="width: 5%;">3,5</th> <th style="width: 5%;">4,7</th> <th style="width: 5%;">5,6</th> <th style="width: 5%;">5,7</th> <th style="width: 5%;">6,7</th> </tr> </thead> <tbody> <tr> <td>Durations</td> <td style="text-align: center;">5</td> <td style="text-align: center;">8</td> <td style="text-align: center;">3</td> <td style="text-align: center;">4</td> <td style="text-align: center;">0</td> <td style="text-align: center;">7</td> <td style="text-align: center;">4</td> <td style="text-align: center;">6</td> <td style="text-align: center;">6</td> <td style="text-align: center;">7</td> <td style="text-align: center;">2</td> <td style="text-align: center;">6</td> </tr> </tbody> </table> <ul style="list-style-type: none"> (i) Draw the CPM Network (ii) Find the critical path. (iii) Calculate Earliest Start Time, Earliest Finish Time, Latest Start Time, Latest Finish Time and Total Float. 	Operations	0,1	0,2	0,3	1,4	2,3	2,6	3,4	3,5	4,7	5,6	5,7	6,7	Durations	5	8	3	4	0	7	4	6	6	7	2	6	K4	CO3
Operations	0,1	0,2	0,3	1,4	2,3	2,6	3,4	3,5	4,7	5,6	5,7	6,7																	
Durations	5	8	3	4	0	7	4	6	6	7	2	6																	

SECTION D

Answer any ONE of the following in 250 words

(1 x 20 = 20)

13.	Solve by simplex method Maximize $Z = x_1 - x_2 + 3x_3$ subject to the constraints $x_1 + x_2 + x_3 \leq 10$ $2x_1 - x_3 \leq 3$ $2x_1 - 2x_2 + 3x_3 \leq 0 \quad x_1, x_2, x_3 \geq 0$	K5	CO4																																										
14.	A steel firm has 4 plants which purchase coal for their production from 3 mines. The cost of shipping (in 100's of RS.) one ton of coal from each mine to each plant are given below: <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th colspan="6">Plants</th> <th>Capacity</th> </tr> <tr> <th></th> <th>P1</th> <th>P2</th> <th>P3</th> <th>P4</th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <th>Mines</th> <td>M1</td> <td>3</td> <td>1</td> <td>4</td> <td>5</td> <td>50</td> </tr> <tr> <td></td> <td>M2</td> <td>7</td> <td>3</td> <td>8</td> <td>6</td> <td>50</td> </tr> <tr> <td></td> <td>M3</td> <td>2</td> <td>3</td> <td>9</td> <td>2</td> <td>75</td> </tr> <tr> <th>Demand</th> <td></td> <td>40</td> <td>55</td> <td>60</td> <td>20</td> <td></td> </tr> </tbody> </table> How much coal should the firm purchase from each mine in order to satisfy the demand of the plants at minimal shipping expenses.(Using Matrix minimum method)	Plants						Capacity		P1	P2	P3	P4			Mines	M1	3	1	4	5	50		M2	7	3	8	6	50		M3	2	3	9	2	75	Demand		40	55	60	20		K5	CO4
Plants						Capacity																																							
	P1	P2	P3	P4																																									
Mines	M1	3	1	4	5	50																																							
	M2	7	3	8	6	50																																							
	M3	2	3	9	2	75																																							
Demand		40	55	60	20																																								

SECTION E

Answer any ONE of the following in 250 words

(1 x 20 = 20)

15.	Determine the sequence which minimizes the total time for processing five jobs on three machines A, B and C. The following table gives the processing times. <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Job</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> </tr> </thead> <tbody> <tr> <td><i>Machine A</i></td> <td>8</td> <td>10</td> <td>6</td> <td>7</td> <td>11</td> </tr> <tr> <td><i>Machine B</i></td> <td>5</td> <td>6</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td><i>Machine C</i></td> <td>4</td> <td>9</td> <td>8</td> <td>6</td> <td>5</td> </tr> </tbody> </table>	Job	1	2	3	4	5	<i>Machine A</i>	8	10	6	7	11	<i>Machine B</i>	5	6	2	3	4	<i>Machine C</i>	4	9	8	6	5	K6	CO5																
Job	1	2	3	4	5																																						
<i>Machine A</i>	8	10	6	7	11																																						
<i>Machine B</i>	5	6	2	3	4																																						
<i>Machine C</i>	4	9	8	6	5																																						
16.	Given the following information: <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Activity</th> <th>a</th> <th>m</th> <th>b</th> </tr> </thead> <tbody> <tr><td>1-2</td><td>3</td><td>6</td><td>15</td></tr> <tr><td>1-6</td><td>2</td><td>5</td><td>14</td></tr> <tr><td>2-3</td><td>6</td><td>12</td><td>30</td></tr> <tr><td>2-4</td><td>2</td><td>5</td><td>8</td></tr> <tr><td>3-5</td><td>5</td><td>11</td><td>17</td></tr> <tr><td>4-5</td><td>3</td><td>6</td><td>15</td></tr> <tr><td>6-7</td><td>3</td><td>9</td><td>27</td></tr> <tr><td>5-8</td><td>1</td><td>4</td><td>7</td></tr> <tr><td>7-8</td><td>4</td><td>19</td><td>28</td></tr> </tbody> </table> <p style="margin-top: 10px;"> i) Draw the Project Network ii) Find the length and variance of each activity. iii) Find the critical path. iv) Find the length and variance of the critical path. </p>	Activity	a	m	b	1-2	3	6	15	1-6	2	5	14	2-3	6	12	30	2-4	2	5	8	3-5	5	11	17	4-5	3	6	15	6-7	3	9	27	5-8	1	4	7	7-8	4	19	28	K6	CO5
Activity	a	m	b																																								
1-2	3	6	15																																								
1-6	2	5	14																																								
2-3	6	12	30																																								
2-4	2	5	8																																								
3-5	5	11	17																																								
4-5	3	6	15																																								
6-7	3	9	27																																								
5-8	1	4	7																																								
7-8	4	19	28																																								
