



**NAVRACHANA
UNIVERSITY**

a UGC recognized University

School: School of Engineering and Technology
Program/s: B.Tech Mechanical
Year: 3 **Semester:** 6
Examination: End Semester Examination
Examination year: May 2023

Course Code: ME 312 **Course Name:** Industrial Engineering and Operations Research
Date: 18/05/2023 **Total Marks:** 40
Time: 2:00 am to 4:00 pm **Total Pages:** 3

Instructions:

- Write each answer on a new page.
- Use of a calculator is permitted/not permitted.

Q. No	Details	Marks	COs*	BTL #																																																																						
Q. 1	<p>For a LPP following simplex table has been obtained after performing one iteration. Is the given solution optimal? If no, find out the optimal solution. Do the multiple optimal solutions exist? If Yes, Find the multiple optimal solutions as well.</p> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th></th> <th>C_j</th> <th>3</th> <th>2</th> <th>5</th> <th>0</th> <th>0</th> <th>0</th> <th></th> <th></th> </tr> <tr> <th>Solution Vector Column</th> <th></th> <th>X_1</th> <th>X_2</th> <th>X_3</th> <th>S_1</th> <th>S_2</th> <th>S_3</th> <th>B_o</th> <th>Minimum Ratio</th> </tr> </thead> <tbody> <tr> <td>$0S_1$</td> <td></td> <td>0</td> <td>4/3</td> <td>0</td> <td>1</td> <td>-1/3</td> <td>0</td> <td>4</td> <td></td> </tr> <tr> <td>$5X_3$</td> <td></td> <td>1/2</td> <td>1/3</td> <td>1</td> <td>0</td> <td>1/6</td> <td>0</td> <td>2</td> <td></td> </tr> <tr> <td>$0S_3$</td> <td></td> <td>0</td> <td>5/3</td> <td>0</td> <td>0</td> <td>-2/3</td> <td>1</td> <td>4</td> <td></td> </tr> <tr> <td>Z_j</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>$C_j - Z_j$</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		C_j	3	2	5	0	0	0			Solution Vector Column		X_1	X_2	X_3	S_1	S_2	S_3	B_o	Minimum Ratio	$0S_1$		0	4/3	0	1	-1/3	0	4		$5X_3$		1/2	1/3	1	0	1/6	0	2		$0S_3$		0	5/3	0	0	-2/3	1	4		Z_j										$C_j - Z_j$										8	CO1	BT1, BT2
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Q. 2	<p>Write the assumptions taken in Wilson's model of inventory control and solve following example. Consider the following data with reference to elementary deterministic economic order quantity model. Annual demand of item: 10000 units, Unit price: 10 Rs, Inventory carrying cost per unit per Year: 1.5 Rs, Cost per order: 30 Rs, Find the total number of economic orders per year to meet the annual demand.</p>	8	CO3	BT1, BT3, BT6																																																																						

Q. 3 Given Below is the basic feasible solution to a transportation problem that minimizes cost of transportation in the standard tabular format.

- Compute the cost corresponding to the present solution.
- Is the given solution optimal?
- Does the alternate solution exist? If Yes, find out.

	A	B	C	Supply		
X	50	4	8	100	150	
Y	12	100	8	11	100	
Z	10	50	6	200	9	250
Demand	50	150	300			

8

C01

BT2,
BT3,
BT4

Q. 4 1. Estimated time T_e and variance of the activities 'V' on the critical path in a PERT new work are given in the following table: (3 Marks)

Activity	T_e (day)	V (day ²)
a	15	4
b	13	4
c	7	1

The probability of completing the project in 38 days is

- 15.6%
- 50.0%
- 81.4%
- 90.0%

2. The precedence relations and duration (in days) of activities of a project network are given in table. Find the total float and free float for activities e and f. (5 Marks)

Activity	Predecessors	Duration(Days)
A	-	2
B	-	4
C	A	2
D	B	3
E	C	2
F	C	4
G	D	6

10

C04

BT2,
BT3,
BT4
BT5

	3. In a project there are three path with same duration. If project needs to be crashed for one day, then how many path to be crashed? Explain your answer. (2 Marks)			
Q. 5	Assume that at bank teller window the customers arrive in their cars at the average rate of twenty per hour according to Poisson distribution. Assume also that the bank teller spends an average of two minutes per customer to complete a service, and the service time is exponentially distributed. Customers who arrive from an infinite population, are served on FCFS basis, and there is no limit to possible queue length. Find out following. A. Utilization factor and probability that there is no customer in system. B. Average waiting time in queue and system. C. Average length of queue and system.	6	CO3 CO4	BT2 BT3 BT5

*****End of Question Paper*****