Name: **Enrolment No:**	**UPES SAP ID:**

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May, 2021

Course: Operation Research **Semester: VIII**
Program: B.Tech – ADE **Time: 3 hours**
Course Code: MECH4008P **Max. Marks: 100**
No. of Pages: 02

Note:

1. The paper consists of 3 sections A, B and C.
2. For Section A, type your answers in the browser directly
3. For Sections B and C, scan and upload your answers.
4. In Section C, Q12 has internal choice.

Section A			
Q1.	(i) Identify the type of the feasible region given by the set of inequalities x - y <= 1 x - y >= 2 where both x and y are positive. a. A triangle b. A rectangle c. An unbounded region d. An empty region (ii) . An assignment problem can be viewed as a special case of transportation problem in which the capacity from each source is and the demand at each destination is . A. 1; 1 B. Infinity; infinity C. 0; 0 D. 1000; 1000 E. -1; -1	**5**	**CO1**
Q2.	i. Which of the following is not the phase of OR methodology? A. Formulating a problem B. Constructing a model C. Establishing controls D. Controlling the environment ii. Hungarian Method is used to solve a. A transportation problem b. A travelling salesman problem c. A LP problem d. Both a & b iii. In Degenerate solution value of objective function.	**5**	**CO2**

	a. increases infinitely b. basic variables are nonzero c. decreases infinitely d. One or more basic variables are zero		
Q3.	True or false a. Linear programming models have an objective function to be maximized but not minimized. b. Linear programming models exhibit linearity among all constraint relationships and the objective function. c. The graphical approach to the solution of linear programming problems is a very efficient means of solving problems. d. Slack variables are only associated with maximization problems. e. Surplus variables are only associated with minimization problems.	**5**	**CO1**
Q4.	a. The optimal solution to a linear programming model always occurs at a (an) ________ point of the feasible region. b. Multiple optimal solutions can occur when the objective function line is __________ to a constraint line. c. In phase 1 of two phase method we remove ___________ from the basic matrix. d. The net cost of shipping one unit on a route not used in the current transportation problem solution is called the ________. e. A game is said be _______ if lower and upper values of the game are same as well as zero	**5**	**CO1**
Q5.	Explain the steps involved in critical path method.	**5**	**CO4**
Q6.	Briefly describe the steps for solving a transportation problem.	**5**	**CO3**
	Section B		
Q7.	Solve using simplex method: Maximize Z = $40x_1 + 80x_2$ Subject to the constraints $2x_1 + 3x_2 \leq 48$ $x_1 \leq 15$ $x_2 < 10$ $x_1 - x_2 > 0$	**10**	**CO1**
Q8	Tata manufactures Cars two factories, one in Pune and one in Jamshedpur. The Pune factory can produce as many as 150 Cars per days, and the Jamshedpur factory can produce as many as 200 cars per day. Cars are shipped by air to customers in Delhi and Bombay. The customers in each city require 130 Cars per day. Because of the deregulation of airfares, Tata believes that it may be cheaper to first fly some Cars to Bangalore or Chennai and then fly them to their final destinations. The costs of flying a Car are shown in Table. Tata wants to minimize the total cost of shipping the required Cars to its customers.	**10**	**CO2**

	Bangalore	Chennai	Delhi	Bombay	Supply
Pune	8	13	25	28	150
Jamshedpur	15	12	26	25	200
Bangalore	0	6	16	17	350
Chennai	6	0	14	16	350
Demand	350	350	130	130	

Q9 Table shows a feasible solution to a transportation problem. Is it optimal solution? If not, find an optimal solution using this feasible solution. **10** **CO3**

2 10	3 30	3 40	4	6 20	100
4 20	7	6	5 40	7	60
5	6	3 30	4	3 20	50
4	7 30	8	4 50	8	80
30	60	70	90	40	

Q10 In a service department manned by one server, on an average 8 customers arrive every 5 minutes while the server can serve 10 customers in the same time assuming Poisson distribution for arrival and exponential distribution for service rate. Determine: **10** **CO3**

a) Average number of customers in the system.
b) Average number of customers in the queue.
c) Average time a customer spends in the system.
d) Average time a customer waits before being served

Q11 Consider the following liner programming problem. **10** **CO2**

Minimize $Z = X_1 - X_2$

Subject to
$$X_1 + X_2 \geq 2$$
$$X_1 + 2X_2 \leq 8$$
$$X_1 \geq 0, \quad X_2 \geq 0,$$

Identify the feasible region on a graphical representation of the problem and answer the following question:

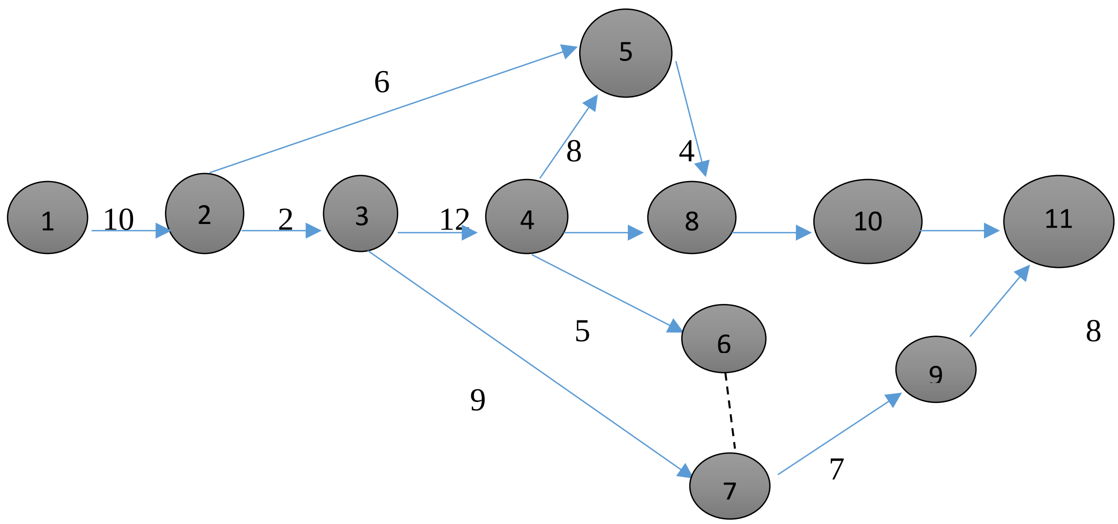
(a) What is the optimal solution
  (i) To the given problem?
  (ii) When the objective function is maximize $Z = X_1 + X_2$?

(iii)When X_1 and X_2 are unrestricted in sign?

(b) How should the first constraint be altered so that a feasible unbounded solution would exist for condition (iii) above for both cases (i) and (ii)?

Section C

Q12	Find the critical path of the following network. Write the earliest, latest times, floats and slacks of each activity and find the critical time.	**20**	**CO4**



OR

Tool Co, a production company, is to undertake its annual maintenance week starting Monday. Most employees would like to avail vacation of during this period since there is little work due to the maintenance. The company since there is little work due to the maintenance. The company also operates on a reduced production mode to meet the demand during the week. The projected number of people required to work in the two shifts for the five days are given in table. The company also decides that the operators work only for four days in the week and decides to have them work for only three consecutive day out of the four days.

How should the available worker be allotted so that the maximum number of people can go on leave on all days of the week? Formulate an LP.

	AM	PM
Monday	10	8
Tuesday	8	9
Wednesday	7	9
Thursday	8	5
Friday	12	10