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UNIVERSITY OF PETROLEUM & ENERGY STUDIES

DEHRADUN

End Semester Examination –Dec 2017

Program/course: B.TECH- Mechanical Engg **Semester – VII**
Subject: OPERATIONS RESEARCH **Max. Marks : 100**
Code : IPEG351 **Duration : 3 Hrs**
No. of page/s: 5

SECTION A

1.

a. 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.

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

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.

b. Solve the given LLP by simplex method and also write important observations.

Maximize $Z = 6X_1 + 8X_2$

Subject to

$$X_1 + X_2 \le 10$$
$$2X_1 + 3X_2 \le 25$$
$$X_1 + 5X_2 \le 35$$
$$X_1, X_2 \ge 0$$

2. Consider the following liner programming problem.

Minimize $Z = X_1 - X_2$

Subject to

$$X_1 + X_2 \ge 2$$
$$X_1 + 2X_2 \le 8$$

$$X_1 \geq 0, \quad X_2 \geq 0,$$

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)?

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

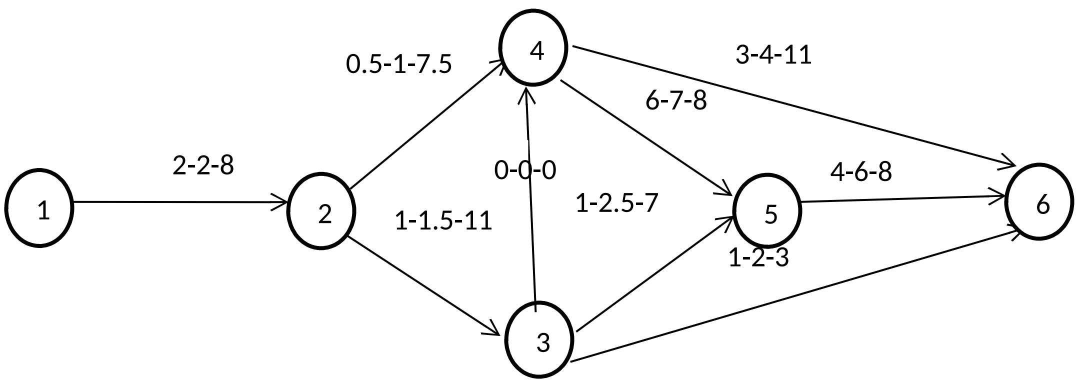
2 (10)	3 (30)	3 (40)	4	6 (20)	100
4 (20)	7	6	5 (40)	7	60
5	6	3 (30)	4	3 (20)	50
4	7 (30)	8	4 (50)	8	80
30	60	70	90	40	

4.

a. Four parts have to be assigned to four machines. All the machines can do all jobs but one job is to be assigned to one machine and one machine should get one job. The time taken by the machines in minutes is given in table. If the parts have to be assembled after machining and assembly takes 10 minutes. Find the earliest time the assembly is completed?

16	9	8	14
12	8	9	13
12	5	4	10
9	10	12	7

b. Consider the network shown in figure. The three time estimates for activities are given along the arrows. Determine the critical path and calculate the floats.



5.

a. Determine the optimal sequence of jobs that minimizes the total elapsed time bases on the following information processing time on machines is given in hours and passing is not allowed:

Job	A	B	C	D	E	F	G
Machine M_1	3	8	7	4	9	8	7
Machine M_2	4	3	2	5	1	4	3
Machine M_3	6	7	5	11	5	6	12

b. Solve the given LLP simplex method.

Maximize $$Z = \frac{3}{4}X_1 - 20X_2 + \frac{1}{2}X_3 - 6X_4$$

Subject to
$$\frac{1}{4}X_1 - 8X_2 - X_3 + 9X_4 \le 0$$
$$\frac{1}{4}X_1 - 12X_2 - \frac{1}{2}X_3 - 3X_4 \le 0$$
$$X_3 \le 0$$
$$X_j \le 0$$

6.

a. A large steel manufacturing company has three options with regard to production: (i) produce commercially (ii) build pilot plat (iii) stop producing steel. The management has estimated that their pilot plant, if built, has 0.8 chance of high yield and 0.2 chance of low yield. If the pilot plant does show a high yield, management assigns a probability of 0.75 that the commercial plant will also have a high yield. If the pilot plant shows a low yield, there is only a 0.1 chance that the commercial plant will show a high yield. Finally, management's best assessment of the yield on a commercial-size plant without building a pilot plant first has a 0.6 chance of high yield. A pilot plant will cost Rs. 3, 00,000. The profits earned under high and low yield conditions are Rs. 1, 20, 00,000 and Rs. 12, 00,000 respectively. Find the optimum decision for the company.

b. Solve the following game by using the principle of dominance.

Player B

Player A		I	II	III	IV	V	VI
	1	4	2	0	2	1	1
	2	4	3	1	3	2	2
	3	4	3	7	−5	1	2
	4	4	3	4	−1	2	2
	5	4	3	3	−2	2	2

<u>SECTION B</u> (Any Two) 20 Marks each

7. A department store wishes to purchase the following quantities of ladies dresses per month:

Dress type	A	B	C	D
Quantity	100	300	200	100

Tenders are submitted by 3 different manufacturers who undertakes to supply not more than the quantities below (all types of dress combined)

Manufacturer	W	X	Y
Quantity	500	600	400

Thee store estimates that its profit per dress will vary with the manufacturer as shown in table. How should orders be placed?

Dress / Manufacturer	A	B	C	D
W	2	3	4	2
X	1	3	3	2
Y	3	4	5	4

8. The automobile company manufactures around 150 scooters. The daily production varies from 146 to 154 depending upon the availability of raw materials and other working conditions:

Production (per day)	146	147	148	149	150	151	152	153	154
Probability	0.04	0.09	0.12	0.14	0.11	0.10	0.20	0.12	0.08

The finished scooters are transported in a specially arranged lorry accommodating 150 scooters. Using following random numbers:

80, 81, 76, 75, 64, 43, 18, 26, 10, 12, 68, 69, 61, 57.

Simulate the process to find out:

(i) What will be the average number of scooters waiting in the factory?

(ii) What will be the average number of empty space on the lorry?

9. A machine operator processes five types of items on his machine each week, and must choose a sequence for them. The set-up cost per change depends on the item presently on the machine and the set-up to be made according to the following table:

From item	To item				
	A	B	C	D	E
A	∞	4	7	3	4
B	4	∞	6	3	4
C	7	6	∞	7	5
D	3	3	7	∞	7
E	4	4	5	7	∞

If he processes each type of item once and only once each week, how should he sequence the item on his machine in order to minimize the total set-up cost?