



COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharashtra.)
SHIVAJI NAGAR, PUNE - 411 005

END Semester Examination

(PE 401) Operations Research TH

Course: B.Tech

Semester: Sem VII

Year: 2014-2015

Max Marks:60

Duration: 3 Hours Time:- 2 pm to 5 pm

Date:20/11/2014

Instructions:

MIS No.

1. Figures to the right indicate the full marks.
2. Mobile phones and programmable calculators are strictly prohibited.
3. Writing anything on question paper is not allowed.
4. Exchange/Sharing of anything like stationery, calculator is not allowed.
5. Assume suitable data if necessary.
6. Write your MIS Number on Question Paper

Q.1 a) Solve by simplex method – to Maximize

$$Z = 10 x_1 + 20 x_2$$

$$\text{s.t } 5 x_1 + 6 x_2 \leq 30$$

$$3 x_1 + 6 x_2 \leq 36$$

$$2 x_1 + 5 x_2 \leq 20$$

$$x_1, x_2 \geq 0$$

b) Write the dual of the above problem

c) Write the redundant constraint in above problem ? Why ?

OR

Q.1. A company manufacture two types of products A & B which are first processed in the foundry and then sent to machine shop for finishing. The number of man-hours required in each shop for the production of each unit of A & B and the number of man-hours available with firm per week are as follows (table).

Product	Man-hours per piece	
	Foundry	Machine Shop
A	10	4
B	5	8

The profit/unit for A & B is Rs. 30 & Rs. 20/- resp. Use simplex method to decide product mix in order to maximize the profit. 3000 & 2400 man-hours are available in foundry & machine shop. Formulate the dual of the above.

- Q.2 a) The processing time (in minutes) taken by 5 operators to make 5 different products are given below. The effective working hours in a day is 6 hours.

Oper- ators	Products				
	1	2	3	4	5
A	10	12	18	15	09
B	12	10	20	18	10
C	08	09	15	10	08
D	09	08	24	12	12
E	10	15	18	12	10

The profits (Rs) per product for 1, 2, 3, 4 and 5 are 4, 2, 3, 3 and 4 respectively. Find out the allocation of operators to products in order to maximize total profit.

- b) In transportation problem given below the total demand exceeds total supply. If the penalty costs per unit unsatisfied are Rs. 5, 3 and 2 for destinations 1, 2 and 3 respectively.
- Find the optimal distribution and minimum cost of transportation
 - Find the next best solution and corresponding transportation cost

Source	Destinations			Capacity
	D ₁	D ₂	D ₃	
S ₁	5	1	7	60
S ₂	6	4	6	340
S ₃	3	2	5	80
Demand	320	100	220	

- Q.3 a) Derive an expression for EOQ ? 3
- b) A machine operator has to perform two operations, turning & threading on number of different jobs. The time required to perform these operations (minutes) is as follows 3

Job	1	2	3	4	5	6
Time for turning	3	12	5	2	9	11
Time for threading	8	10	9	6	3	1

Determine the order in which the jobs should be processes in order to minimise the total time required to complete all jobs.

- b) Find EOQ with following data: 4

Quantity	Unit cost (Rs.)
$0 < Q < 500$	10/-
$500 \leq Q < 750$	9.25/-
$750 \leq Q$	8.75/-

The monthly demand for product is 200 units, cost of ordering is Rs. 100/- & storage cost is 2% of unit cost.

- Q.4 a) State the advantages & limitations of simulation techniques 2

- b) Jobs in a job shop are being processed in two centers A and B. Jobs would first go through A and after processing it would go to centre B. The probability distribution for the time taken for a job, in each centre is given below:

Centre A		Centre B	
Process Time (in mins)	Prob.	Process Time (in mins)	Prob.
10	0.2	8	0.3
11	0.3	9	0.4
12	0.4	10	0.3
13	0.1	-	-

Determine how many number of jobs could be processed in the shop per day of 8 hours shift, by simulation.

Use Random No.'s

- i) For Centre A: 49, 83, 11, 19 & 97
- ii) For Centre B: 74, 27, 61, 50 & 8

- c) There are 10,000 bulbs in a decorative set. When any bulb fails, it is replaced. The cost of replacing a bulb individually is Rs. 1 only. If all the bulbs are replaced at the same time the cost per bulb would be reduced to Rs. 0.35. The percentage of bulbs surviving at the end of the months is given. Determine the optimal replacement policy

t	0	1	2	3	4	5	6
% of bulbs Surviving	100	97	90	70	30	15	0

- Q.5 a) Derive an expression for Minimum Cost Service Rate in queuing theory.

- b) A typist at an office of a company receives on the average 20 letters per day for typing. The typist works 8 hours a day & it takes on the average 20 minutes to type a letter.

- i) What is the typist's utilization rate ?
- ii) What is the average number of letters waiting to be typed ?
- iii) What is the average waiting time needed to have a letter typed ?

- c) Solve the following game by Graphical Method.

$$\begin{bmatrix} -5 & 5 & 0 & -1 & 8 \\ 8 & -4 & -1 & 6 & -5 \end{bmatrix}$$

- Q.6 a) A small project is composed of seven activities whose time estimates are listed in the table as follows:

Activity	Estimated duration (weeks)		
	Optimistic	Most likely	Pessimistic
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

- i) Draw the project network
- ii) Find the expected project duration & identify critical path

- iii) What is the probability that the project will be completed 4 weeks later than expected ?
- iv) What is the expected duration for 75 % chance of project completion ?

b) Explain Fulkerson's rules for numbering the events with suitable network.

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Given:

Z	-0.5	-0.67	-1.00	-1.33	-2.00
P	0.3085	0.025	0.1587	0.0918	0.028