

2023
B.E. (Mechanical Engineering)
Eighth Semester
MEC-802: Operation Research

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 (Section-A) which is compulsory and selecting two questions each from Section B-C.

x-x-x

Section - A

1. (a) What do you understand by static and dynamic models? Give example of each. 2*5=10
(b) When does degeneracy happen in transportation problem?
(c) What are artificial variables? Why do we need them?
(d) What is the utility of duality in an LP model? Explain by taking a suitable example.
(e) What are the various assumptions underlying the 'expected time' estimate in PERT?

Section B

2. (a) Discuss in detail methodology of operation research. 5
(b) Old hens can be bought for Re 2 each but young ones cost Re 5 each. The old hens lay 3 eggs per week and young ones 5 eggs per week, each egg being worth 30 paise. A hen costs Re 1 per week to feed. If a person has only Rs. 80 to spend on hens, how many of each kind should he buy to get a profit of more than Rs 6 per week assuming that he cannot house more than 20 hens? Formulate the problem as LP problem and find the optimal solution graphically. 5
3. Solve the following LP problem using simplex method: 10
Maximize $Z = 3x_1 + 2x_2$
subject to $2x_1 + x_2 \leq 2,$
 $3x_1 + 4x_2 \geq 12,$
and $x_1 \geq 0, x_2 \geq 0$

4. Use dual simplex method to solve the following LP problem: 10
Minimize $Z = 3x_1 + x_2$
subject to $x_1 + x_2 \geq 1,$
 $2x_1 + 3x_2 \geq 2,$
and $x_1, x_2 \geq 0$

Section C

5. (a) Use Vogel's Approximation method to obtain an initial feasible solution of the following transportation problem. 5

	W_1	W_2	W_3	W_4	W_5	Supply
F_1	4	2	3	2	6	8
F_2	5	4	5	2	1	12
F_3	6	5	4	7	7	14
Demand	4	4	6	8	8	

(2)

- (b) A salesman has to visit five cities 1, 2, 3, 4 and 5. He does not want to visit any city twice before completing the tour of all the cities and wishes to return to his home city, the starting station. Distance (in hundred kilometers) between the five cities is given in table. Select the route that will result in minimization of distance travelled by the salesman.

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		To city				
		1	2	3	4	5
From city	1	---	3	6	2	3
	2	3	---	5	2	3
	3	6	5	---	6	4
	4	2	2	6	--	6
	5	3	3	4	6	--

6. (a) In a bank, cheques are cashed at a single 'teller' counter. Customers arrive at the counter according to Poisson distribution with average rate of 30 customers per hour. The teller takes, on an average, a minute and a half to cash a cheque. If the service time is exponentially distributed, calculate the following:

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- (i) Percentage of time the teller is busy.
- (ii) Average time a customer is expected to wait.

- (b) A company has four machines that are to be used for three jobs. Each job can be assigned to one and only one machine. The cost of each job on each machine is given in the following table:

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	M_1	M_2	M_3	M_4
J_1	18	24	28	32
J_2	8	13	17	18
J_3	10	15	19	22

Determine the job-assignment pairs that shall minimize the cost.

7. Prepare the network diagram of the activities associated with the project and thence find out the following:

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- (i) Critical path and its length.
- (ii) Total float and free float for each non-critical activity.

Activity	A	B	C	D	E	F	G	H	I
Duration(weeks)	5	7	2	3	1	2	1	3	10
Immediate Predecessor	--	A	B	B	C	D	C	E,F	G,H