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QUESTION BANK (DESCRIPTIVE)

Subject with Code : OPERATIONS RESARCH (16ME324) **Course & Branch**: B.Tech - ME
Year & Semester: IV-B.Tech & I-Semester **Regulation:** R16

UNIT –I
INTRODUCTION TO OR AND LINEAR PROGRAMMING

1. Solve the following LPP Minimize $Z= X_1- 3X_2+3X_3$ **L3 CO1 12M**
   Subjected to $3X_1-X_2+2X_3 \leq 7$, $2X_1+_{4X2} \geq -12$,$-4X_1+3X_2+8X_3 \leq 10$ and $X_1,X_2, X_3 \geq 0$
2. Solve the following LPP **L3 CO1 12M**
   Maximize $Z=3X_1+5X_2+4X_3$,
   Subjected To: $2X_1+3X_2 \leq 8$, $2X_2+5X_3 \leq 10$, $3X_1+2X_2+4X_3 \leq 15$ and $X_1,X_2,X_3 \geq 0$
3. Solve the following Problem by Graphical method **L3 CO1 12M**
   Maximize $Z = 6X_1 + 10X_2$,
   Subjected to $X_1+X_2 \leq 70$, $X_1 \leq 40$, $X_2 \geq 20$, $2X_1 +3X_2 \leq 300$.
4. Solve the following by using Big-M **L3 CO1 12M**
   method Maximize $Z = 2X_1+3X_2+4X_3$,
   Subjected to $3X_1+X_2+4X_3 \leq 600$, $2X_1+4X_2+2X_3 \geq 480$,
   $2X_1+3X_2+3X_3 = 540$ and X_1 , X_2 ,$X_3 \geq 0$
5. Solve the following LPP by Dual Simplex method **L3 CO1 12M**
   Minimize $Z = X_1+ 2X_2+3X_3$,
   Subjected to $2X_1-X_2+X_3 \geq 4$, $X_1+X_2+2X_3 \leq 8$, $X_2-X_3 \geq 2$ and X_1, X_2 & $X_3 \geq 0$
6. Solve the following Degeneracy in simplex method **L3 CO1 12 M**
   Maximize $3X_1 + 9X_2$,
   Subjected to $X_1 +4X_2 \leq 8$, $X_1 + 2X_2 \leq 4$, X_1, $X_2 \geq 0$
7. Solve the following Dual problem by using Simplex Method **L3 CO1 12 M**
   Minimize $Z = 25\ X_1 + 10\ X_2$,
   Subjected to $X_1 + X_2 = 50$ $X_1>20$, $X_2 <40$, X_1, $X_2 \geq 0$

8. A person requires at least 10 and 12 units of chemicals A and B respectively, for his garden. A liquid product contains 5 and 2 units of A and B respectively per bottle. A dry product contains 1 and 4 units of A and B respectively per box. If the liquid product sales for Rs. 30 per bottle, dry product sales for Rs. 40 per box. How many of each should be purchased in order to minimize the cost and meet the requirements? Formulate the L.P.P. **L1 L6 CO1 12 M**

9. Solve the following problem by using Big-M-method **L3 CO1 12 M**

Maximize $z = X_1+2X_2+3X_3-X_4$,

subjected to : $X_1+2X_2+3X_3=15$,

$2X_1+X_2+5X_3=20$, $X_1+2X_2+X_3+X_4= 10$ and $x_1, x_2, x_3, x_4 \geq 0$

10 A. Define operations research. How OR is useful for decision makers **L1 CO1 4M**

B. Discuss the importance model in the solution of OR problems **L6 CO1 4M**

C. What are the limitations of linear programming technique **L1 CO1 4M**

UNIT-II
TRANSPORTAION PROBLEM AND ASSIGNMENT PROBLEM

1. Determine the basic Feasible solution to the following Transportation problem using NWC ,VCM and VAM **L5 CO2 12M**

	A	B	C	D	E	SUPPLY
P	2	11	10	3	7	4
Q	1	4	7	2	1	8
R	3	9	4	8	12	9
DEMAND	3	3	4	5	6	

2. Solve the following transportation problem **L3 L5 CO2 12M**

	A	B	C	D	AVAILABLE
P	4	6	8	13	**50**
Q	13	11	10	8	**70**
R	14	4	10	13	**30**
S	9	11	13	8	**50**
REQUIRED	**25**	**35**	**105**	**20**	

Determine the Shipping scheme by the Northwest corner Rule and Test the above solution for Optimality

3. Solve the following transportation problem to maximize profit **L3 CO2 12M**

	A	B	C	D	SUPPLY
P	40	25	22	23	**100**
Q	44	35	30	30	**30**
R	38	38	28	30	**70**
DEMAND	**40**	**20**	**60**	**30**	

4. A as salesman has visits of Five cities A,B,C,D and E the distance between the five cities is as Follows. If the salesman starts from city A and has to come back to his starting point, which route is should be select So that the total distance travelled in minimum.

L6 CO2 12M

	A	B	C	D	E
A	-	7	6	8	4
B	7	-	8	5	6
C	6	8	-	9	7
D	8	5	9	-	8
E	4	6	7	8	-

5. A department has 5 employees and five jobs are to be performed. The time each man will take to perform each job is given in the following table below. How the job should be Allocated one per employee, so as to minimize the total man-hours. **L1 CO2 12M**

MACHINES / **JOBS**	A	B	C	D	E
1	9	3	10	13	4
2	8	17	13	20	5
3	5	14	8	11	6
4	11	13	9	12	3
5	12	8	14	16	7

6. Find the minimum transportation cost for the following data **L1 L6 CO2 12M**

		A	B	C	D	E	F	Available
Factory	**1**	9	12	9	6	9	10	5
	2	7	3	7	7	5	5	6
	3	6	5	9	11	3	11	2
	4	6	8	11	2	2	10	9
	Requirement	4	4	6	2	4	2	

7. There are three parties who supply the following quantities ofcoal and three consumers who require the coal as follows Find the minimum transportation cost **L1 L6 CO2 12M**

Party 1:	14 tons	consumer A :	6 tons
Party 2:	12 tons	consumer B :	10 tons
Party 3:	5 tons	consumer C :	15 tons

The cost Matrix is as shown below

	A	B	C
1	6	8	4
2	4	9	3
3	1	2	6

8 The processing time in hours for the jobs when allocated to the different machines is indicated below. Assign the machines for the jobs so that the total processing time inmin. **L3 CO2 12M**

MACHINES

JOBS

	1	**2**	**3**	**4**	**5**
1	9	22	58	11	19
2	43	78	72	50	63
3	41	28	91	37	45
4	74	42	29	49	39
5	36	11	57	22	25

9. Consider the problem of assigning five operators to five machines. The assignment costs are given in following Table **L1 L3 CO2 12M**

	M 1	M 2	M 3	M 4	M 5
A	7	7	-	4	8
B	9	6	4	5	6
C	11	5	7	-	5
D	9	4	8	9	4
E	8	7	9	11	11

Operator A cannot be assigned to machine M3 and operator C cannot be assigned to machine M4. Find the optimum assignment schedule

10 A What is transportation problem **L1 CO2 4M**

B What do you mean by balanced transportation problem **L1 CO2 4M**

C What is travelling salesman problem **L1 CO2 4M**

UNIT-III
GAME THEORY AND QUEING THEORY

1. A. Find the saddle point following GAME

Player A	Payer B					
		I	II	III	IV	V
	I	9	3	1	8	0
	II	6	5	4	6	7
	III	2	4	4	3	8
	IV	5	6	2	2	1

L1 CO3 6M

B. Find the optimal strategy of following GAME

Player A	Payer B			
		I	II	III
	I	-3	-2	6
	II	2	0	2
	III	5	-2	-4

L1 CO3 6M

2. A Find the saddle point following GAME

Player A	Payer B			
		B_1	B_2	B_3
	A_1	-3	-1	6
	A_2	2	0	2
	A_3	5	-2	-4

L1 CO3 6M

B Solve the following (2x4) GAME

Player A	Payer B				
		B_1	B_2	B_3	B_4
	A_1	2	2	3	-1
	A_2	4	3	2	6

L3 CO3 6M

3. Solve the following GAME, using the Dominance Principle

L3 CO3 12M

FirmA	Firm B				
	4	6	5	10	6
	7	8	5	9	10
	8	9	11	10	9
	6	4	10	6	4

4. A. Solve the following GAME Graphically

L3 CO3 6M

Player B	Payer A			
		I	II	III	IV
	I	2	2	3	-2
	II	4	3	2	6

B. Find the saddle point following GAME **L1 L3 CO3 6M**

Player A	Payer B					
		I	II	III	IV	V
	I	9	3	1	8	0
	II	6	5	4	6	7
	III	2	4	4	3	8
	IV	5	6	2	2	1

5. Solve the following game, using the Dominance Principle. **L3 CO3 12M**

FirmA	Firm B					
	B1	B2	B3	B4	B5	B6
A1	4	2	0	2	1	1
A2	4	3	1	3	2	2
A3	4	3	7	-5	1	2
A4	4	3	4	-1	2	2
A5	4	3	3	-2	2	2

6. Consider a self-service store with one cashier. Assume Poisson arrivals and exponential service times. Suppose that 9 customers arrive on the average every 5 minutes and the cashier can serve 10 in 5 minutes, Find **a)** Average number of customers queuing for service **b)** Probability of having more than 10 customers in the system. **c)** Probability that a customer hasto queue for more than 2 minutes **L1 L3 CO3 12M**

7. In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day, assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average of 36 minutes. Calculate a).Expected queue size b).Probability that the queue size exceeds 10. If the input of trains increases to an average of 33 per day what will be the change in (a) and (b). **L3 L5 CO3 12M**

8. A. Define server, arrival rate, queue, service rate and infinite queue. **L1 CO3 4M**

B. A telephone company is planning to install telephone booths in a new airport. It has established the policy that a person should not have to work more than 10% of the times to use a phone. The demand for use is estimated to be person with an average of 30 per hour. The average phone call has an exponential distribution with a mean time of 5 minutes. How many phone booths should be installed? **L1 L3 CO3 8M**

9. A. State briefly the applications ofqueuing models. **L1 CO3 4M**

B. In a big textile mill, trucks loaded with raw cotton arrive at a rate of 12 trucks per day. Assuming that the inter arrival time follows an exponential distribution and the service time distribution is also exponential with an average 34 minutes. Determine the following: i) Mean line length II).Probability that the queue size exceeds 12. **L3 L5 CO3 12M**

10 A. What is game theory? What are the various types of games? **L1 CO3 4M**

B What is Queuing Theory and what are the elements of Queuing system? **L1 CO3 4M**

C Explain Pure strategy and Mixed strategy **L2 CO3 4M**

UNIT-IV
SEQUENCING , PERT & CPM

1 Determine the sequence for the jobs and the total elapsed time **L5 CO4 12M**

	A	B	C	D	E	F	G	H	I
Machine1	4	7	6	11	8	10	9	7	6
Machine2	8	10	9	6	5	11	5	10	13

2 Find the sequence that minimizes the total elapsed time required to complete the following tasks on the machines in the order 1 – 2 – 3. Find also the minimum total elapsed time and the ideal times on the machines. **L1 L3 CO4 12M**

		A	B	C	D	E	F	G
Tasks time on Machines	**1**	3	8	7	4	9	8	7
	2	4	3	2	5	1	4	3
	3	6	7	5	11	5	6	12

3 A What is mean by sequencing Problem and Define total elapsed time **L1 CO4 4M**

B Determine the sequence for the jobs and the total elapsed time **L3 CO4 8M**

	A	B	C	D	E	F	G	H	I
Machine1	4	7	6	11	8	10	9	7	6
Machine2	8	10	9	6	5	11	5	10	13

4 . Solve the following sequencing problem of four jobs on six machines

L3 CO4 12M

JOBS	**MACHINES**					
	1	**2**	**3**	**4**	**5**	**6**
1	19	8	8	3	11	24
2	18	6	9	6	9	18
3	12	5	8	5	7	15
4	20	5	3	4	8	11

5 A project has the following schedule. Construct PERT network and compute the total float for each activity. Find critical path with its duration **L1 L3 CO4 12M**

Activity	Time in month	Activity	Time in month	Activity	Time in month
1-2	2	3-6	8	6-9	5
1-3	2	3-7	5	7-8	4
1-4	1	4-6	3	8-9	3
2-5	4	5-8	1		

6. A. List similarities and differences between PERT and CPM **L1 CO4 4M**

B. State the rules for drawing network diagram. **L1 CO4 4M**

C. What is line of balance and Define total elapsed time **L1 CO4 4M**

7 A project has the following schedule. Construct PERT network and compute the total float for each activity. Find critical path and its duration .Also calculate Total Float, Free Float, Construct PERT network and compute the total float for each activity. Find critical path with its duration. **L1 L6 CO4 12M**

Activity	Time in month	Activity	Time in month	Activity	Time in month
1-2	2	3-6	1	6-9	3
1-4	2	4-5	5	7-8	3
1-7	1	4-8	8	8-9	3
2-3	4	5-6	4		

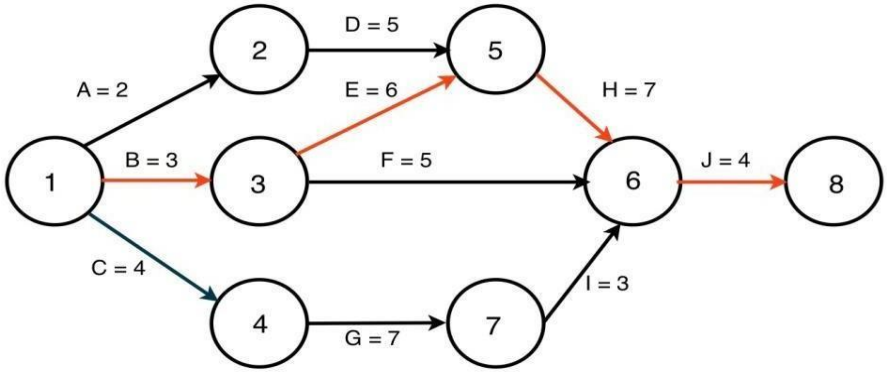
8 A project has the following schedule. Construct PERT network and compute the total float for each activity. Find critical path and its duration .Also calculate Total Float, Free Float **L1 L6 CO4 12M**

Activity	**1-2**	**1-3**	**2-4**	**3-4**	**3-5**	**4-9**	**5-6**
Time in weeks	4	1	1	1	6	5	4
Activity	5-7	6-8	7-8	8-9	8-10	9-10	
Time in weeks	8	1	2	1	8	7	

9 The following table lists the jobs of a network with their estimates
i) Draw the project network ii) Calculate the length and variance of the critical path and iii) What is the approximate probability that the jobs on the critical path will be completed in 41 Days. **L1 L6 CO4 12M**

JOBS	**Optimistic (t_o)**	**Most likely (t_m)**	**Pessimistic (t_p)**
1-2	3	6	15
1-6	2	5	14
2-3	6	12	30
2-4	2	5	8
3-5	5	11	17
4-5	3	6	15
6-7	3	9	27
5-8	1	4	7
7-8	4	19	28

10. Find the critical path and calculate the Total float , Free float **L1 L6 CO4 12M**



UNIT-V
DYNAMIC PROGRAMMING ,INTRODUCTION TO MAINTENACE

1 Bright Metals limited is considering two different investment proposals A &B . The details are as listed below. Suggest the best proposal on basis of NPV method .considering the future discounted at 12%.Also find out IRR of two proposals. **L1 L6 CO5 12M**

		Proposal A	**Proposal B**
Investment Cost		Rs. 9500	Rs.20000
Estimated Income	Year 1	4000	8000
	Year 2	4000	8000
	Year 3	4500	12000

2 A Explain the Bellman's principle of optimality **L2 CO5 6M**

B Describe the various types of replacement situations and Explain about group replacement **L1 CO5 6M**

3 The cost of a machine is Rs6100 and its scrap value is Rs.100.The maintenance costs found From experience are as follows. When should the machine be replaced? **L5 CO5 12M**

Year (n)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Running M/C Cost in Rs	100	250	400	600	900	1200	1600	2000

4 A truck owner from his past records that the maintenance costs per year of a truck whose Purchase price is Rs.8000 are as given below. When should the machine be replaced?

L5 CO5 12M

Year (n)	1	2	3	4	5	6	7	8
Running cost (MC)in Rs.	1000	1300	1700	2000	2900	3800	4800	6000
Resale Price(Rs)	4000	2000	1200	600	500	400	400	400

5 Assume that present value of one rupee to be spent in a years' time is Re.0.90 and C=Rs 6000, Capital cost of equipment .Running costs are given in the table below. When should the machine be replaced? **L5 CO5 12M**

Year (n)	1	2	3	4	5	6	7
Running cost (MC)in Rs.	1000	1200	1600	2000	2600	3200	4000

6 The yearly cost of 2 machines A and B when money value is neglected is as follows.

Year (n)	1	2	3	4	5
Machine A	1800	1200	1400	1600	1000
Machine B	2800	200	1400	1100	600

Find their cost patterns if money values is 10% per year and hence find which machine is most Economical **L1 L5 CO5 12M**

7 A. What is dynamic programming? Explain the advantages and disadvantages of dynamic Programming? **L1 L2 CO5 6M**

B. State the Principle of optimality **L1 CO5 6M**

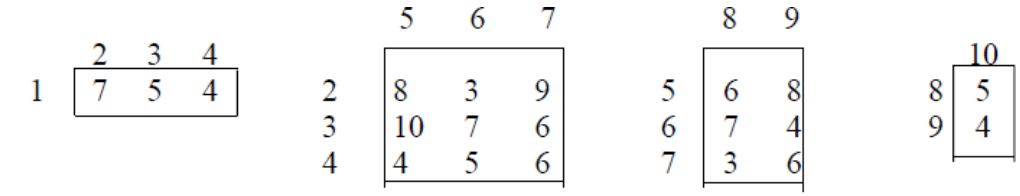
8 A manufacturer, finds from his past records that casts per year associated with a machine with a purchase price of Rs 50,000/- are as given below. Determine the optimum policy

L5 CO5 12M

Year (n)	1	2	3	4	5	6	7	8
Running cost (MC)in Rs.	15000	16000	18000	21000	25000	29000	34000	40000
Scrap value	35000	25000	17000	12000	10000	5000	4000	4000

9 A Discuss a short notes on individual replacement **L6 CO5 4M**

B Draw the network diagram and find the shortest path and distance byusing the dynamic Programming. **L6 CO5 8M**



10 Define

A Group replacement **L1 CO5 3M**

B MAPI method **L1 CO5 3M**

C Failure Trees **L1 CO5 3M**

D Types of simulation models in detail **L1 CO5 3M**