[5670]-538

B.E. (Mechanical)
OPERATION RESEARCH
(2015 Pattern) (Semester-I) (Elective-II) (402045B)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.*

2) *Answers in one answer books.*

3) *Figures to the right indicate full marks.*

4) *Assume suitable data if necessary.*

Q1) a)   Discuss various phases of solving Operation research (OR) Problem.**[4]**

b)   The data refers to the machining whose cost is Rs. 60,000. The other costs are as follows:

Year	1	2	3	4	5
Resale value (Rs.)	42,000	30,000	20,400	14,400	9,650
Cost of Spares (Rs.)	4,000	4,270	4,880	5,700	6,800
Cost of labors (Rs.)	14,000	16,000	18,000	21,000	25,000

[6]

Determine at which time it is profitable to replace the machine.

OR

Q2) A department of company has five employees with five jobs to be performed. The time (in hours) that each man takes to perform each job is given in the effectiveness matrix. How should the jobs be allocated, one per employee so as to minimize the total man-hours? **[10]**

Employees

Jobs		I	II	III	IV	V
	A	10	5	13	15	16
	B	3	9	18	13	6
	C	10	7	2	2	2
	D	7	11	9	7	12
	E	7	9	10	4	12

P.T.O.

Q3) A food products company is contemplating the introduction of a revolutionary new product with new packaging or replacing the existing product at much higher price (S1). It may even make a moderate change in the composition of the existing product, With a new packaging at a small increase in price (S2), or may a small change in the composition of the exisisting product, backing it with the word "New" and a negligible increase in price (S3). The three different possible states of nature or events are high increase in sales (N1), no change in sale (N2) and decrease in sale (N3). The marketing department of the company worked out the payoff's in terms of the yearly net profits for each of the strategies of three events. This is represented in the following table. Which strategy should be concerned executive choose on the basis of

a) Maxi-min criteria,   b) Maxi-max criteria,

c) Mini-max criteria   d) Laplace criteria

Strategies	States of nature		
	N1	N2	N3
S1	7,00,000	3,00,000	1,50,000
S2	5,00,000	4,50,000	0
S3	3,00,000	3,00,000	3,00,000

[10]

OR

Q4) A dairy firm has three plants located in a state. The daily milk production at each plant is as follows :

Plant 1:   6 million liters,

Plant 2:   1 million liters, and

Plant 3:   10 million liters.

Each day, the firm must fulfil the needs of its four distribution centres. The

minimum requirement of each centre is as follows:

Distribution centre 1 : 7 million liters,

Distribution centre 2 : 5 million liters,

Distribution centre 3 : 3 million liters, and Distribution centre 4 : 2 million liters, Cost (in hundreds of rupees) of shipping one million litre from each plant to each distribution centre is given in the following table: **[10]**

Distribution Centre

Plants		D1	D2	D3	D4
	P1	2	3	11	7
	P2	1	0	6	1
	P3	5	8	15	9

Find initial feasible solution for a given problem by using

a) North-west corner rule

b) Least cost method

c) Vogel's approximation method

Q5) a) Explain with the help of neat sketch looping and dangling type of errors in the network. **[4]**

b) A company has decided to modernized its office. The major elements of the project are as follows. **[12]**

Activity	Description	predecessor Activity	Duration(Days)
A	Organize sale office	---	6
B	Hire salesman	A	4
C	Train salesman	B	7
D	Select advertising agency	A	2
E	Plan advertising campaign	D	4
F	Conduct advertising campaign	E	10
G	Design package	---	2
H	Set up packaging facilities	G	10
I	Package initial stocks	J,H	6
J	Order stock from manufacturer	----	13
K	Select distributors	A	9
L	Sell to distributors	C,K	3
M	Ship stocks to distributors	I,L	5

a) Draw an arrow diagram for this project.

b) Find out the critical path

c) For each non-critical activity find out the total and free floats.

OR

Q6) a) For the project
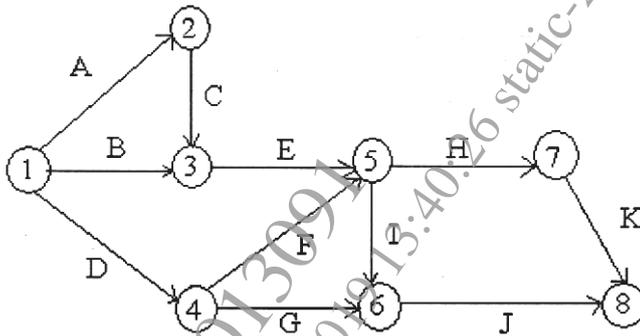
Task :	A	B	C	D	E	F	G	H	I	J	K
Least time:	4	5	8	2	4	6	8	5	3	5	6
Greatest time:	8	10	12	7	10	15	16	9	7	11	13
Most likely time:	5	7	11	3	7	9	12	6	5	8	9

Find the earliest and latest expected time to each event and also critical path in the network. **[10]**

b) Compare and contrast CPM and PERT. Under what conditions would you recommend the scheduling by PERT? Justify your answer with reasons. **[6]**

Q7) a) Six jobs are to be process on three machines. The processing time is as follows, Find the optimal schedule so that the total elapsed time is minimized. **[10]**

Job	A	B	C	D	E	F	G
Machine M1(Min)	3	8	7	4	9	8	7
Machine M2 (Min)	4	3	2	5	1	4	3
Machine M3 (Min)	6	7	5	11	5	6	12

b) Explain with the help of neat sketch a generalised queuing model. Also explain the Kendall's notation for representing queuing models? **[6]**

OR

Q8) a) In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average of 36 minutes. Calculate:
   i) Expected queue size (Line length)
   ii) Probability that the queue size exceeds
   if the input of trains increases to an average of 33 per day. What will be the change in 1 and 2. **[8]**

b) Seven jobs are performed, first on machine X and then on machine Y. The time taken, in hours by each job on each machine is given below: Determine a sequence and the idle time on both the machine. **[8]**

Job	J1	J2	J3	J4	J5	J6	J7
MachineX	20	90	80	20	120	15	65
Machine Y	25	60	75	30	90	35	50

Q9) a) Solve the following integer LP problem using the cutting plane method
Maximize $Z=3X_1+12X_2$ **[12]**
Subject to constrain
i) $2X_1+4X_2 \leq 7$
ii) $5X_1+3X_2 \leq 15$
iii) $X_1, X_2 \geq 0$ and are integers.

b) Explain in brief Branch and Bound method. **[6]**

OR

Q10) a) A company has five salesmen who have to be allocated to four marketing zones. The return (Profit) from each zone depends upon the numbers of salesman working in that zone. The expected return for different numbers of salesman in different zones, as estimated from the past record, are given in the following table. Determine the optimum allocation policy. (Use DP) **[12]**

Number of salesman	Marketing Zones		
	Zone 1	Zone 2	Zone 3
0	30	35	42
1	45	45	54
2	60	52	60
3	70	64	70
4	79	72	82
5	90	82	95
6	98	93	102
7	105	98	110
8	100	100	110
9	90	100	110

b) Explain in brief Dynamic programming (DP) model. **[6]**

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