

B.CHEMICAL ENGINEERING 4 TH YEAR 2 ND SEMESTER EXAMINATION, 2017

OPERATIONS RESEARCH

ANSWER ANY FOUR QUESTIONS

ASSUME MISSING DATA, IF ANY

FULL MARKS: 100

TIME: 3 HOURS

REFERENCE: EX/CHE/T/423A/2017 (old)

1. The Oil India Corporation is considering whether to go for an off-shoring oil drilling contract to be awarded in Bombay High. If they bid, value would be Rs 600 million with a 65% chance of gaining the contract. They may set up a new drilling operation or move already existing operation, which has proved unsuccessful, to the new site. The probability of success and expected returns are as follows:

Outcome	Probability	New Drilling Operation Expected revenue (Rs million)	Existing Operation Expected Revenue (Rs million)	Probability
Success	0.75	800	700	0.85
Failure	0.25	200	350	0.15

If the Corporation do not bid or lose contract they can use the Rs 600 million to modernize their operation. This would result in a return of either 5% or 8% on the sum invested with probabilities 0.45 and 0.55 (Assume that all costs and revenue have discounted to present value)

- i) Construct a decision tree for the problem showing clearly the course of action.
- ii) By applying an appropriate decision criterion recommend whether or not the Oil India Corporation should bid the contract. Use Expected Monetary Value approach.

2. ABC company is engaged in manufacturing 5 brands of packed snacks. It is having the manufacturing setups, each capable of manufacturing any of its brands one at a time. The costs to make a brand on these setups vary according to the following table:

	S ₁	S ₂	S ₃	S ₄	S ₅
B ₁	4	6	7	5	11
B ₂	7	3	6	9	5

B ₃	8	5	4	6	9
B ₄	9	12	7	11	10
B ₅	7	5	9	8	11

Assuming five setups are S_1, S_2, S_3, S_4 and S_5 and five brands are B_1, B_2, B_3, B_4 and B_5 . Find the optimum assignment of products on these setups resulting in the minimum costs.

3. An aircraft uses rivets at an approximately constant rate of 5,000 kg per year. The rivets cost Rs 20 per kg and the company personnel estimate that it costs Rs 200 to place an order, and the carrying cost of inventory is 10% per year (inventory rate). Inventory carrying cost is $I \times C$.

i) How frequently should orders for rivets be placed, and what quantities should be ordered for?

ii) If the actual costs are Rs 500 to place an order and 15% for carrying cost, the optimum policy would change. How much is the company losing per year because of imperfect information?

4. In an election campaign, the strategies adopted by the ruling and opposition party along with pay-offs (ruling party's % share in votes polled) are given below:

Opposition Party's Strategies

Ruling Part's Strategies	Campaign one day in each city	Campaign two days in large towns	Spend two days in large rural sectors
Campaign one day in each city	55	40	35
Campaign two days in large towns	70	70	55
Spend two days in large rural sectors	75	55	65

Assume zero sum game. Using the principal of dominance find the optimum strategies for both parties and expected pay-off to ruling party. Determine the probability of choosing the strategies for both the ruling and the opposition party.

5. A company has three factories at Amethi, Baghpat and Gwalior, and four distribution centres at Allahabad, Bombay, Kolkata and Delhi. With identical cost of production at the three factories the only variable cost involved is transportation cost. The demand at four distribution

centres is 6000 tonnes, 2000 tonnes and 1500 tonnes respectively. The transportation costs per tonne from different factories to different centres are given below:

Factory	Distribution Centres			
	Allahabad	Bombay	Kolkata	Delhi
Amethi	3	2	7	6
Baghpat	7	5	2	3
Gwalior	2	5	4	5

Using Vogel's approximation method suggest the optimum transportation schedule and find the minimum cost of transportation.

6. The Reliable construction company has just made the winning bid of \$5.4 million to construct a new plant for a major manufacturer. The manufacturer needs the plant to go into operation within a year. Therefore, the contract includes the following provisions:

- i) A penalty of \$300,000 if Reliance has not completed construction by the deadline 47 weeks from now.
- ii) To provide additional incentives for speedy construction, a bonus of \$150,000 will be paid to Reliance if the plant is completed within 40 weeks.

Activity	Activity Description	Immediate Predecessor	Estimated Duration (in weeks)
A	Execute	---	2
B	Lay the foundation	A	4
C	Put up the rough wall	B	10
D	Put up the roof	C	6
E	Install exterior plumbing	C	4
F	Install interior plumbing	E	5
G	Put up exterior siding	D	7
H	Do the exterior painting	E,G	9
I	Do the electrical work	C	7
J	Put up the wallboard	E,I	8
K	Install the flooring	J	4

L	Do the interior painting	J	5
M	Install exterior fixtures	H	2
N	Install interior fixtures	K,L	6

- a) Draw the Earliest start/Earliest Finish diagram for the activities of the project
- b) Draw the Latest start/Latest Finish diagram for the activities of the project
- c) Identify the critical path for the project.