

B.E. (Min) Part-III
6th Semester Examination, 2010
Optimization Technique in Mineral Industry
(MN 602)

Time: 3 hours

Full Marks: 70

Use separate answer scripts for each half
Question Nos. 1 & 6 are compulsory
Answer FOUR questions from the rest, taking TWO from each half
Marks are indicated on the right margin of the questions
Students can use Standard Normal Distribution Table

I* Half

1. a) Write the differences between PERT and CPM
 b) Prove that the area covered up by the p.d.f of normal distribution is equal to 1.
 d) Write on the factors on which total inventory cost depends,
 e)' What are the different components of queuing problem?
[4+4+4+3=15]
2. The following table lists the jobs of an opencast project network with their time estimates:

Activities	Immediate Predecessors	Duration (months)		
		Optimistic	Most likely	Pessimistic
A	-	7	16	28
B	A	4	19	25
C	A	10	16	37
D	B	7	13	37
E	B,C	13	19	33
F	B	19	22	33
G	D,E	4	7	19
H	F,G	13	19	49
I	B,C	13	25	37
J	I,H	7	13	19

- a) Construct the project network.
- b) Identify the critical path.
- c) Determine the expected duration of project completion.
- d) What is the project duration within which one can expect to complete the project with 0.9 probability?

[4+1+1+4=10]

A small open cast mining project consists of the jobs in the following table. With each job is listed its normal time and a minimum (crash) time. The cost per week of crashing each job is also given.

Activities	Immediate Predecessors	Normal Duration (weeks)	Crash duration (weeks)	Cost of crashing per week (lakhs Rs.)
A	-	10	6	20
B	-	8	5	25
C	-	14	10	30
D	A	5	3	10
E	C	11	6	15
F	B,D,E	2	1	40

- What is the normal project length and the minimum project length?
- Overhead costs total Rs. 60 lakhs per week. What is the optimum length schedule in terms of both crashing and overhead costs?
- List the scheduled durations of each job for your solution.

[2+6+2=10]

- Define EOQ
- If the ordering cycle length is 4.5 months on the basis of EOQ, determine the rounding off value for the cycle length. Derive necessary expressions.
- Daily demand for roof bolt in an underground mine is 50. Each time an order is placed by the mine store to a supplier, a fixed cost of Rs. 5000 is incurred. The yearly holding cost per roof bolt is Rs. 5. Find out EOQ and ordering interval.

[1+5+4=10]

- Derive the basic queuing parameters for an M/M/1 queue.
- Time study pointed out mat trucks arrive at a shovel at the rate of 5 per hour, whereas the average shovel loading time is 6 min per truck. On the assumptions of Poisson arrival process for trucks and exponential loading time process, estimate the following queue parameters:
 - Average number of trucks at the shovel at a given time.
 - Average waiting period (including the service time).
 - Probability that the shovel is idle.
 - Probability for five trucks to be present at the shovel.

[6+4a=10]

Second half

6. a) Write short notes on followings
 i. Matrix minima method
 ii. Dual problem in LPP
 iii. Opportunity cost matrix
 b) Find the mean and the standard deviation of the uniform distribution (discrete in nature).
 (3x3+4)

7. Solve the following LPP by Simplex Method

Maximize $Z = 60X_1 + 50X_2$
 Subject to $X_1 + 2X_2 < 40$
 $3X_1 + 2X_2 < 60$
 $X_1, X_2 > 0$

(1D)

8. A firm has divided its marketing area into three zones. The amount of sales depends upon the number of salesman in each zone. The firm has been collecting the data regarding sales and salesmen in each area over a number of past years. The information is summarized below. The firm is interested to identify the maximum profit and its allocations in different zones with 7, 8 and 9 salesmen for the next year.

No. of Salesmen	Profit in thousands of rupees		
	Zone-1	Zone-2	Zone-3
0	30	45	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	no

(11)

- 9 a) A and B throw alternatively with a pair of ordinary dice. A wins if he throws 7, before B throws 6 and B wins if he throws 6 before A throws 7- If A begins the game, then show that his chance of winning is 36/61
 b) Find the optimal assignment for a problem with the following cost matrix.

	M ₁	M ₂	M ₃	M ₄	M ₅
J ₁	9	5	3	1	2
J ₂	4	10	6	6	5
J ₃	4	9	10	3	7
J ₄	5	4	2	8	4
J ₅	10	6	9	10	6

(5+6)

b) The mine's sales of each one of

Power plants	W	X	Y	Z
Mines				
A	9	22	10	21
B	15	20	12	8
C	20	12	10	16

Develop the initial basic feasible solution by VAM.

(4+7)