

BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR
B.E. 6TH SEMESTER (MinE) FINAL EXAMINATION – 2012
Optimization Technique in Mineral Industry (MN 602)

Full Marks: 70

Time: 3 hrs

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 are allowed to use Standard Normal Distribution Table

1st Half

1. An opencast project is composed of seven activities whose time estimates are listed in the following table:

<u>Activities</u>	<u>Estimated duration (in weeks)</u>		
	<u>Optimistic</u>	<u>Pessimistic</u>	<u>Most likely</u>
1-2	1	7	1
1-3	1	7	4
1-4	2	8	2
2-5	1	1	1
3-5	2	14	5
4-6	2	8	5
5-6	3	15	6

- a. Draw the project network and identify all paths through it.
 - b. Find the expected duration and variance of each activity.
 - c. What is the expected project length?
 - d. Calculate the variance and standard deviation of project length.
 - e. What is the probability that the project will be completed at least 3 weeks earlier than expected?
 - f. What is the probability that the project will be completed not more than 3 weeks later than expected?
 - g. If the project due date is 18 weeks, what is the probability of not meeting the due date? [2+2+1+2+2+2+2=13]
- 2.
- a. Define and derive EOQ. Find out the expression of total optimal inventory cost.
 - b. A Mining Workshop purchases 9,000 parts of a machine for its annual requirements, ordering one month usage at a time. Each part costs ₹ 20. The ordering cost per order is ₹15 and the carrying charges are 15% of the average inventory. You have been assigned to suggest a more economical purchasing policy for the company. What advice would you offer and how much would it save the company per year? [6+5 =11]
3. A small open cast mining project consists of the jobs in the following table. With each job is listed its normal time (in weeks) and a minimum (crash) time (in weeks). The cost (in lakhs ₹) per week of crashing each job is also given.

Job		Normal Duration (week)	Crash duration (week)	Cost of crashing per week (lakhs ₹)
i	j			
1	2	9	6	20
1	3	8	5	25
1	4	15	10	30
2	4	5	3	10
3	4	10	6	15
4	5	2	1	40

- a. Overhead costs total ₹60 lakhs per week. What is the optimum length schedule in terms of both crashing and overhead costs?
- b. List the scheduled durations of each job for your solution. [9+2=11]

4. A Mining Company has adopted the following policy as per inventory control is concerned at their pit top store:

Item	Annual Demand (Unit)	Cost per Unit (₹/unit)
A	500	4
B	800	8
C	2000	6
D	12000	5
E	16000	2

If the ordering cost is ₹10/order for each item and the inventory running cost is 12% of the average inventory,

- a. suggest the appropriate policy so that the cost can be minimized.
 - b. calculate the % saving through the new policy. [9+2=11]
5. a. Derive the expressions of P_n , L , L_q , W and W_q and $P(\geq k)$ for single server and infinite input source case. The terminologies and notations are indicating the standard ones. [11]

Second half

6. a) Write short notes on followings:

- I. Vogel's Approximation Method
- II. Binomial Distribution

b) Find the mean and the standard deviation of the uniform distribution (discrete in nature).

(4×2+5)

7. a) Three coins are tossed together. Find the probability to get at least one head.

b) In a post office 3 clerks are assigning to process incoming mail. The first clerk B_1 processes 40%, the second clerk B_2 processes 35% and third clerk B_3 processes 25% of the mail. The first clerk has an error rate of 0.04, the second clerk has an error rate of 0.06 and the third clerk is 0.03. A mail selected at random from the days output is found to have an error. The postmaster wishes to know the probability that was processed by first, second and third clerk respectively having an error.

(4+7)

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. For the next year the firm has only nine salesmen and the problem is to allocate these salesmen to three different zones so that the total sales are maximize.

Profit in thousands of rupees

No. of Salesmen	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	110

(11)

9. a) Find the optimal assignment for a problem with the following cost matrix.

	M_1	M_2	M_3	M_4	M_5
J_1	8	4	2	6	1
J_2	7	9	5	5	4
J_3	3	8	9	2	6
J_4	4	3	1	6	3
J_5	9	5	8	9	5

b) What is the necessity for introduction of artificial variable in solving LPP by simplex method?

(7+4)

10. a) **A** & **B** throw alternatively with a pair of dice. **A** wins if he throws 6, before **B** throws 7 and **B** wins if he throws 7 before **A** throws 6. If **A** begins the game then show that his chance of winning is $31/60$

b) Let there are three origins **A**, **B**, **C** which have finished goods form destinations **W**, **X**, **Y**, **Z** which need these goods. Let the number of finished goods in **A**, **B** and **C** be 7, 13 and 11 respectively, which requirements in **W**, **X**, **Y** and **Z** are 6, 10, 6 and 9 respectively. The unit costs of transportation from of each origin to destination are given by the following opportunity cost matrix. Develop the initial basic feasible solution by Vogel's Approximation Method.

	W	X	Y	Z	Goods Available
A	9	22	10	21	7
B	15	20	12	8	13
C	20	12	10	16	11
Goods Required	6	10	6	9	

(5+6)