THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF ENGINEERING TECHNOLOGY
BACHELOR OF INDUSTRIAL STUDIES (Industrial Management)
FINAL EXAMINATION 2008/2009

MEX 4241– OPERATIONAL DECISION MAKING

DATE : 13th of May 2009
TIME : 0930hours – 1230hours
DURATION : 03 Hours

INSTRUCTIONS:

- **Answer any five (05) questions.**
- **All questions carry equal marks.**

1. Maximize the equation, $Z=10X_1 + 15X_2 + 20X_3$

   Subject to

   $$2X_1 + 4X_2 + 6X_3 \leq 24$$
   $$3X_1 + 9X_2 + 6X_3 \leq 30$$
   $$X_1, X_2, X_3 \leq 0$$

   Using simplex method.

2. A municipal council has installed 2000 lamps and the lifetime of the bulbs are normally distributed with a mean of 900 burning hours and a standard deviation of 150 hrs. How many of these bulbs can be expected to fail,
   (a) in the first 600 burning hours
   (b) between 600-1100 burning hours

   After what number of burning hours would you expect that 5% of the bulbs fail and 200 bulbs are still in good condition?

3. Supply, Demand and Transportation costs per unit for a transportation problem are shown in the table below.

Supply origin (Factories)	Demand destination (Warehouse)			Origin availability (Units)
	W1	W2	W3	
F1	90	80	100	1000
F2	20	40	50	1900
F3	40	90	60	1600
Destination Requirement	700	2000	1800	4500

Determine an initial basic feasible solution using North-West corner rule and Matrix-Minima rule. Find an optimal solution using any method you are familiar with.

4. A Mill buys its raw materials from a vendor. The annual demand of the raw material is 9000 units. The ordering cost is Rs 100 per order and the carrying cost is 20% of the purchase price per unit per month where the purchase price per unit is Rs 1. Find the following;

   (a) Economic order quantity
   (b) Total cost
   (c) Number of orders per year
   (d) Time between two consecutive orders

5. A furniture shop stocks deluxe type of tables and tables has a cost of Rs 500 and the holding cost is Rs 200 per year per table. Annual demand is 5000 units and there can be shortages and back orderings. The annual shortage cost is Rs 400 per each table. Find the followings;

   (a) Optimal order quantity
   (b) Allowable shortage level
   (c) Minimal total inventory cost
   (d) Total number of orders per year
   (e) Length of inventory cycle.

6. ABC is a distribution center for hardware material items needed for building construction works. At ABC, trucks loaded with bricks arrive to be unloaded. The manager of the center estimates that trucks arrive at an average rate of 2 trucks per hour following the Poisson distribution and each worker can unload one truck in 2 hours. The manager also knows that each worker who unloads these trucks is paid Rs 20.00 per hour in wages regardless of whether they are busy or idle. The cost of a truck being idle (to wait to unload) is Rs 100.00 per hour. Perform a queuing analysis and economic analysis for this situation assuming a single channel facility.

   $P_0 = [1 - \lambda/\mu]$ Probability that the system is idle
   $L = \lambda/(\mu - \lambda)$ Average number of units in the system
   $W = 1/(\mu - \lambda)$ Average time a unit spends in the system
   $L_q = \lambda^2/\mu(\mu - \lambda)$ Average number of units in the queue
   $W_q = \lambda/\mu(\mu - \lambda)$ Average time a unit spends in the queue
   $P_q = \lambda/\mu$ Probability that an arriving unit has to wait for services
   where λ is arrival rate and μ is service rate.

7. In a bolt manufacturing company, out of the total out-put 25%, 35%, and 40% of the items are produced respectively by machines A, B and C. It is found that the machine A , B and C produce respectively 5%, 4% and 2% defective items in their production. A bolt is selected at random and is found to be defective. Find the probability that the item is manufactured by the machines A, B and C.

ALL RIGHTS RESERVED