THE OPEN UNIVERSITY OF SRI LANAKA
BACHELOR OF MANAGEMENT STUDIES – LEVEL 06
ASSIGNMENT TEST – 2008/2009
OPERATIONS RESEARCH – MCU 4202

DATE: 08/11/2008 **TIME: 10.00 A.M TO 12.00 P.M**

ANSWER ANY FOUR QEUSTIONS

(1) A Service Station has only one Servicing plant and works 09 hours per day. At the service station Vehicles, arrive at the rate of 08 per day. The average time taken to service one vehicle is 45 minutes.

(i) What is the probability that there are two vehicles at the service station
(ii) How many hours will the service station idle per day.
(iii) On the average how many vehicles are there at the service station
(iv) On the average how many vehicles are there waiting to be serviced
(v) How long will a vehicle have to be kept at the service station
(vi) How long will a vehicle have to wait until it is taken for servicing
(vii) What are the assumptions you have made in your calculations.
(viii) It is observed that the rate of arrival of vehicles has suddenly increased to 30 per day. What is the least number of servicing plants required to maintain the service.

(2) A project consist of eight activities A, B, ...H. Whose precedence and durations are given in the table below.

Activity	Precedence	Duration (Days)
A	PROJECT START	2
B	PROJECT START	4
C	AFTER "A"	3
D	AFTER "B"	6
E	AFTER "B"	7
F	AFTER "C" AND "D"	4
G	AFTER " E"	9
H	AFTER " F" AND "G"	5

(i) Construct the Network diagramme
(ii) Time analyse the network and name the critical path
(iii) Find EST, EFT, LFT and LST in respect of each activity

(iv) Activities " D" and "E" use the same resource (R) it is observed that an addition or removal of one unit of (R) from activity "D" would increase or decrease its duration by one day. An addition or removal of one unit of (R) from activity "E" would increase or decrease its duration by two days. What is the earliest project completion time that could be achieved by transferring resource (R) between activities " D" and "E"

(3) M_1, M_2, M_3 and M_4 are four men who could perform any of the four jobs J_1, J_2, J_3 or J_4. The time taken by M_1, M_2, M_3 and M_4 to perform the jobs is explained in the table below.

TIME TAKEN TO PERFORM JOB (DAYS)

MEN	JOBS			
	J_1	J_2	J_3	J_4
M_1	11	13	8	10
M_2	4	7	6	5
M_3	21	12	9	15
M_4	18	17	7	12

(i) Find the optimal pattern of assigning Men to Jobs so that the total time taken to complete all four jobs is a minimum.

(ii) Find the optimal pattern if it is told that M_1 should not be a assigned to Job J_3.

(4) A retailer observes that the annual demand for his car batteries is 3000. The cost of placing one order for batteries is Rs. 1200. The inventory holding cost of one battery for one year is Rs. 80.

(a) Assuming that stock outs are not allowed

(i) Calculate economic order quantity (EOQ)
(ii) Calculate Re- order level if Lead time is one month
(iii) Calculate Re- order level if Lead time is three months

(b) If it is assumed that stock outs are not costly and that stock outs are allowed and cost of stock out is Rs.120 per battery per year

(i) Calculate economic order quantity (EOQ)
(ii) Calculate the maximum level of stock

(5) Road Development Department operates four worksites W_1, W_2, W_3 and W_4 that need to be supplied with bitumen. Their Weekly requirement of bitumen is respectively 200, 500, 100 and 700 Containers. The bitumen could be supplied by three suppliers S_1, S_2 and S_3 whose weekly capacities are respectively 600, 400 and 500 containers. The cost of transporting one container from a given supplier to a given worksite is explained in the table below.

COST OF TRANSPORTING ONE CONTAINER

	W_1	W_2	W_3	W_4
S_1	12	7	15	8
S_2	5	11	9	14
S_3	10	16	12	17

(i) Find an initial feasible solution
(ii) Solve the transportation problem

(6) Write short notes on the following

(i) Economic order quantity (EOQ)
(ii) Queuing Theory
(iii) Re-order Level
(iv) Critical Path
(v) Assignment Theory

Formula

$$EOQ = \sqrt{\frac{2DA}{C}}$$

$$EOQ = \sqrt{\frac{2DA}{C}\left(\frac{c+s}{s}\right)}$$

$$a = \frac{S \times EOQ}{C+S}$$

Variables

λ Rate of arrival of units

μ Rate of service completion

$\theta = \lambda / \mu$

H = Number of working hours per day.

$P_{(n)}$ = Probability of "n" units in the queuing system

L_s = Average number of units in queuing system

L_q = Average number of units in queue

W_s = Average time spent by unit in queuing system

W_q = Average time spent by unit in queue.

Formulae

$$P(n) = \theta P(n-1) \quad \text{——— (1)}$$

$$P(n) = \theta^n P(0) \quad \text{——— (2)}$$

$$P(n) = \theta^n (1-\theta) \quad \text{——— (3)}$$

(Probability that queuing system empty) $= (1-\theta)$ ——— (4)

(Probability that the server is idle) $= (1-\theta)$ ——— (5)

(Number of hours server idle per day) $= H(1-\theta)$ ——— (6)

$$L_s = \theta / (1-\theta) \quad \text{——— (7)}$$

$$L_q = \theta^2 / (1-\theta) \quad \text{——— (8)}$$

$$L_s = \lambda W_s \quad \text{——— (9)}$$

$$L_q = \lambda W_q \quad \text{——— (10)}$$