THE OPEN UNIVERSITY OF SRI LANKA
BACHELOR OF MANAGEMENT STUDIES DEGREE PROGRAMME - LEVEL 06
ASSIGNMENT TEST – 2012/2013
OPERATIONS RESEARCH – MCU 4202
DURATION – TWO (02) HOURS

DATE: 09th June 2012	**TIME: 10.00 am – 12.00 noon**

Answer any four (04) Questions.
All questions carry equal marks.

(Q1) a) Four teachers T_1, T_2, T_3, and T_4 could teach any of the four subjects S_1, S_2, S_3 and S_4. Past experience show that certain teachers are better on certain subjects. The average mark obtained by the students when a given teacher is assigned a given subject is shown in the table below.

AVERAGE MARKS OBTAINED

TEACHER	SUBJECTS			
	S_1	S_2	S_3	S_4
T_1	40	70	30	35
T_2	30	55	45	50
T_3	65	75	70	80
T_4	60	50	85	40

Find how the teachers should be assigned the subjects, so as to maximize total marks obtained for all four subjects

b) Find how the teachers should be assigned the subjects so as to maximize total marks if teacher "T_3" is not given subject S_1.

(Q2) a) what is meant by a balanced transportation problem? Explain.

b) S_1, S_2, and S_3 are three suppliers of a building material with weekly capacities of 100, 150 and 75 tons respectively. They supply material to four work sites W_1, W_2, W_3 and W_4 whose weekly requirements are 80, 140, 45 and 60 respectively. The cost of transporting one ton of material between the suppliers and work sites is explained in the table below.

COST OF TRANSPORT PER TON

SUPPLIERS	WORKSITE			
	W_1	W_2	W_3	W_4
S_1	7	5	4	6
S_2	3	2	6	4
S_3	6	8	5	5

i) Find an initial feasible solution using either North West Corner rule method or Least Cost method.

ii) Find the optimal transportation plan that would minimize the total transport cost.

(Q3) A project consists of eight activities A,B,C.....H whose precedence and durations are given in the table below.

ACTIVITY	PRECEDENCE	DURATION (DAYS)
A	PROJECT START	5
B	PROJECT START	8
C	A	3
D	B	4
E	B	7
F	'C' and 'D'	5
G	E	4
H	'F' and 'G'	6

i) Construct the network diagramme.

ii) Calculate the float of each activity.

iii) Name the critical path.

iv) Evaluate "EST", "EFT", "LFT" and "LST" of activity "D".

v) The progress of the project after 3 months was reviewed. It was observed that.

   a) Activity "A" is complete.
   b) Activity "C" is complete
   c) 4 days work of activity B has been done.
   d) Rest of activities has not been started.

Considering this progress of work, draw the new net work diagramme.

(Q4) A trader engaged in selling car batteries observes that the annual demand for his batteries is 720. The cost of a battery is Rs. 3000. The cost of placing one order for batteries is Rs.1500 and the cost of holding one battery in stock for one year is Rs. 96.

a) Calculate Economic Order Quantity (EOQ).

b) Calculate total inventory cost corresponding to the EOQ.

c) Calculate Re-order level if lead time is one month.

d) Calculate Re-order level if lead time is 4 months.

e) Find Economic Order Quantity if the capital available to purchase batteries is Rs. 400,000.

f) Find the Economic Order Quantity if a discount of 5% is given to all purchases more than 100 batteries.

(Q5) a) State the condition for equilibrium in a single server queue.

b) At a petrol station there is only one unit to pump petrol and vehicles arrive in a Poisson fashion at the rate of 10 per hour. The average time taken to pump Petrol to one vehicle is 5 minutes and has a Negative Exponential Distribution. The Petrol station works 24 hours a day.

i) What is the probability that there are three vehicles at the Petrol station?

ii) How many hours does the server at the Petrol station idle per day?

iii) On average how many vehicles are there at the Petrol station?

iv) On average how many vehicles are there waiting to pump Petrol?

v) On average how long must a vehicle wait at the station to pump petrol?

vi) On average how long must a vehicle wait until it is taken to pump Petrol?

(Q6) Write short notes on the following topics.

a) Economic Order Quantity (EOQ)

b) North-West Corner rule method.

c) Critical Path.

d) Assignment Theory.

MATHEMATICAL FORMULEE

Variables:

λ = *Rate of arrival of units*

μ = *Rate of service completion*

$\theta = \lambda / \mu$

H = *Number of working hours per day*

$P_{(n)}$ = Pr *obability 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

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

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

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

(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)

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

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

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

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

$$EOQ = \sqrt{\frac{2da}{q}}$$

$$k = \frac{da}{q} + \tfrac{1}{2} qc$$