THE OPEN UNIVERSITY OF SRI LANKA
BACHELOR OF MANAGEMENT STUDIES DEGREE PROGRAMME - LEVEL 6
ASSIGNMENT TEST 2016/2017
OPERATION RESEARCH - MCU 4202

DATE: 16th October 2016 **TIME: 10.00 am - 12.00 noon**

This paper consists of six questions.

Answer any three (03) questions.

(Q1) Four new machine M_1, M_2, M_3 and M_4 are to be installed in a newly built factory. Four locations L_1, L_2, L_3 and L_4 are reserved for the installation of machines. The cost of installation of machines would depends on the machine and the selected location as explained in the table below. Use assignment theory to find how the machines should be assigned to the locations so that the total cost of installation is a minimum.

COST OF INSTALLATION "RS. 000"

Machine	Location			
	L_1	L_2	L_3	L_4
M_1	9	12	40	14
M_2	11	9	10	8
M_3	16	50	15	12
M_4	10	12	11	7

(Q2) The Road Development Department operates four worksites w_1, w_2, w_3 and w_4 whose weekly requirement of bitumen is 200, 500, 100 and 700 containers respectively. This bitumen is supplied by three suppliers s_1, s_2 and s_3 whose weekly capacities are 600, 400 and 500 containers respectively. The cost of transporting one container from a given suppliers to a given worksites is explained in the table below.

COST OF TRANSPORTING ONE CONTAINER "RS. 000"

SUPPLIER	WORK SITE			
	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

The Road Development Department wishes to find the transportation plan that would minimize transportation cost.

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

(Q3) A project consists of seven activities A, B, C, D, E, F and G whose precedence, duration in days, cost slope and maximum possible days that could be crashed is explained in the table below. (Cost slope is given as "Rs. 000" per day)

ACTIVITY	PRECEDANCE	DURATION DAYS	COST SLOPE (000"/DAY)	MAXIMUM POSSIBLE DAYS CRASHED
A	-	8	4	2
B	-	5	1	4
C	A	6	3	3
D	A	4	1	3
E	B, C	5	7	2
F	D, E	4	6	3
G	F	2	8	1

(i) Construct the network diagramme for the above.
(ii) Calculate floats for each activity and name the critical path.
(iii) Calculate EST, EFT, LFT and LST of activity "D".
(iv) Suppose the management wants to reduce project duration by 5 days. What are the activities that you would crash and what is the total cost involved?

(Q4) At a laboratory blood samples are received in a Poisson fashion at the rate of 8 per hour. There is only one technologist who on the average takes 6 minutes to test one blood sample. The laboratory works 10 hours a day.

(i) How many hours does the technologist idle per day?
(ii) What is the probability that there are three blood samples at the laboratory?
(iii) On the average how many blood samples are there in the laboratory?
(iv) How long will a blood sample have to be kept at the laboratory?
(v) On the average how many blood samples are there waiting to be tested in the laboratory?
(vi) How long must a blood sample be kept until it is taken for testing?
(vii) Blood samples, as they are received are put in a freezer that has a capacity to hold 8 blood samples. If the freezer is full the sample is kept out side. What is a probability that a blood sample just received is kept outside the freezer?

Formulae

λ = Rate of arrival of units

μ = Rate of service completion

θ = λ/μ

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 units in queuing system

W_q = Average time spent by units in queue

$P(n) = \theta P(n-1)$ ———— (1)

$P(n) = \theta^n P(0)$ ———— (2)

$P(n) = \theta^n (1-\theta)$ ———— (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) = $H(1 - \theta)$ ———— (5)

$L_s = \theta/(1 - \theta)$ ———— (7)

$L_q = \theta^2/(1 - \theta)$ ———— (8)

$L_s = \lambda W_s$ ———— (9)

$L_q = \lambda W_q$ ———— (10)