THE OPEN UNIVERSITY OF SRI LANKA
BACHELOR OF MANANGEMENT STUDIES DEGREE PROGRAMME
LEVEL 06 – 2008/2009
OPERATIONS RESEARCH – MCU 4202
DURATION : THREE HOURS

Date-12th July 2009 **Time-09.30A.M.-12.30 NOON**

ANSWER ANY FIVE (05) QUESTIONS
ALL QUESTIONS CARRY EQUAL MARKS

1) a) Solve the following linear programming problem using simplex method.

Maximise $P = 80x + 120y$

$3x + y \leq 15$

$x + 2y \leq 10$

$x \geq 0 \quad , \quad y \geq 0$

b) Write down the dual of the linear programming problem.
c) With the help of final optimal table of the primal, write down the optimal solution of the dual.
d) Briefly explain how the dual problem is helpful in decision making.

2) 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 worksites is explained in the table below.

COST OF TRANSPORT PER TON

SUPPLIERS	WORK-SITES			
	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

a) Find the optimal transport plan that would minimize the total transport cost.
b) Evaluate this minimum total transport cost.
c) Suppose the material has to be purchased and then transported and the purchasing price of suppliers S_1, S_2 and S_3 are respectively 5, 8 and 7 per ton. Find the optimal transport plan.

3) The coach of a swim team needs to assign swimmers to a 200 yard medley relay to send to junior Olympics. Since most of his swimmers are very fast in more than one stroke it is not clear how the swimmers should be assigned to the four strokes. The four fastest swimmers and the best times (in seconds) they have achieved in each of the 50 yard strokes is explained in the table below.

	SWIMMERS			
	RAVI	**MANJU**	**SAMAN**	**KAMAL**
BACK STROKE	37	32	33	33
BREAST STROKE	43	33	42	38
BUTTER FLY	33	28	38	30
FREE STYLE	29	26	29	28

a) Find the optimal pattern of assigning swimmers to the four strokes that would minimize total swimming times.

b) Find the optimal pattern if a condition is laid down to say the Ravi should not be assigned butter fly stroke.

4) A project consist of eight activities A, B,.....,H whose details are given in the table below.

ACTIVITY	**PRECEDANCE**	**DURATION DAYS**	**CRASH COST PER DAY (Rs"000")**	**MAXIMUM POSSIBLE DAYS OF CRASHING**
A	P.S	4	6	1
B	P.S	10	8	2
C	P.S	6	6	1
D	A	8	1	1
E	A	8	8	1
F	B,D	5	2	4
G	C	7	5	3
H	E,F,G	4	3	3

P.S. = PROJECT START

a) (i) Construct the network diagram
(ii) Time analyse and name the critical path
(iii) Find EST, EFT, LFT, and LST of Activity "E"

b) The progress of the project was reviewed after A few days and it was observed that activity "A" was complete, Activity "B" was 60% complete, activities "C" and "E" were 50% complete each and activity "D" was 25% complete. Taking this progress into consideration.

(i) Construct the revised network diagram.
(ii) Time analyse and find the new critical path.
(iii) The management wishes to reduce the project duration of this revised network by 3 days. Explain how this could be done with least cost.(You need to only explain .Do not draw the network again)

5) a) Briefly explain the three types of costs involved with maintaining stocks (Inventories) at organization.

b) A motor car manufacturer observes that the annual demand for one of it's special spare part is 6000. The cost of placing one order for this spare part is Rs. 1800 and the cost of holding one spare part for one year is Rs.15. Assuming that stock outs are not allowed; Calculate:

(i) Economic order quantity (EOQ)
(ii) The total cost corresponding to this EOQ
(iii) Re-order level (ROL) if lead time is one month.
(iv) Re-order level (ROL) if lead time is three months.

c) If stock-outs are allowed and the cost of running one item out of stock for one year is Rs. 30, find.

(i) Economic order quantity (EOQ)
(ii) Maximum level of stock the manufacturer may have.

d) The motor car manufacturer decides to purchase a machine that would turn out this part. The machine has a capacity of 21,000 per annum and the set-up cost is Rs.800.Calculate economic order quantity (EOQ) for this item.

6) a) Briefly discuss the importance of queuing theory in management decision making.

b) A health centre has only one surgeon and a ward with eight beds to accommodate patients waiting for surgery. Patients arrive in a Poisson fashion at the rate of 5 per day. The time taken by the surgeon on a patient has a negative exponential distribution with the mean time 90 minutes. When a patient arrives, if the ward is full he is put on a waiting list.

Patients, after surgery do not go back to the ward.. The surgeon works 9 hours a day.

(i) How many hours does the surgeon idle per day?
(ii) On the average how many beds are vacant in the ward?
(iii) How long has a patient got to wait at the health centre?
(iv) How long has a patient got to wait until he is taken for surgery?
(v) What is the probability that a patient who just arrives is put on the waiting list?
(vi) On the average how many patients are there in the waiting list?

7) Write short notes on
(i) Random Number
(ii) Simulation
(iii) North – West corner rule
(iv) Critical path
(v) Economic order quantity

FORMULA LIST

(i) Server IDLE TIMF = H(1-θ)

(ii) $L_s = \frac{\theta}{1-\theta}$

(iii) $L_s = \lambda W_s$ and $L_q = \lambda W_Q$

(iv) $P(n) = \theta^n(1-\theta)$

(v) $L_Q = \frac{\theta^2}{1-\theta}$

(vi) $EOQ = \sqrt{\frac{2DA}{C}}$

(vii) $k = \frac{DA}{Q} + \frac{1}{2}QC$

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

(x) Maximum level of stock = $\frac{S \times EOQ}{C+S}$

(xi) $EOQ = \sqrt{\frac{2DA}{C\left(1-\frac{D}{R}\right)}}$