

THE OPEN UNIVERSITY OF SRI LANKA
 BACHELOR OF MANAGEMENT STUDIES DEGREE PROGRAMME
 LEVEL 6
 OPERATIONS RESEARCH - MCU 4202
 FINAL EXAMINATION – 2012
 DURATION THREE (03) HOURS



DATE: 7th April 2012

TIME: 9.30 am – 12.30 pm

*Use of a non-programmable calculator is allowed.
 Answer any five (05) questions. All questions carry equal marks.
 (Graph papers will be provided.)*

- Q1. a. A Businessman produces two types of bakery products; type (A) and type (B). While all other resources are available in plenty, he has only 250 square feet of oven space and 600 kg of flour for his daily production. One item of type (A) requires one square foot of oven space and 4 kg of flour. One item of type (B) requires 2 sqft. of oven space and 3 kg of flour. While the demand for type (A) is unlimited, the maximum daily demand for type (B) is 100 items. The businessman makes a profit of Rs 30.00 on one item of type (A) and profit of Rs.100.00 on one item of type (B). He wishes to maximize profit.
- Formulate the linear programming model.
 - Using graphical method find how many items of type (A) and type (B) should be produce to maximize profit.
- b. It is now observed that by adding a certain ingredient to type (B) its quality is improved and the demand for type (B) would be unlimited. However the profit would reduce from Rs.100.00 to Rs. 95.00 per item. You need to evaluate this suggestion in the interest of the businessman. For this purpose formulate the new liner programming model. (You do not have to solve it.

- Q2. a. Explain different types of floats in the activities of a project network.
- b. A project consists of eight activities A,B,C,...,H whose precedence and durations are explained in the table below.

ACTIVITY	PRECEDANCE	DURATION(DAYS)
A	PROJECT START	5
B	PROJECT START	12
C	PROJECT START	8
D	AFTER 'A'	6
E	AFTER 'A'	15
F	AFTER 'B' AND 'D'	8
G	AFTER 'C' AND 'F'	12
H	AFTER 'E' AND 'G'	18

- (i) Construct the Network diagram.
- (ii) Find the float of each activity.
- (iii) Name the critical path.
- (iv) Find "EST", "EFT", "LFT", "LST" of Activity "C"?

- Q3.** a. State the limitations of Assignment Theory.
- b. A businessman has four busses B_1, B_2, B_3 and B_4 and has four route permits R_1, R_2, R_3 and R_4 to operate them. The daily profit derived is about the same for all four buses which ever route the bus may run on. But the fuel consumptions differ. The daily fuel consumed when a given bus is operated on a given route is explained in the table below.

Daily Fuel Consumption (Ltr.)

ROUTE	BUS			
	B_1	B_2	B_3	B_4
R_1	25	27	42	35
R_2	14	9	10	8
R_3	24	30	28	32
R_4	20	23	15	18

In view of the present fuel crisis the businessman hopes to minimize the total fuel consumed. Find how the buses should be assigned to the four routes so as to minimize total fuel consumption.

- Q4.** A retailer observes that the annual demand for his tyres is 3000. The cost of placing one order for tyres is Rs. 1350/=. The inventory holding cost of one tyre for a period of one year is Rs.90/=. It is assumed that stock outs are not allowed;
- a) (i) Calculate EOQ (Economic Order Quantity)
- (ii) Calculate Re-order level (ROL) if lead time is one month.
- (iii) Calculate Re-order level (ROL) if lead time is two months.
- (iv) State your assumptions.
- b) Due to changes in market conditions the stock out cost has come down. The cost of having one tyre out of stock for one year is Rs. 160/=. If stock out are allowed;
- (i) Calculate EOQ (Economic Order Quantity).
- (ii) Calculate the maximum level of stock
- Q5.** A company is considering the problem of distributing imported cement from three ports P_1, P_2 and P_3 to four distribution centers D_1, D_2, D_3 and D_4 . The weekly supplies (capacities) of cement at the ports P_1, P_2 , and P_3 are 20, 38 and 16 tons respectively. The weekly demand at the distribution centers D_1, D_2, D_3 and

D_4 are 10,18,22, and 24 tons respectively. The cost of transporting one ton between the ports and distribution centers are shown in the table below.

COST OF TRANSPORTING ONE TON				
PORTS	DISTRIBUTION CENTERS			
	D_1	D_2	D_3	D_4
p_1	70	60	100	50
p_2	80	50	70	60
p_3	90	70	30	50

- (i) Find an initial feasibility solution using either North West Corner rule or Least Cost Method.
- (ii) Find the optimal transportation plan that would minimize total transport cost.
- (iii) State your assumptions.
- Q6. a) Prove that the condition for equilibrium in a single serve queue is 'Rate of arrival' < 'Rate of service completion'.
- b) Vehicles arrive at a service station in a Poisson Fashion at the rate of 3 per hour. The service station works 10 hours a day and has only one servicing plant. The average time taken to service one vehicle is 15 minutes. (This service time has a negative exponential distribution)
- i) What is the probability that there are three 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 long must a vehicle be kept at the service station?
- v) On the average how many vehicles are there waiting to be taken for servicing?
- vi) On the average how long must a vehicle wait until it is taken for servicing?
- vii) The service station has a parking area with 5 parking lots. What is the probability that a vehicle that just arrives will find no parking lot?
- Q7. Write short notes on the following.
- a) Simulation
- b) Balance Transportation Problem
- c) Critical Path Analysis
- d) Economic Order Quantity (EOQ)

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MATHEMATICAL FORMULEE

$$P(n) = \theta^n (1 - \theta)$$
$$\text{Server Idle Time} = H(1 - \theta)$$

$$L_s = \frac{\theta}{1 - \theta}$$

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

$$L_s = \lambda w_s$$

$$L_Q = \lambda w_Q$$

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

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

$$Q = \frac{S \times EOQ}{(C+S)}$$