

EASTERN UNIVERSITY SRI LANKA
FACULTY OF COMMERCE AND MANAGEMENT

FINAL YEAR SECOND SEMESTER EXAMINATION
BACHELOR OF COMMERCE - 2017/2018 (June/July 2020) - PROPER / REPEAT

COC 4073 OPERATIONS RESEARCH

Answer All Questions

Time: 03 Hours

01. (i) Andy makes handcrafted dolls, which he sells at craft fairs. He is considering mass producing the dolls to sell in stores. He estimates that the initial investment for plant and equipment will be Rs. 250000, whereas labour, material, packaging, and shipping will be about Rs.100 per doll.
- a) If the dolls are sold for Rs. 300 each, what sales volume is necessary for Andy to break even?
 - b) Andy has determined that Rs. 100000 worth of advertising will increase sales volume by 400 dolls. Should he spend the extra amount for advertising?
 - c) Andy is concerned that the demand for his dolls will not exceed the break-even point. He believes he can reduce his initial investment by purchasing used sewing machines and fewer machines. This will reduce his initial investment from Rs. 250000 to Rs. 170000. However, it will also require his employees to work more slowly and perform more operations by hand, thus increasing variable cost from Rs. 100 to Rs. 140 per doll. Will these changes reduce his break-even point?

(06 Marks)

- (ii) The Crumb and Custard Bakery makes coffee cakes and pastries in large pans. The main ingredients are flour and sugar. There are 25 Kg of flour and 16 kg of sugar available, and the demand for coffee cakes is 5. Five Kilograms of flour and 2 kilograms of sugar are required to make a pan of coffee cakes, and 5 Kilograms of flour and 4 Kilograms of sugar are required to make a pan of pastries. A pan of coffee cakes has a profit of Rs. 10, and a pan of pastries has a profit of Rs. 50. The Crumb and Custard Bakery wants to determine the number of pans of cakes and pastries to produce each day so that profit will be maximized.
- a) Formulate a linear programming model for this problem.
 - b) Solve this model by using graphical analysis.
 - c) Determine the number of pans of cakes and pastries to produce each day so that profit will be maximized.
 - d) Determine the maximum profit.
 - e) How much flour and sugar will be left unused if the optimal numbers of cakes and Danish are baked?
 - f) Explain the effect on the optimal solution if the unit profit on coffee cake is increased from Rs. 10 to Rs. 15.

(14 Marks)

(Total 20 Marks)

02. (i) Solve the following linear programming model using simplex method.

$$\begin{aligned} \text{Minimize } & Z = 5X_1 + X_2 \\ \text{Subject to } & 3X_1 + 4X_2 = 24 \\ & X_1 \leq 6 \\ & X_1 + 3X_2 \leq 12 \\ & X_1, X_2 \geq 0 \end{aligned}$$

(14 Ma

(ii) Solve the following linear programming model graphically and explain the solution result:

$$\begin{aligned} \text{Maximize } & Z = 60X_1 + 90X_2 \\ \text{Subject to } & 60X_1 + 30X_2 \leq 1500 \\ & 100X_1 + 100X_2 \geq 6000 \\ & X_2 \geq 30 \\ & X_1, X_2 \geq 0 \end{aligned}$$

(06 Mar

(Total 20 Mar

03. (i) A concrete company transports concrete from three plants to three construction sites. The supply capacities of the three plants, the demand requirements at the three sites, and the transportation costs per ton are as follows:

	Construction site			Supply (tons)
	1	2	3	
Plant	Transportation cost per ton (in Rs, 100s)			
A	6	7	4	100
B	5	3	6	180
C	8	5	7	200
Demand (tons)	135	175	170	

The company wants to determine the optimal distribution schedule.

- Find the total minimum transportation cost for initial allocation with least cost cell method.
- Find the total transportation cost for optimum allocation using stepping stone method.

(10 Marks)

- (ii) An electronics firm produces electronic components, which it supplies to various electrical manufacturers. Quality control records indicate that different employees produce different numbers of defective items. The average number of defects produced by each employee for each of six components is given in the following table:

Employee	Average number of defects					
	Component					
	A	B	C	D	E	F
1	30	24	16	26	30	22
2	22	28	14	30	20	13
3	18	16	25	14	12	22
4	14	22	18	23	21	30
5	25	18	14	16	16	28
6	32	14	10	14	18	20

Determine the optimal assignment that will minimize the total average number of defects produced by the firm per month and compute the minimum total average number of defects.

(10 Marks)

(Total 20 Marks)

04. (i) a) Each unit of an item costs a company Rs.4,000 with annual holding costs of 18 percent of unit cost for interest charges, 1 percent for insurance, 2 percent allowance for obsolescence, Rs.200 for building overheads, Rs.150 for damage and loss and Rs.400 miscellaneous costs. If the annual demand for the item is constant at 1,000 units and each order costs Rs.10,000 to place, calculate the economic order quantity and the total cost of stocking the item.
- b) If the supplier will only deliver batches of 250 units, how does this affect the costs?

(10 Marks)

- (ii) Westside Auto purchases a component used in the manufacture of automobile generators directly from the supplier. Westside's generator production operation, which is operated at a constant rate, will require 1000 components per month throughout the year. Assume that the ordering costs are Rs. 25 per order, the unit cost is Rs. 2.50 per component, and annual holding costs are 20% of the value of the inventory. Westside has 250 working days per year and a lead time of 5 days. Answer the following inventory policy questions.

- a) What is the EOQ for this component?
 b) What is the reorder point?
 c) What is the cycle time?
 d) What are the total annual holding ordering costs associated with your recommended EOQ?

(10 Marks)

(Total 20 Marks)

05.

You are given the following information about a project and the network developed to manage the project. All the times are given in weeks.

Activity	Preceding Activity	Optimistic Time	Most Likely Time	Pessimistic Time	Expected Time
A	-	2	4	6	4
B	-	2	5	8	5
C	-	5	8	11	8
D	A	6	7	8	7
E	A	9	10	11	10
F	A	5	9	13	9
G	B,D	4	8	12	8
H	B,D	6	9	12	9
I	G,E	12	13	14	13
J	G,E	7	10	13	10
K	F,C	3	6	9	6
L	I,K	10	13	16	13

Required:

- Draw the network diagram for the given project.
- Calculate Earliest Start Time, Earliest Finish Time, Latest Start Time, Latest Finish Time and Total float for each activity.
- Identify the critical activities and critical path of the project by using the figures calculated in part (b).
- What is the expected project completion time?
- What is the probability that this project is completed within 50 weeks?

(Total 20 Marks)