

Time: 3 Hours
Marks: 110 *old* rule, and 70 *newrule*

Answer the following questions, all are equal marks:-

Q 1:

(a) With aid of sketch(s) and useful assumptions, if any, develop:-

i- A formula of determining Min-Cost batch size.

ii- A formula of determining the production range associated with Min-cost batch size.

(b) The constant costs per piece are known to be \$ 4, the carrying charges factor $K = \$ 0.0005$ per unit per day, and the setup costs per batch are \$ 10000.

1- Find the production range if the allowable increase in total costs per piece is 3% above the minimum unit costs.

2- To scale, plot the total unit costs against Q then graphically show and find the production range at 5% above the minimum unit costs.

Q 2:

A man has a hoppy (هاوي) to own different cars. He owns Mercedes, Peugeot, Fiat and Seat. In order to determine which car runs best on a type of Benzin, he buys the benzin from different stations (محطات بنزين). After a week, he discovered that each car used different amount of benzin, depending on the type used as shown in the Table below.

Benzin Consumed (in Liter)				
	ESSO	CO-OP	MOBIL	MISR
Mercedes	15	14	7	12
Peugeot	12	16	13	7
Fiat	10	9	5	15
Seat	8	7	6	13

(a) In order to minimize total purchase of Benzin, which car should use which Benzin? (Note that only one car per type of Benzin, all cars must equally used, and all types of Benzin cost the same from all stations).

(b) If cost of Benzin differ (ESSO cost P.T 170 per Litre, CO-OP P.T 180 per Liter, MOBIL P.T 120 per Litre and MISR P.T 190 per Liter). Will there be a new allocation?.....If so, what is it?..... What is his total Benzin purchase?

Q 3:

Use simplex method of Linear programming to:

$$\text{Minimize } Z = X_2 - 3X_3 + 2X_5$$

$$\text{Subject to: } 3X_2 - X_3 + 2X_5 \leq 7$$

$$-2X_2 + 4X_3 \leq 12$$

$$-4X_2 + 3X_3 - 8X_5 \leq 10$$

$$\text{Where: } X_2, X_3, X_5 \geq 0$$

Q 4:

Consider the problem of assigning four different types of machines and five types of tasks. The no. of M/cs available in the 4 types are 25, 30, 20 and 30. The no. of jobs in the 5 tasks are 20, 20, 30, 10 and 25. M/c type 4 cannot be assigned to task 4. Formulate a mathematical model for determining the optimal assignment for M/cs to tasks given the following unit cost.

What would be the total cost?

Tasks					
	1	2	3	4	5
Machines					
1	\$ 10	\$ 2	\$ 3	\$ 15	\$ 9
2	5	10	15	2	4
3	15	5	14	7	15
4	20	15	13	-	8

Q 5:

Elaraby Electronic Company produces two models, LCD-1 and LCD-2. The two models are assembled by passing sequentially through three workstations on the same assembly line. The assembly capacities are shown in the given Table. Each workstation has maximum availability of 480 minutes per day. However, the workstations require daily maintenance which amount to 12 %, 14 % and 10 % of the daily time availability for stations 1, 2 and 3 respectively.

The company wishes to determine the daily units to be assembled of each model to minimize the sum of unused times at all three workstations. Find also the % utilisation of each station in such a case.

Workstation	Units/hour	
	LCD-1	LCD-2
1	15	10
2	12	12
3	10	15

Best wishes

Dr.Eng. Mohamed Sobeih