

# ORDRE DES INGÉNIEURS DU QUÉBEC

## NOVEMBER 2019 SESSION

Open-book examination  
Calculators : only authorized models  
Duration : 3 hours

### 16-MC-B2 INTEGRATED MANUFACTURING SYSTEMS

#### QUESTION I (20 POINTS).

Demand for heart transplant surgery at Laval Hospital has increased steadily in the past few years:

Year	1	2	3	4	5	6
HeartTransplants	45	50	52	56	58	?

The director of medical services predicted 6 years ago that demand in year 1 would be 41 surgeries.

1. Use exponential smoothing, first with a smoothing constant of 0.3 predict the demand at year 6. What happens when the smoothing constant is changed from 0.3 to 0.6? Calculate the sum of squares of deviations and the average absolute deviation. What can be said about the smoothing factor to use for the prediction? 7 POINTS
2. Using simple weighted moving averages of order 3, the weights being 2, 4, 6, predict demand in the sixth year. 7 POINTS
3. Which of the three forecasting methods is best? Justify your answer. 6 POINTS

#### QUESTION II (20 POINTS)

Scott Dustan's firm has developed the following supply, demand, cost and inventory data.

	Month		
	1	2	3
Demand	40	50	40
Capacity			
Regular	30	35	30
Overtime	10	12	10
Subcontract	5	5	5
Initial Inventory	20 units		

Cost per unit	
Regular time	\$100
Overtime	\$150
Subcontract	\$200
Inventory, per month	\$4

1. Develop a plan that minimizes total cost. No back orders are allowed. 15 POINTS
2. Compute the total cost of the plan. 5 POINTS

### QUESTION III (20 POINTS)

Radio Manufacturing Company make flashing lights for toys. The company operates its production facility 300 days per year. It has orders for about 12000 flashing lights per year and the capability of producing 100 per day. Setting up the light production costs \$50. The cost of each light is \$1. The holding cost is \$0.10 per light per year.

1. What is the optimal size of the production run? 5 POINTS
2. What is the average holding cost per year? 5 POINTS
3. What is the average setup cost per year? 5 POINTS
4. What is the total cost per year, including the cost of the lights? 5 POINTS

### QUESTION IV (20 POINTS)

A part structure, lead time (weeks), and on-hand quantities for product A are shown in figure 1. The product quantities of each component needed for each assembly are noted in parenthesis. From the information shown, generate:

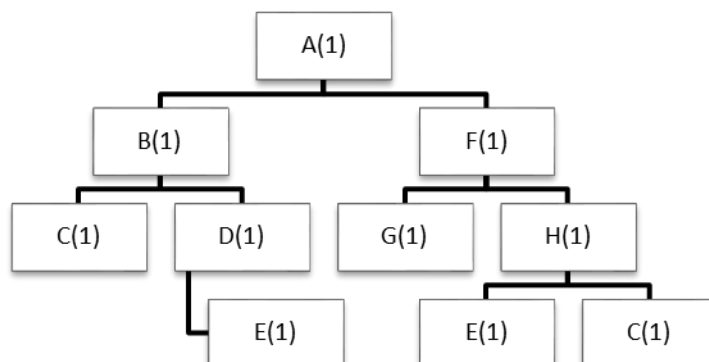
1. Net requirements for each part to produce 10 As in week 8 using lot-for-lot ordering. 15 POINTS

You have just been notified, via fax, that the lead time for component G of product A has been increased to 4 weeks.

2. Which items have changed and why? 1 POINT
3. What are the implications for the production plan? 2 POINTS
4. As a production planner, what can you do? 2 POINTS

Figure 1. Product Structure

Part	Inventory on hand	Lead Time (weeks)
A	0	1
B	2	1
C	10	2
D	5	1
E	4	1
F	5	1
G	1	3
H	10	



**QUESTION V (20 POINTS)**

The following jobs are waiting to be processed at Julie Morel's machine center.

Job	Date order received	Production days needed	Date order due
A	110	20	180
B	120	30	200
C	122	10	175
D	125	16	230
E	130	18	210

1. In what sequence would the jobs be ranked according to the following rules:

- a. FCFS (First Come First Served). 4 POINTS
- b. EDD (Earliest Due Date) 4 POINTS
- c. SPT (Shortest Processing Time) 4 POINTS
- d. LPT (Longest Processing Time) 4 POINTS

2. All dates are according to shop calendar days. Today on the planning calendar is day 130 and none of the jobs have been started or scheduled. Which rule is best? 4 POINTS