

## National Exams May 2009

### 07-Mec-B4, Integrated Manufacturing Systems

3 hours duration

#### NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. This is an OPEN BOOK EXAM.  
Any non-communicating calculator is permitted.
3. Any five questions constitute a complete paper. Only the first five (5) questions as they appear in your answer book will be marked.
4. Each question is of equal value.
5. Some questions require an answer in essay format. Clarity and organization of the answer are important.

Question 1:

- a) What common components of demand do we wish to take into account in a forecasting system for operations?
- b) What is the general structure of adaptive forecasting systems?
- c) How is economic forecasting different from regression analysis?

Question 2:

- a) What are the three basic controllable variables of a production planning problem? What are the four major costs?
- b) Distinguish between pure and mixed strategies in production planning.
- c) How does Search Decision Rule method work?
- d) What are the general conditions for which preventive maintenance is appropriate?

Question 3:

The requirements for a motor drive unit to be assembled into a dictating machine follow the assembly schedule for the completed unit. The assembly schedule requires motor drive units with the timing shown in Table 1. Other data for the motor drive unit are: average requirements are  $\bar{R} = 116.7$  units per week,  $c_p = \$400$  per lot, and  $c_H = \$4$  per unit per week. What is the inventory record and total incremental cost under each of the following lot size policies?

- a) Economic lot size
- b) Economic periodic reorder model
- c) Part-period total cost balancing

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Requirements Schedule for a Motor Drive Unit

Week number	1	2	3	4	5	6	7	8	9	10	11	12
Requirements, units	25	30	75	125	200	325	400	100	0	100	0	100

Total Requirements for 12 weeks, 1390 units.

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Table 1

## Question 4:

- a) A large manufacturer of watches makes some parts and buys some other parts from a vendor. Periodically, the vendor submits a batch of parts that meet the specifications of the horologist. The vendor thus wishes to keep a continuous check on production of watch parts. One gear has been a special problem. A check of 25 samples of 5 pieces gave the following data on a key dimension:

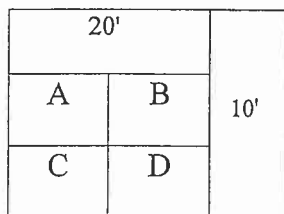
$$\bar{\bar{X}} = 0.125 \text{ inch} \qquad \bar{R} = 0.002 \text{ inch}$$

What criterion should be set up to determine when the process is out of control? How should this criterion compare with the specifications? What are the alternatives if the criterion is not compatible with the specification?

- b) A manufacturer of dustless chalk is concerned with the density of the product. Previous analysis has shown that chalk has the required characteristics only if this density is between 4.4 gm/cc and 5.0 gm/cc. If a sample of 100 pieces gives an average of 4.8 gm/cc and a standard deviation of 0.2, is the process aimed at the proper density? If not, what should the aim be? Is the process capable of meeting the density requirements?

## Question 5:

A small service organization has four departments arranged as shown in the figure below, on the left, with interdepartment distances based on the center of departments A, B, C and D. The number of trips between departments during a typical week is given on the right. The department sizes are appropriate, and the cost of a trip is primarily a function of distance. What do you think of the present layout? Would you suggest any changes?



	A	B	C	D
A	-	25	15	20
B		-	20	10
C			-	5
D				-

## Question 6:

- a) A line is defined by its end points  $(0, 0)$  and  $(2, 3)$  in a two-dimensional graphics system. Express the line in matrix notation and perform the following transformations on this line:
- Scale the line by a factor of 2.0.
  - Scale the original line by a factor of 3.0 in the x-direction and 2.0 in the y-direction.
  - Rotate the original line by  $45^\circ$  about the origin.
  - Translate the original line by 2.0 units in the x-direction and 2.0 units in the y-direction.
- b) A line in two-dimensional space has end points defined by  $(1, 1)$  and  $(1, 3)$ . It is desired to move this line by a series of transformations so that its end points will be at  $(0, 1)$  and  $(0, 5)$ .
- Describe the sequence of transformations required to accomplish the movement of the line as specified.
  - For each transformation in the sequence, write the transformation matrix.

## Question 7:

- Define a generative process planning system.
- What are the objectives of a machinability data system?
- What are the benefits of computer-aided process planning?