

THE UNIVERSITY OF ADELAIDE
DEPARTMENT OF MECHANICAL ENGINEERING
EXAMINATION FOR THE DEGREE OF BACHELOR OF ENGINEERING
NOVEMBER 2000
MANUFACTURING ENGINEERING 2 [7915]

TIME: THREE HOURS

[Candidates are allowed 10 mins before the exam. begins, to read the paper.]

Answer ALL Questions

[Candidates are allowed to refer to notes & books. Calculators may be used.]

1.1 Why do forecasting methods need to be monitored or controlled?

Given below are the actual demand and the forecasts made by two forecast models.

| Actual Demand | Forecast (Model A) | Forecast (Model B) |
|---------------|--------------------|--------------------|
| 2488 | 2650 | 2625 |
| 3372 | 3180 | 3510 |
| 2891 | 3070 | 2950 |
| 2295 | 2180 | 2300 |
| 2816 | 2785 | 2750 |

- (i) Compute the MAD for both forecast models.
- (ii) Compute the RSFE for both forecast models.
- (iii) Indicate which model you think is better and why.

[12 Marks]

1.2 Types of layout performance criteria are listed below:

transportation, supplies, labour, resources, customer convenience, material handling, communications, employee attitudes.

From this list choose THREE criteria that you consider to be most important in the following four settings:

- (a) garment plant, (b) paper mill, (c) car repair shop, (d) distribution warehouse.

[8 Marks]

2.1 The Exotic Appliance Company is installing an assembly line to produce one of its small appliances and you have been asked to balance the line. The tasks that are to be performed are listed below, along with the time required to perform each task and its immediate predecessor(s). The line is to produce 300 units in a full 8 hours of work.

- (a) assign tasks to the workstations by selecting the longest available task.
- (b) compute the balance delay,
- (c) is there an improvement in balancing the line if the shortest task criteria had been utilised?

| TASK | TIME (secs) | PREDECESSOR(S) |
|------|-------------|----------------|
| A | 51 | None |
| B | 22 | A |
| C | 28 | A |
| D | 32 | A |
| E | 39 | A |
| F | 20 | B |
| G | 20 | C |
| H | 16 | D |
| I | 12 | E |
| J | 42 | F, G |
| K | 44 | H, I |
| L | 20 | J |
| M | 20 | K |
| N | 12 | L, M |

[15 Marks]

2.2 Indicate for each of the following list of tasks whether it would be better performed by a human or a machine.

- Make rapid and consistent responses to input signals.
- Recognise patterns of complex stimuli that may vary from situation to situation.
- Adapt decisions to situational conditions.
- Retrieve coded information quickly and accurately.
- Develop entirely new programmes.
- Detect small amounts of light or sound.
- Store coded information quickly and in substantial quantity.

[5 Marks]

3.1 Under what conditions would it be reasonable for an organisation to convert from a job-shop production system to a cellular system?

Explain how converting a job-shop process into a cellular process could reduce throughput time and average in-process inventory.

[8 Marks]

3.2 What is group technology and why was it developed? Compare this concept with the characteristics of conventional manufacturing layouts.

How does group technology form "part families". Discuss an alternative method for forming "part families" to include the advantages and disadvantages of both methodologies.

[12 Marks]

4. The Materials Requirements Planning (MRP I) module is an important part of the Manufacturing Resources Planning (MRP II) manufacturing management information system. Neatly sketch a block diagram of the MRP I module clearly showing its relationships and direction of communication with its input and other modules it relies on to produce its outputs.

[4 Marks]

Clearly explain what the MRP I module is designed to achieve, and how it will do this through the interactions with the other modules in your diagram.

[6 Marks]

Why is it necessary for the accuracy of the stored data to be at least 98% correct and what are the likely results if this data does not reach this level?

[4 Marks]

How do you differentiate between the use of Just-in-Time and Materials Resources Planning (MRP II) in manufacturing industry? Explaining the reason for your choice, what type of industry would use:

- (i) Materials Resource Planning (MRP II)?
- (ii) Just-in-Time (JIT)?

[6 Marks]

5. Define the meaning of (i) dependent demand, and (ii) independent demand and explain what system and why it should be used, when determining quantities to be ordered.

[5 Marks]

In a large transport organisation the average demand for 5 litre cans of 10W40 engine oil is 20 per day. If operations continue 7 days per week and for 365 days per year, determine an appropriate economic order quantity and a reorder level for the inventory system that will also contain a 5% safety stock to allow for variation in demand. Briefly explain how this system would work.

[6 Marks]

If the daily demand is not constant and has a standard deviation of 6.15 cans per day, determine an improved inventory model that will provide for a 99.5% service probability level without including a safety stock.

[9 Marks]

The costs associated with the operations are:

Inventory holding cost \$0.50 per can per year.

Order costs are \$10 per order.

Order lead time is two weeks.

Assume that for a probability level of 99.5, z from the areas of the cumulative standard distribution table is 2.6.