**PRINCE OF SONGKLA UNIVERSITY**
**FACULTY OF ENGINEERING**

**Mid Term Examination :** Semester I                **Academic Year :** 2006

**Date :** July 30, 2006.                **Time :** 13:30-16:30

**Subject :** 225-351 Production Planning and Control        **Room :** A400

ทุจริตในการสอบ  โทษขั้นต่ำปรับตกในรายวิชานั้น
และพักการเรียน 1 ภาคการศึกษา

**Instructions :**

1. There are 4 questions, 100 points.
2. Attempt all questions.
3. A sheet of paper note at size A4, a dictionary and a calculator are allowed.
4. Borrowing things from other students is prohibited.

| Problem | Full Score | Score |
|---------|-----------|-------|
| 1 | 25 | |
| 2 | 20 | |
| 3 | 25 | |
| 4 | 30 | |
| Total | 100 | |

**Assoc. Prof. Dr. Sunchai Klinpikul**
**Instructor**

**1. A firm's sales for a product line during the 12 quarters of the past three years were as follows :**

| Year | Quarter | Sales |
|------|---------|-------|
| 1 | 1 | 600 |
|   | 2 | 1,550 |
|   | 3 | 1,500 |
|   | 4 | 1,500 |
| 2 | 5 | 2,400 |
|   | 6 | 3,100 |
|   | 7 | 2,600 |
|   | 8 | 2,900 |
| 3 | 9 | 3,800 |
|   | 10 | 4,500 |
|   | 11 | 4,000 |
|   | 12 | 4,900 |

The firm wants to forecast each quarter for the fourth year :

(a) Forecast the sales in the fourth year by a linear trend extrapolation.

( 15 points )

(b) Compute the control chart for the forecast by using standard deviation method and $\alpha = 0.05$ .

( 10 points )

2.    A manager of the machining department of a company is trying to select a CNC drilling machine to process an extra 200 unit order in the next month. He has two CNC drilling machines ( CNC-1 and CNC-2 ). CNC-1 has a monthly depreciation cost of $ 5,000 and CNC-2 has a monthly depreciation of $ 2,000. Both machines are well maintained and available to process the order without any additional tooling. In addition to these costs, administrative overhead costs of $ 500 per month for CNC-1 and $ 300 per month for CNC-2 are charged. The company is operating 25 days per month and the order can be filled within one month by either machine. Operating cost on CNC-1 is estimated at $ 0.10 per unit and that of CNC-2 is estimated at $ 0.20 per unit.

Which machine should the manager select to process the order ?

( 20 points )

3. Sally's silk screening produces specialty T-shirts and sales in the market with the estimated demand :

| Demand (per day) | no. of days / year |
|---|---|
| 300 | 18 |
| 400 | 35 |
| 500 | 140 |
| 600 | 105 |
| 700 | 35 |
| 800 | <u>17</u> |
| | <u>**350**</u> |

The selling price of the T-shirt is $ 20 per piece. Set up cost for silk screening is $ 150 per order. Carrying cost is estimated at 25% of item value. Interest rate is 5% per year

(a) What is the economic order quantity of the t-shirt being produced ? How many orders per year ?

( 15 points )

(b) Determine a safety stock and reorder point using ultra conservative method and the average lead time is 5 days.

( 10 points )

**4.** A furniture company produces 3 products : end tables, sofas and chairs. These products are processed in 5 departments : the saw lumber, fabrics cutting, sanding, staining and assembly departments.

End tables and chairs are produced from raw lumber only, and the sofas requires lumber and fabric. The specific requirements for each product are as follows :

| Resources (Quantity per month) | Required for end table | Required for sofa | Required for chair |
|---|---|---|---|
| Lumber ( 4,300 board feet ) | 10 board feet | 7.5 board feet | 4 board feet |
| Fabric ( 2,500 yards ) | none | 10 yards | none |

**Activities ( per month )**

| | | | |
|---|---|---|---|
| Saw Lumber (280 hours) | 30 min. | 24 min. | 30 min. |
| Cut Fabric (140 hours) | none | 24 min. | none |
| Sand (280 hours) | 30 min. | 6 min. | 30 min. |
| Stain (140 hours) | 24 min. | 12 min. | 24 min. |
| Assemble (700 hours) | 60 min. | 90 min. | 30 min. |

The company's direct labor expenses are $ 75,000 per month for the 1,540 hours of labor, at $ 48.70 per hour.

Based on current demand, the firm can sell 300 end tables, 180 sofas, and 400 chairs per month.

Sales prices are $ 400 for end table, $ 750 for sofas and $ 240 for chairs. Assume that labor cost is fixed and the firm does not plan to hire or fire any employee over the next month.

Formulate a linear programming model for this firm.

( 30 points )