*Submit your answers to the following problems in paper form by 02:00pm on Friday 2005-11-04.
*You will lose 30% of the assignment points for late submission; late submission is accepted until 02:00pm on Monday 2005-11-07.
*This Problem set is worth 100 points.
*Direct Relevance of answers, brevity and clarity are required.

1. Chapter 6, Exercise #7, [6 points]

The marginal product of labor in the production of computer chips is 50 chips per hour. The marginal rate of technical substitution of hours of labor for hours of machine-capital is 1/4. What is the marginal product of capital?

2. Chapter 7, Exercise #8, [34 points: 16,10,8]

You manage a plant that mass produces engines by teams of workers using assembly machines. The technology is summarized by the production function $q = 5KL$

where q is the number of engines per week, K is the number of assembly machines, and L is the number of labor teams. Each assembly machine rents for $r = \$10,000$ per week and each team costs $w = \$5,000$ per week. Engine costs are given by the cost of labor teams and machines, plus \$2,000 per engine for raw materials. Your plant has a fixed installation of 5 assembly machines as part of its design.

   a. What is the cost function *for your plant* — namely, how much would it cost to produce q engines?

      What are the average and marginal costs for producing q engines?

      How do average and marginal costs vary with output?

   b. How many teams are required to produce 250 engines?
      What is the average cost per engine?

   c. You are asked to make recommendations for the design of a new production facility. What capital/labor *(K/L)* ratio should the new plant accommodate if it wants to minimize the total cost of producing any level of output q? *(K can change)*

3. [24 points: 18,6]

A firm's total cost function is given by the equation: $TC = 4000 + 5Q + 10Q^2$. Using this production function:

   (1) Write an expression for each of the following cost concepts:

       a. Total Fixed Cost
       b. Average Fixed Cost
       c. Total Variable Cost
       d. Average Variable Cost
       e. Average Total Cost
       f. Marginal Cost

(2) Determine the quantity that minimizes average total cost. Demonstrate that the predicted relationship between marginal cost and average cost holds.

4. [16 points: 8,8]

Conigan Box Company produces cardboard boxes that are sold in bundles of 1000 boxes. The market is highly competitive, with boxes currently selling for $100 per thousand. Conigan's total and marginal cost curves are:

$$TC = 3,000,000 + 0.001Q^2$$

$$MC = 0.002Q$$

where Q is measured in thousand box bundles per year.

a. Calculate Conigan's profit maximizing quantity. Is the firm earning a profit?
b. Analyze Conigan's position in terms of the shutdown condition. Should Conigan operate or shut down in the short-run?

5. [20 points: 8,6,6]

The market demand for a type of carpet known as KP-7 has been estimated as:

$$P = 40 - 0.25Q,$$

where P is price ($/yard) and Q is rate of sales (hundreds of yards per month). The market supply is expressed as:

$$P = 5.0 + 0.05Q.$$

A typical firm in this market has a total cost function given as:

$$C = 100 - 20.0q + 2.0q^2.$$

a. Determine the equilibrium *market* output and price.
b. Determine the output for a typical *firm*.
c. Determine the profit (or loss) earned by the typical *firm*.