

## Problem set 1

“due” 2/4/2010

**Problem 1** The Bouncing Ball Ping Pong Co. sells table tennis sets that consist of two paddles and one net. What is the firm’s long-run expansion path if it incurs no costs other than what it pays for paddles and nets, which it buys at market prices? How does your answer depend on the relative prices of paddles and nets?

**Problem 2** In February 2003, Circuit City Stores replaced skilled sales representatives who earn up to \$54,000/year with relatively unskilled workers who earned \$14 to \$18/hour. Suppose that sales representatives sell one particular Sony high definition TV. Let  $q$  represent the number of TV’s sold per hour,  $s$  the number of skilled sales reps per hour, and  $u$  the number of unskilled reps per hour. Working eight hours/day, each skilled worker sells 6 TV’s/day, while each unskilled worker sells 4. The wage rate of the skilled workers is  $w_s = \$26/\text{hour}$ , and the wage rate of the unskilled workers is  $w_u = \$16/\text{hour}$ .

- a. Using a graph, show the isoquant for  $q = 4$  with skilled sales representatives on the x-axis, and unskilled on the y-axis.
- b. Draw a representative isocost line for  $c = \$104$  per hour.
- c. Using an isocost-minimizing diagram, identify the cost-minimizing number of skilled and unskilled reps to sell  $q = 4$  TV’s per hour.

**Problem 3** A bottling company uses two inputs to produce bottles of the soft drink Sludge: bottling machines (K) and workers (L). The isoquants have the usual smooth, curvy shape. The machines cost \$1,000 per day to run; the workers earn \$200/day. At the current level of production, the marginal product of the machines is an additional 200 bottles per day, while the marginal product of labor is 50 more bottles per day. Is this firm producing at minimum cost? If so, explain why. If not, explain how the firm should change the ratio of inputs it uses to lower its cost.

**Problem 4** Suppose Molly produces rocking chairs using both machines (K) and labor (L). Specifically, suppose that if Molly uses  $K$  machines and  $L$  labor, she produces  $f(L, K) = \frac{1}{2}L^{\frac{1}{4}}K^{\frac{1}{2}}$  rocking chairs per hour. Suppose that the going rate for an hour of labor is \$20, while her rental rate of capital is \$10 per hour.

- a. Using one of the methods outlined in class, sketch isoquants corresponding to outputs of  $Q = 2$ ,  $Q = 4$ , and  $Q = 8$ .
- b. On a new graph, copy over the  $Q = 8$  isoquant. Then, draw two isocost lines, one representing a cost that is *above* the minimum cost of producing  $Q = 8$  output, and one representing a cost that is *below* the minimum cost. Be precise.
- c. Using your graph from b, explain how you know that the minimum cost of producing 8 output is between the two cost levels identified in part b.
- d. Go as far as you can, graphically or mathematically, in identifying the minimum cost of producing 8 units.
- e. (extra credit)<sup>1</sup> Identify Molly’s cost function,  $c(Q)$ . Show that if the price of a rocking chair is set at \$320, Molly should produce 64 chairs/hour

<sup>1</sup>in the sense that there may be a corresponding extra credit question on the quiz.

f. Fact: Molly maximizes her profits by producing 64 chairs, using 256 labor hours and 1,024 machine hours. Explain why MPL and MPK are not equal, despite Molly maximizing profits.

**Problem 5** Doug's production function for his economics midterm score is  $\min\{O, 2I\}$ , where  $I$  is time spent in class each week and  $O$  is time spent out of class studying each week. With any time not spent studying or in class, Doug can earn \$10 painting houses.

Describe Doug's "cost function" for achieving a midterm score of  $Q$ , that is the cost per week, measured in foregone wages, required for Doug to get a score of  $Q$  on the midterm.