Problem Set II: Costs, Competitive Output, and Labor Supply

DUE DATE: Thursday, November 2, 2017, at the beginning of lecture. NO late papers will be accepted! PLEASE write your answers in the spaces provided on this handout. Be neat: illegible answers will not receive credit. Show your main calculations on each page or on the back. This problem set is to be only your own work.

Problem 1: Cost Minimization

a. Steve’s Ice Cream can produce ice cream using combinations of labor and capital. The following combinations of L and K lie on the indicated isoquants, with the amount of labor listed first in each combination, capital second:

\( Q=5 \) (gal) Isoquant: \((4,20)\) \((6,13)\) \((8,9)\) \((12,6)\) \((18,4)\)
\( Q=6 \) (gal) Isoquant: \((6,22)\) \((7,16)\) \((8,12)\) \((12,8)\) \((19,7)\)

Graph these isoquants on the next page, putting labor on the horizontal axis and capital on the vertical. Draw the sections of the isoquants between the listed combinations as straight-line segments.

b. The wage rate is for now $8/hr. The rental rate of capital is $12/hr. Find the cost-minimizing input combination if the output is to be \( Q=5 \) gal. Graph the associated isocost line on the next page and label it IC-A. Enter the input usage, total cost, and average cost data in the following table.

\( Q=5: \) \( L = \) ____\( K = \) ____\( \text{Total } C(Q) = \) ____\( \text{AC}(Q) = \) ____
\( Q=6: \) \( L = \) ____\( K = \) ____\( \text{Total } C(Q) = \) ____\( \text{AC}(Q) = \) ____

Repeat this procedure for \( Q=6 \) gal., labeling the isocost line IC-B.

The marginal cost of producing the sixth gallon is: ____

Between \( Q=5 \) and \( Q=6 \), returns to scale are: ______________

(Hint: Is your returns to scale answer consistent with the values of marginal and average cost entered above?)

c. Steve's workers, tired of being exploited, organize a union and win a wage increase to $18/hr. Recompute the input usage and cost data from b. Draw the new isocost lines. Label the new isocost line for \( Q=5 \) as IC-C, and the new one for \( Q=6 \) as IC-D. Fill out the following table.

\( Q=5: \) \( L = \) ____\( K = \) ____\( \text{Total } C(Q) = \) ____\( \text{AC}(Q) = \) ____
\( Q=6: \) \( L = \) ____\( K = \) ____\( \text{Total } C(Q) = \) ____\( \text{AC}(Q) = \) ____

The marginal cost of producing the sixth gallon is: ____

Between \( Q=5 \) and \( Q=6 \) returns to scale are now: ______________
Problem 2: Short-Run Competitive Supply

Next to Steve’s Ice Cream is Molly’s Doughnuts. Assume that there are many small, independent doughnut stores in the same neighborhood, that Molly’s doughnuts are just like everybody else’s, and that all doughnut stores clearly advertise their prices. (I.e., Molly’s business is a perfect competitor.)

a. At Q=1, Molly’s sunk costs (SFC) are $8 and her short-run total cost (STC) is $14. Her STC figures for other outputs are given in the following table. Complete the table by entering the values of SFC, short-run avoidable cost (SVC), short-run average total cost (SATC), and short-run average avoidable cost (SAVC) for each output up to Q=7. Enter also the short-run marginal cost (SMC) incurred in going from one output to the next. (I.e., fill in all the unshaded boxes.)
b. On the axes at the right, graph the SAVC and SATC at each output level in the table. For visual clarity, connect adjacent points with straight-line segments. Also graph the SMC of going from one output to the next, using the stair-step method. Finally, indicate on the graph Molly’s short-run competitive supply curve. Be sure to mark each curve clearly!

c. Suppose that all of Molly's sunk costs are also long-run fixed costs. (This is the “special case” we discussed in class.) Then her long-run total costs (LTC) are identical to her short-run total costs. For what price range in (b) would her supply decision be different in the long run than in the short run?

Price range:_________

What would the long-run output(s) be for these prices? (Hint: Calculate LATC and LMC from LTC.)

Output(s):___________
Problem 3: Competitive Labor Supply

a. Roger derives utility from consuming "goods," G, and leisure, R, each (24-hour) day. Points along three of Roger's indifference curves are as follows, where in each bundle the amount of R is listed first and the amount of G second.

IC-1: (7,12) (8,7) (10,4) (16,2) (24,1)
IC-2: (9,12) (10,7) (12,4) (16,3) (24,2)
IC-3: (11,12) (12,8) (14,5) (18,4) (24,3)

Graph and label these indifference curves on the next page, assuming that the IC sections between adjacent bundles are straight line segments. Graph leisure on the horizontal axis.

b. The price of goods, p, will be $36 throughout. Consider three different wage levels, w1 = $9/hr., w2 = $12/hr., and w3 = $18/hr. Graph the three corresponding (24-hour day) budget lines and label them, respectively, BL-1, BL-2, and BL-3. Label the corresponding demanded bundles A, B, and C. Use the results to complete the following table with information on amounts of leisure and goods consumed and labor supplied for each wage level.

<table>
<thead>
<tr>
<th>p</th>
<th>w</th>
<th>Leisure (R)</th>
<th>Goods (G)</th>
<th>Labor Supplied</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>9</td>
<td>__________</td>
<td>_________</td>
<td>__________</td>
</tr>
<tr>
<td>36</td>
<td>12</td>
<td>__________</td>
<td>_________</td>
<td>__________</td>
</tr>
<tr>
<td>36</td>
<td>18</td>
<td>__________</td>
<td>_________</td>
<td>__________</td>
</tr>
</tbody>
</table>

c. Use the "arc" method to compute the elasticity of labor supply with respect to the wage rate between bundles A and B: __________

Between B and C: __________

What term is used to describe the shape of Roger's labor supply curve? (Hint: Sketch a graph.) __________

Use the "arc" method to compute the (cross) elasticity of demand for G with respect to the wage rate between bundles A and B: __________

Between B and C: __________