18 PROFIT MAXIMIZATION FOR THE COMPETITIVE FIRM

Purpose: To practice application of the rule for a competitive firm to maximize profits: MR = MC.

Computer file: **pcmax98.xls**

Instructions and questions:

You are a management consultant to the **CLEAN CREW SERVICE CO.**, a small provider of apartment cleaning services in a large market with many competitors. The graph shows the short-run average cost curve for the production of **CLEAN CREW**'s services. Quantity is the number of apartments cleaned per day. Average and marginal costs, as well as market price, are measured on the vertical axis. The base value for fixed cost is $250, and the amount of tax on the firm's output is zero.

Market price is determined in the market for apartment cleaning services, but you can adjust it to any value you want for experimental purposes, and to formulate sensible management policies. Your job as a consultant is to recommend an output level to **CLEAN CREW**'s management under a variety of economic conditions. When you choose an output level, Excel computes and shows the corresponding levels of total, average, and marginal cost, as well as the amount of total revenue. You'll need a hand calculator to compute total profit (total revenue minus total cost) at each output level you choose.

Total profits are maximized at the output level where marginal revenue equals marginal cost. Marginal revenue equals price for a competitive firm. Another way to say the rule is that marginal revenue minus marginal cost must be zero for total profit to be a maximum. The value of MR-MC for any output you choose is displayed on the worksheet. As you experiment with different output levels you can see MR-MC change. *For profit to be a maximum, MR-MC must be zero.*

An easy way to find the output where profit is zero is to use Goal Seek. Within Goal Seek you want MR-MC to be zero by changing output.

Here are some things to watch for and learn as you do the problems:

1) THE PROFIT MAXIMIZING OUTPUT IS THE ONE WHERE MR = MC. SO WHEN MR MINUS MC EQUALS ZERO, PROFIT IS MAXIMIZED.

2)   The most common error that people make in thinking about profit maximization is that profit is maximized at the bottom of the average cost curve. Total profit is not maximized at the bottom of the average cost curve.

3)   If MR is greater than MC, increasing output will add more to revenue than to costs, and so increase profit.

Here are some hints to help you get the answers quicker:

1)   Use Goal Seek this way to find the output where profit is maximized.
(a) Select the cell that contains the current value for MR-MC(NEW) by clicking on it. Choose Goal Seek from the Tools menu. The dialog box provides space to enter the three pieces of information: *MR-MC, zero, and output*.
b) The value in the Set Cell box is F18. If the Set Cell box does not contain F18 (or F218), edit the box until it does.
c) Click on the To Value box. Use the keyboard to enter the number zero (0), but don't hit the Enter key.
d) Click on the By Changing Cell box. Because you want to change *output* to get MR-MC equal to zero, click on the current value for output, cell F29. F29 is displayed.
e) Click on the OK button.
f) Excel displays another dialog box showing the status of goal seeking. To incorporate the results into the worksheet, click on OK. To return to the values you started with choose Cancel.

2)   Use the Answer Bin to get the word answers if necessary.

MATH MAVEN'S CORNER: The total cost curve when there is no tax is given by $TC = 250 + aQ + bQ^2$, where Q is output. Total revenue is pQ, where p is the price of output. Profit = $TR - TC$. To maximize profit, take the derivative of profit with respect to output and set the derivative equal to zero. By definition, *MR* is the derivative of *TR* with respect to Q, and *MC* is the derivative of *TC* with respect to Q. Maximizing profit therefore requires *MR = MC*. Note that for a competitive firm *MR always* turns out to be equal to price.

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Questions

Set fixed cost and the tax to their baseline values.
1) At what level of output is average cost minimized?

Set all variables to their baseline values.
2) If price is $60 per apartment, and the firm tries to minimize average cost, what are total costs of the firm?

Set price to $60, as in question 2), and set output where AC is minimized.
3) What's the firm's total revenue?
4) What's the firm's total profit?

Set all variables to their baseline values, and set price to $60.
5) At what output is total profit maximized?
6) What's total revenue at that output?
7) What's total cost at that output?

With variables at baseline values, set the price to $60.
8) What's total profit when profit is maximized? [Compare to answer 4.]

With fixed cost and tax at their baseline values, set output to the level where profit is maximized.
9) What is marginal cost at that output?

Following on from question 9:
10) What is marginal revenue at the profit maximizing output?
11) What is profit per unit of output (average profit) at that output?

Set all variables to baseline values. Set price to $20.
12) How much should the firm produce to maximize profit?
13) How much should the firm supply?

Now raise price to $30.
14) How much should the firm produce to maximize profit?
15) How much should the firm supply?

Now raise price to $40.
16) How much should the firm produce to maximize profit?
17) How much should the firm supply?

18) Given the price of output, which curve shows the amount the firm wants to supply? [Enter mc or ac.]

19) Set price back to $60, and set output to the profit maximizing amount. Print out the sheet, construct, and shade in the area that shows *total profit*. TURN IN THE PRINTOUT AS REQUESTED BY YOUR INSTRUCTOR.