Questions and Problems, Ch. 7 (100%: 25 points; maximum, 30 points)
The point total for each question is given in parenthesis before the question or problem number. Answers need not be typed, but they must be legible and presented as complete sentences. Points will be deducted for incorrect grammar, and mistakes of an analytical, mathematical, or graphical nature. Generally a 10 point question that asks for a verbal response should be about three quarters of a page in length. Feel free to work on the questions and problems together, but no coping is allowed. Also, feel free to ask about the homework in class, or in my office. Q&P designated as a “Spreadsheet Problem” are intended to familiarize yourself with the basics of using a spreadsheet. Include the spreadsheet with your answers.

(10)7-1. Spreadsheet Problem: A firm has the following short-run production function: \( Q = 50L + 6L^2 - 0.5L^3 \) with the corresponding marginal product of labor equation, \( MP_L = 50 + 12L - 1.5L^2 \) where \( Q \) = quantity of output per week; and \( L \) = number of workers per week.

a. Provide a table showing total product, average product, and marginal product varying labor in increments of one unit from zero to 11.
b. When does the law of diminishing returns take effect?
c. Calculate the range of values for labor over which stages I, II, and III occur.
d. Assume each worker is paid $10 per hour and works 40 hours per week. How many workers should the firm hire if the price of output is $10. Suppose the price of output falls to $7.50. What do you think would be the short-run impact on the firm’s production? The long-run impact.
e. Graph the production function over the range 0 to 11 units of labor. On a separate graph, plot the \( MP_L \) and the average product of labor over the same range of labor.

(10)7-2. Spreadsheet Problem: The owner of a car wash is trying to decide on the number of people to employ based on the following short-run production function: \( Q = 6L - 0.5L^2 \), with the corresponding marginal product of labor equation, \( MP_L = 6 - L \).

a. Generate a schedule showing total product, average product of labor, and marginal product of labor using a range of labor inputs 0 to 6.
b. Plot the production function and the \( AP_L \) and \( MP_L \) on two graphs.
c. Suppose the price of a basic car wash is $5. How many people should be hired if each worker is paid $6 per hour?
d. If the owner can hire students on a part-time basis for $4 per hour, should he hire assuming he/she keeps the other workers and continues to pay them $5 per hour?

(10)7-3. The owner of a small car-rental service is trying to decide on the appropriate numbers of vehicles and mechanics to use in the business for the current level of operations. He recognizes that his choice represents a trade-off between the two resources. His past experience indicates that this trade-off is as follows:

<table>
<thead>
<tr>
<th>Vehicles</th>
<th>100</th>
<th>70</th>
<th>50</th>
<th>40</th>
<th>35</th>
<th>32</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanics</td>
<td>2.5</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>25</td>
<td>35</td>
</tr>
</tbody>
</table>

a. Assume the annual (leasing) cost per vehicle is $6,000 and the annual salary per mechanic is $25,000. What combination of vehicles and mechanics should he employ?
b. Illustrate the problem with the use of an isoquant/isocost diagram. Indicate graphically the optimal combination of resources.