10.14 Exercises

1. Imagine a river basin with a water supply that is large in relation to water use by any single user group. Enter this water supply as a fixed quantity, $\overline{W}$, on a two-axis (w, $) graph. Within this basin, let's call the user groups "people factories" and assume they are all identical. Draw a MNB function for a single factory on the graph, scaling the function appropriately for the setting described thus far.

a. As long as the summed demand of all people factories does not challenge available basin supply, what point on the single MNB function best describes a factory's "requirement"? Why?

b. Make use of your graph in a discussion that portrays the growth process as a slow, incremental increase in the number of people factories. (Every n years a new factory pops up.) Assume that water use by these factories is strictly rival. Illustrate aggregate natural water demand as a complement to your discussion and include it within your discussion. Is the idea of a requirement misdirected throughout this basin's history?

2. Program the point expansion method into a spreadsheet or other computer program. Set it up so that you may easily enter the three required numbers: elasticity, point quantity, and point price. The program should output four clearly labeled functions or parameters for these four functions: linear demand, inverted linear demand, constant elasticity demand, and inverted constant elasticity demand. Once completed, you should be able to change any of the three input numbers and automatically get all four functions. Use these inputs in the final, saved, and printed edition of your program: $\varepsilon = -0.4$ and $(w,p) = (160,2.5)$.

3. Redraw figure 10.1 for a three-activity setting with the following parameters: $K = 30$, $\{w_1, w_2, w_3\} = \{2400, 1000, 400\}$, and $\{\pi_1, \pi_2, \pi_3\} = \{200, 100, 50\}$. Precisely label the relevant axes markings. For example, do not simply label p' on the price axis; put a number there.

4. Use the specifications of the prior problem to compose a precisely stated linear programming problem, like that produced in box 10.1.

5. The availability of an actual data set for box 10.2 allows you to conduct your own regression analysis of residential water demand. Many computer programs are capable of doing ordinary least squares regression – for example, Excel does this. Using the 1,080 observation data set given on the Web site, reestimate demand using the marginal price (MP) variable instead of average price. What differences occur? (By the way, the use of AP or MP specifications has been highly debated in water demand literature.)