ECON 321, Assignment 3:
BP, Chapter 2: 2.2 and 2.3

1. Read Section 2.2.1 and 2.2.2.

2. As you know, with a monopoly, you can just as easily use q as the choice variable as p, since they are both determined along the same demand curve. The section "The Monopoly Pricing Formula" takes the q approach, but it may be more typical to have a monopoly choose price. In that case, consider the following alternative version:

Define the ***price elasticity of demand*** in a market by $\eta = \frac{dQ}{dp}\frac{p}{Q}$

and recall that ***revenue*** is pQ

Then we can define ***marginal revenue*** by

$$MR = \frac{dpQ}{dQ} = \frac{dp}{Q}Q + p\frac{dQ}{dQ} = p\frac{1}{\eta} + p = p\left(1 - \frac{1}{|\eta|}\right)$$

That means we can write the standard monopoly profit max condition, MR=MC as

$$p\left(1 - \frac{1}{|\eta|}\right) = MC \Rightarrow p - MC = \frac{p}{|\eta|} \Rightarrow \frac{p - MC}{p} = \frac{1}{|\eta|}$$

where the ***Lerner Index*** is equal to one over elasticity.

3. The sections "Monopoly Pricing: Several Goods" and "Linked Demands, Unlinked Costs" are particularly interesting. Let's simplify the profit maximization problem, using a demand system similar to what we worked with in the last assignment:

$$Q_1(p_1, p_2) = a - bp_1 + dp_2 \qquad Q_2(p_1, p_2) = a - bp_2 + dp_1$$

And to keep things simple, just make the marginal costs constant: $C_1'(q_1) = c_1$ and $C_2'(q_2) = c_2$.

4. With these simplifications, show the first order conditions in the form shown in the L_i equation in the "Linked Demands, Unlinked Costs" section.

5. Let's confirm the logic about how pricing changes if the products are complements or substitutes. Set up a Mathematica notebook with the demand functions, profit functions, first order conditions, optimal prices, and optimal quantities. (Each one is just a solution or modification of the previous.)

7. Now evaluate the optimal quantities with the parameters $a = 10, b = 2, c_1 = 1, c_2 = 1$ and trying out $d = 0$, $d = 1$, and $d = -1$. Does this confirm the book's results?

8. Can you think of some real world firms that produce two products and price them lower or higher than they (probably) would if they produced only a single product? (E.g. an auto firm might raise prices on cars and SUVs if they are substitutes.)

9. Keep reading, especially section 2.3. We will circle back to the SSNIP test, m-firm concentration indices, and Herfindahl indices in future classes.