Assignment #1 for Managerial Economics, ECO 351M, Fall 2016
Due, Monday Sept 12.

1. From Ch. 3 of Kreps's *Micro for Managers*,
   a. Problem 3.1.
   b. Problem 3.2.
   c. Problem 3.8.
2. From Ch. 3 of Kreps's *Micro for Managers*,
   a. Problem 3.9.
   b. Problem 3.11.
3. From Ch. 4 of Kreps's *Micro for Managers*,
   a. Problem 4.4.
   b. Problem 4.6.
   c. Problem 4.8.
4. From Ch. 4 of Kreps's *Micro for Managers*,
   a. Problem 4.9.
   b. Problem 4.10.
   c. Problem 4.13.
5. From Ch. 5 of Kreps's *Micro for Managers*,
   a. Problem 5.3.
   b. Problem 5.4.
   c. Problem 5.5.
6. From Ch. 5 of Kreps's *Micro for Managers*,
   a. Problem 5.11.
   b. Problem 5.12.
7. A biotech firm spends $x \geq 0$ researching a cure for a rare condition (for example, one covered by the Orphan Drug Act), its expected benefits are $B_1(x)$, the social benefits not capturable by the firm are $B_2(x)$, and both are increasing functions.
   a. Show that the optimal x is larger than the one the firm would choose.
   b. Show that allowing the firm to capture more of the social benefits (e.g. by giving longer patents or subsidizing the research), governments can increase the x that the firm chooses.
8. An oil company owns the right to pump as high a flow of oil from their well located over one part of an underground sea of oil. As a function of the flow they choose, f_i, they make profits this year of $\Pi_i(f_i)$. The higher the flow chosen now, the higher the costs, $C_i(f_i)$, of pumping oil in the future (if you pump too hard, the small openings in the underground rock through which the oil flows begin to collapse). Higher flow also increases the future costs of the other oil companies pumping from the same underground sea. Show that the flow chosen by i is inefficiently high. (Oil fields often operate under what are called unitization agreements in order to solve these kinds of problems.)
9. One part of the business model of a consulting company is to hire bright young men and women who have finished their undergraduate degrees and to work them long hours for pay that is low relative to the profits they generate for the company. The youngsters are willing to put up with this because the consulting company provides them with a great deal of training and experience, all acquired

over the course of the, say, three to five years that it takes for them to burn out, to start to look for a job allowing a better balance of the personal and professional. The value of the training that the consulting company provides is at least partly recouped by the youngsters in the form of higher compensation at their new jobs. Show that the consulting company is probably providing an inefficiently low degree of training.

10. For $x, t \in [1200, 1900]$, let $f(x,t) = xt$. Since $\partial^2 f/\partial x \partial t = 1$, this function has strictly increasing differences, and since $\partial f(x,t)/\partial x > 0$ for all x, t, $x^*(t) \equiv \{100\}$. Let $g(x,t) = \log(f(x,t)) = \log(x) + \log(y)$ and note that $\partial^2 g/\partial x \partial t = 0$, strictly increasing differences have disappeared, but $\partial g(x,t)/\partial t > 0$ for all x, t. Let $h(x,t) = \log(g(x,t))$, and $\partial^2 h/\partial x \partial t < 0$, strictly increasing differences have become decreasing differences, but $\partial h(x,t)/\partial x > 0$ for all x, t. The problems $\max_{x \in [1200,1900]} h(x,t)$ provide an example of strictly decreasing differences with a non-decreasing $x^*(\cdot)$.
11. Suppose that an organization has 4 subdivisions, each subdivision has 3 possible projects, projects $k = 1, \ldots, 12$, project k, if run at proportion α, $0 \leq \alpha \leq 1$, gives benefit αB_k and costs αC_k of a scarce resource. The company has a total of $1,200$ of the scarce resource. We are going to work through how to solve the company's problem of picking the right projects to fund, first by asking what would happen if each division is allocated 300 of the $1,200$ in resources, that is, if each of the four is allocated $\frac{1}{4}$ of the total. To do this, we need the data on the projects' benefits and costs, which is

Division	Project	B_k	C_k	B_k/C_k
I	1	600	100	6
	2	1,400	200	7
	3	1,000	200	5
II	4	500	50	10
	5	750	250	3
	6	1,000	200	5
III	7	900	100	9
	8	3,500	500	7
	9	1,600	400	4
IV	10	800	100	8
	11	1,000	250	4
	12	1,200	400	3

Give, as a function of the price p charged for the resource each division's demand for the resource. Summing these demands gives the total demand curve for the resource. The supply curve is fixed at $1,200$. Find the intersection of the demand and the supply curves.