

This problem set is worth 100 points. You should choose problems adding up to at least 100 points (write at the top of your problem set which ones you have chosen) and complete them.

Reading: 17.1-17.6 of Easley and Kleinberg. You do NOT need to read 17.7.

1. **(20 points)** Problem 1 in EK Chapter 17. In addition, after part (c), analyze three steps of the dynamic behavior of the population (as in Section 17.4) if the price is $p = \frac{1}{4}$ and the initial fraction of the population using the product is $z_0 = \frac{3}{4}$. Graph the dynamics in a staircase plot.

2. **(20 points)** Problem 2(a,b) in EK Chapter 17.

3. **(20 points)** Problem 3 in EK Chapter 17.

4. **(20 points)** Problem 4 in EK Chapter 17.

5. **(40 points)** Consider the example worked out in EK Section 17.4 where $r(x) = 1 - x$, $f(z) = z$, and it is derived that

$$g(z) = \begin{cases} 1 - p/z & \text{when } z \geq p \\ 0 & \text{otherwise.} \end{cases}$$

Here p is the price the monopolist charges. Throughout, assume the equilibrium reached in the staircase iteration starting from $x = 1$ is played. Throughout, also assume that the monopolist's marginal cost of serving consumers is 0.

- a. (5 points) Suppose that $p = 1/10$. Calculate consumer surplus and producer surplus.
- b. (7 points) Suppose that p is increased slightly from an initial value of $1/10$. Does consumer surplus increase, decrease, or stay the same relative to (a)? If you can, give and explain the answer precisely without calculations.
- c. (5 points) Answer (b) for the producer surplus. Now (and for the rest of the problem) you may do calculations as needed, including numerical ones.
- d. (10 points) Suppose the monopolist seller can charge any price it wants. What price should a profit-maximizing monopolist charge, to two decimal places?
- e. (5 points) What are consumer and producer surplus at the outcome you identify in (d)?
- f. (8 points) What is the value of p where a (half) stable equilibrium with positive z exists, but fails to exist for any $p' < p$? Can this be a profit-maximizing price for the monopolist? Why or why not?

6. (20 points) Consider the network market effects model of EK Chapter 17. Suppose the market finds an equilibrium level of demand by doing iterative best-response (“staircase”) dynamics from an initial level of demand $z_0 \in (0, 1)$. Can changing the price of the good slightly (say, less than 2%) cause a large jump in demand? If this is possible, (i) draw an example of a g curve before and after the slight price change (ii) illustrate how the equilibrium demand is reached in each case and (iii) *describe what features of the environment (e.g., the function g , the initial level z_0) are important to make this possible*. If it is not possible, give a clear explanation of why not.