SECTION # 5

- Versioning
  - 4X, Q1
- Short-run and long-run supply
  - 4X, Q6 and PS 4, Q3
- Questions on problem set 4
- Oligopolistic competition (Nash equilibrium, Bertrand, Cournot)

Versioning concepts

- Pricing such that market segments self-select with respect to different versions
  - Works only when willingness to pay of segments observable
  - Inelastic demand segment buys high-priced premium version
  - Elastic segment buys stripped-down version at low price

- To solve versioning problems
  - Price low-end version at low type customer's willingness to pay
  - Price high-end version at: (high type customer's willingness to pay – high type customer surplus from buying low-end version)
  - Compare profit of selling two versions versus profits of selling one version to one/all segments

(Quantity)Versioning example (4X-Q1)

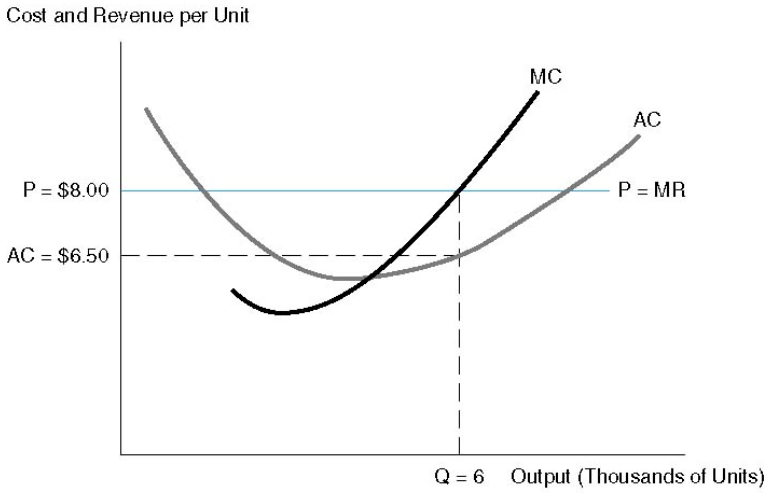
- Want to sell 1L & 2L bottles of OSKI juice
- A values at $3.25 & $5; B values at $4 & $7
- MC = $1 per liter; 1000 cust in A, 1200 in B
- What are the prices for 1L & 2L bottles?

	A 1000	B 1200
1L	3.25	4
2L	5	7

- Set price of 1L = 3.25. (A gets C.S. of 0 and B gets C.S. = 0.75)
- Price of 2L has to be at most (7 – 0.75) = 6.25 for B to buy 2L
- At 1L=$3.25 & 2L=$6.25, π = (3.25 – 1).1000 + (6.25 – 2).1200 = 7350
- This is greater than π = 6600 ((5 – 2).2200) obtained by selling only 2L
- <u>Price 1L at 3.25 and 2L at 6.25</u>

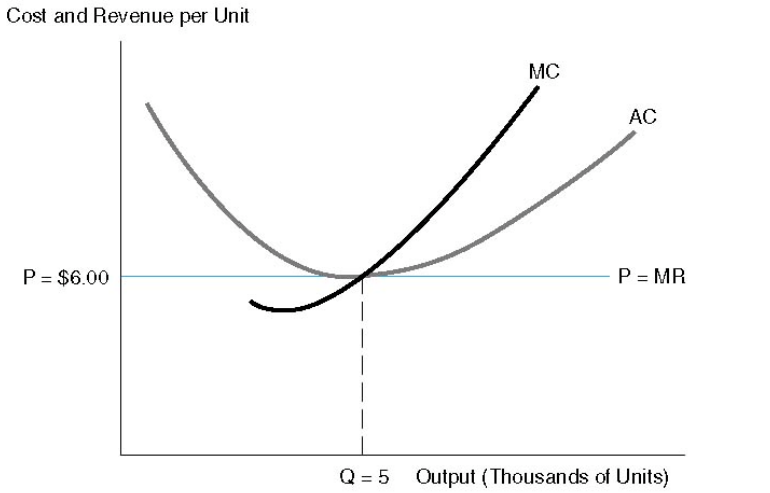
Short-run & long-run supply concepts

- A supply curve for a firm tells us how much output it produces at every possible price
- A firm's short-run supply curve is the portion of its MC curve above the average cost curve
- Firms are earning profits in the short run so long as P > AC
- $\pi > 0 \Rightarrow TR > TC \Rightarrow P.Q > AC.Q \Rightarrow P > AC$



(a) A Competitive Firm's Optimal Output

- In long run, firms enter & reduce profits
- Price is pushed down to AC_{MIN}
- In the long run AC = MC for each firm and we get **$P = MR = MC = AC_{MIN}$** (since AC = MC at AC_{MIN}) and $\pi = 0$



(b) Long-Run Equilibrium in a Competitive Market

- Firm shuts down & exits if $P < AC_{MIN}$
- Note: MC curve intersects the AC curve at AC_{MIN} or where slope of AC curve $(d(AC)/dq) = 0$

Short-run v/s long-run example (4X-Q6)

- Price-taking firms in electrical plug (homogenous good) industry
- Each plug plant has annual $TC = 980 + 20q^2$; $MC = 40q$,
- Market demand $Q = 99{,}960 - 50P$

A. If market price per plug, P = 400, calculate short-run q and π

- $P = MC \Rightarrow 40q = 400$, $\underline{q = 10}$
- $\pi = 4000 - (980 + 20.100) = 4000 - 2980 = \underline{1020}$

B. Calculate long-run price, quantity, profit per firm and *n* of firms

In the long run, each firm produces at AC_{MIN} *i.e.* where AC = MC

- $980/q + 20q = 40q \Rightarrow \underline{q = 7}$
- $P = MC = 40q = \underline{280}$
- $Q = 99{,}960 - 50.280 = \underline{85{,}960}$
- $N = Q/q = 85{,}960/7 = \underline{12{,}280}$

Short-run v/s long-run example (4X-Q6)

C. Effect of 1900 tax per year on each plug plant
   - Raises TC (and AC) of each firm to $2880 + 20q^2$ (& $2880/q + 20q$)
   - The point of AC_{MIN} (where MC intersects AC) moves up
   - To find new profit maximizing point, set $2880/q + 20q = 40q$
   - q=12, P = MC = 40q = 480
   - Q = 99,960 – 24,000 = 75,960; n = 75,960/12 = 6330
   - In comparison to (B), q & P have gone up; Q and n have gone down.

D. If 20 firms are exempt from taxes
   - Nothing changes except …
   - Tax exempt firms earn 1900 per year in economic profits

PS4, Q 3

- Each pencil plant has $TC = 400 + q^2$ ($AC = 400/q + q$, $MC = 2q$)

A. If P=100, what are q, p and π?
- P= 100; MC = P ⇒ 2q = 100 ⇒ q = 50
- π = TR − TC = 100·50 − (400 + 50^2) = 2100

B. If market demand is Q = 50000 − 200·P, (& P = 100), how many firms in industry?
- Q = 30,000. If each firm is producing 50, then n = 30,000/50 = 600 firms.

C. What are long-run P, Q, n?
- new firms can enter and at P = 100, make positive economic profits
- Firms produce at AC_{MIN} in long run, i.e. where AC = MC
  ⇒ 400/q +q = 2q ⇒ q = 20 and MC = 2.20 = 40. P = 40
  Q = 50000 − 200 · 40 = 42000 and n = 42000/20 = 2100

D. If n = 2100, what is short-run industry supply?
- each firm in the market has a supply curve of MC = P = 2q
- MC = P = 2q ⇒ q = P/2. Q = 2100·(P/2) = 1050·P

E. Long run supply curve is perfectly elastic and is a horizontal line at P = 40

PS4, Q3

F . Now, one firm has technology to produce pencils more cheaply (at one plant), so that TC = 200+ $q^2/2$ (AC = 200/q + q/2 and MC = q). What is the effect on π, P, n?

- MC = P ⇒ <u>q = 40</u>. TR = 40·40 = 1600 and TC = 200 + 800 = 1000, <u>π = 600</u>
- Produce twice as a high cost firm, and one firm exits out of the industry

G. Firm patents new production technology and replicates it. How many plants?

- Charge <u>P = 39.99</u> and capture the entire market.
- Produce at AC_{MIN} i.e. where AC = MC ⇒ 200/q + q/2 = q ⇒ <u>q = 20</u>
- sell q = 42,000 by producing at 42,000/20 = <u>2100 identical plants</u>
- profit is $400 per plant for a total profit of <u>$840,000</u>

Nash equilibrium

- IN Nash Equilibrium, each player makes decisions that give her the highest payoffs, given the actions of her competitors, i.e.
  - I'm doing the best I can given what you are doing
  - You are doing the best you can given what I'm doing
- Finding NASH equilibrium
  - Prisoner's dilemma (1 NE = confess, confess)
  - Battle of sexes (2 NE Boxing, Opera and Opera, Boxing)

Prisoner B

Prisoner A	Confess	Don't confess
Confess	-5, -5	-1, -10
Don't confess	-10, -1	-2, -2

JILL

JACK	Boxing	Opera
Boxing	2, 1	0,0
Opera	0,0	1, 2

Oligopolistic competition

- Cournot model
  - Firms produce homogenous goods
  - Each firm treats the output of the other as fixed and decides how much to produce
  - Cournot equilibrium is a NASH equilibrium because each firm is doing its best, given what the other firms are doing

- Bertrand model
  - Firms produce homogenous goods
  - Firms compete by simultaneously choosing a price instead of quantity
  - Bertrand equilibrium is where both firms price at marginal costs and make zero profits (also a NASH equilibrium)