PROBLEM SET THREE--MBA 5110

1. Suppose a competitive firm has $C = \$1800 + 2q^2$ and $P = \$100$.
   a) Find the firm's profit-maximizing q and its π.
   b) If each firm has identical cost, is the market in long run equilibrium? If it is not, what will happen, & what will P equal in the long run? If $\pi < 0$ currently, *will* each firm operate?

2. Suppose *FC* increases by the same amount for each firm in a competitive market (when firms have identical *C* functions & sell the same product). What happens to *P*, *q*, *Q*, & π in the short run & in the long run?

3. In Table 1, is there a DS e in the game? If not, are there any Nash e? If there are more than one Nash e, how can the game have a solution?

Table 1		Betty	
		Left	Right
Abe	Top	6, 3	3, 2
	Bottom	4, 7	5,8

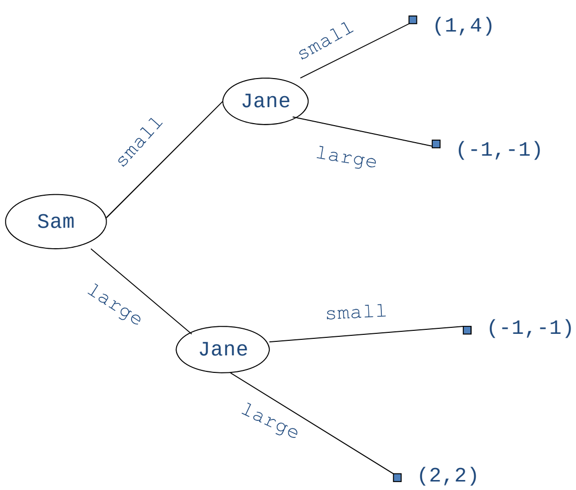
4. In Table 2, is there a DS e?

Table 2		Zeke	
		Deny	Confess
Babe	Deny	-1,-1	-10, 0
	Confess	0,-10	-8,-8

5. Find the sub-game perfect Nash equilibrium in Figure 1. What happens if Jane insists she will always choose *small*?

Figure 1

The 1st # in parentheses is Sam's payoff.



Answers

1. a) $MC = \frac{\partial C}{\partial q} = 4q$. A price taker has $MR = P$, so $MR = \$100$, & π is max when $100 = 4q$, so $q =$ **25**. $\pi = R - C = Pq - C = 100(25) - 1800 - 2(25)^2 =$ **- \$550**.

   b) Since $\pi < 0$, this is not a long run e (e means equilibrium). Firms will operate in the short run because $AVC = 2q = \$50 < P = \$100$. In the long run, exit will occur, & fewer firms ⇒ market supply decreases, $Q\downarrow$, & $P\uparrow$. For the long run ($\pi = 0$), P must $= AC$, which (since $P = MR = MC$ for a π-maximizing price taker) only happens if $MC = AC$, which occurs at the minimum point of AC. To find the minimum pt. of AC, set $MC = AC$:

   $4q = 1800/q + 2q$, or $q^2 = 900$, so $q =$ **30**.

   Insert 30 into MC or AC to find $MC = AC =$ **\$120---**the P in long run e.

2. In the short run, $C\uparrow$ (@ any q), so $AC\uparrow$, & also $AFC\uparrow$. Since $\Delta VC = 0$, $\Delta MC = 0$: C shifted up parallel to the old C. Since MC did not change, nor did the # of firms (in the short run), market supply did not change. Demand has not changed, so P & Q have not changed. Total output not changing does not prove q did not change (some could produce more & others could produce less if firms were not identical), but because $MR = P$ for a price taker, & P & MC did not change), in fact $\Delta q = 0$ for each firm. With $C\uparrow$, $\pi\downarrow$, so, if we started in long run equilibrium ($\pi = 0$), we now have $\pi < 0$. Exit will occur in the long run, causing, $P\uparrow$, $Q\downarrow$, & $q\uparrow$. Each firm can produce more with $Q\downarrow$ because there are fewer firms.

3. No DS for either player. 2 Nash e: {*top*, *left*} & {*bottom*, *right*}. Abe prefers {*top*, *left*} & Betty prefers {*bottom*, *right*}, so she tries to commit to *right*, & he tries to commit to t*op*. If one succeeds, that tells us which Nash e we will see.

4. Both have DS: *confess*, so DS e is {***confess***, ***confess***}.

5. {***large***, ***large***} is SGP Nash e. If Jane announces a strategy of always going *small*, & he believes this, the Nash e is {*small*, *small*}. However, he should not believe this unless a) she has committed to *small*; or b) this is part of a repeated game, so it pays her to develop a reputation for going *small*.