Suggested Solutions of First Midterm Exam

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1 BDM

a. The bids 4 and 5 are not weakly dominated. For all the other bids, they are all weakly dominated by bidding 5.

		random number				
		3	4	5	6	7
bid	$x \leq 2$	0	0	0	0	0
	3	2	0	0	0	0
	4	2	1	0	0	0
	5	2	1	0	0	0
	6	2	1	0	-1	0
	$x \geq 7$	2	1	0	-1	-2

b. I should bid 3 or 4 since they give me the largest expected payoff ($\frac{2}{5}$).

		random number				
		3	4	5	6	7
bid	$x \leq 2$	0	0	0	0	0
	3	2	0	0	0	0
	4	1	1	0	0	0
	5	0	0	0	0	0
	6	-1	-1	-1	-1	0
	$x \geq 7$	$5-x$	$5-x$	$5-x$	$5-x$	$5-x$

2 Extensive Form Game

a. The normal form is

		Incumbent	
		S	W
Entrant	E	$(1,1)$	$(-1,-1)$
	N	$(0,2)$	$(0,2)$

Note that the strategies are:

E: enter the market
N: not enter the market
S: share the market
W: start a war

b. The Nash equilibria are (E, S) and (N, W). The best response is as follows:

		Incumbent S	Incumbent W
Entrant	E	$(^*1, 1^*)$	$(-1, -1)$
	N	$(0, 2^*)$	$(^*0, 2^*)$

c. Both (E, S) and (N, W) are Pareto efficient. For both Nash equilibria, there is no other outcome that can make one player better off without making someone else worse off.

d. Yes, (N, W) involves the use of weakly dominated strategies. To make a war (W) is weakly dominated by sharing the market (S).

e. The subgame perfect equilibrium is (E, S). By backward induction, if the entrant enters the market (E), the incumbent's best response is to share the market (S). Given that, the entrant's best response is to enter the market

3 Cournot/Hotelling Duopoly

(a) The profit equations for Unbalance (firm 1) and Contrapositive (firm 2) are

$$\begin{aligned} \pi_1 &= (60 - 2x_1 - x_2)x_1 - x_1 \\ \pi_2 &= (60 - 2x_2 - x_1)x_2 - x_2 \end{aligned}$$

(b) For Unbalance (firm 1)

$$\max_{x_1} \pi_1 = (60 - 2x_1 - x_2)x_1 - x_1$$

F.O.C

$$59 - 4x_1 - x_2 = 0$$

The best response is

$$x_1 = \frac{59 - x_2}{4}$$

For Contrapositive (firm 2)

$$\max_{x_2} \pi_2 = (60 - 2x_2 - x_1)x_2 - x_2$$

F.O.C

$$59 - 4x_2 - x_1 = 0$$

The best response is

$$x_2 = \frac{59 - x_1}{4}$$

(c) From the best responses, the Nash Equilibrium is $(x_1, x_2) = (\frac{59}{5}, \frac{59}{5})$