Problem Set # 1

Question 1

a) Identify the rollback equilibrium of this game. Explain in words OR by visually pruning the tree how you arrived at this solution. (4 pts)

Answer :-

If we consider the options player 2 has in the case when player 1 took the Up option, we can see that player 2 will take option Down because it has the highest reward of 6. In this case, player 1 will get a reward of 3.

If we consider the options player 2 has in the case when player 1 took the Down option, we can see that player 2 will take option Up because it has the highest reward of 9. In this case, player 1 will get a reward of 2.

Knowing all this, player 1 will take the option Up because player 1 will get a higher reward (3 vs 2).

This is the rollback equilibrium of the game.

b) In one sentence, give one reason why some people might think the equilibrium in this game is "bad". (2 pts)

Answer :-

The equilibrium in this game is bad because there is another option in which both players 1 and 2 could have got higher rewards viz. player 1 choosing Down and player 2 choosing Down and therefore the players were individually irrational.

Question 2

a) What is the Rollback Equilibrium outcome of this game? Explain in words OR by visually pruning the tree how you arrived at this solution. (4 pts)

Answer :-

If we consider the options the Rival R has in the case when the Incumbent I took the Advertise option, we can see that the Rival R will take option Don't Enter option because it has the highest reward of 3. In this case, the Incumbent I will get a reward of 3.

If we consider the options the Rival R has in the case when the Incumbent I took the Don't Advertise option, we can see that the Rival R will take option Enter because it has the highest reward of 4. In this case, the Incumbent I will get a reward of 2.

Knowing all this, the Incumbent I will take the option Advertise because the Incumbent I will get a higher reward (3 vs 2). The rival will get a reward of 3.

This is the rollback equilibrium of the game.

b) Now suppose the Rival is not flexible – it must commit to an entry decision (Enter or Don't Enter) before observing the advertising decision of the Incumbent. Draw this game tree in its extensive form, making sure to clearly label the nodes (I and R), branches (with the possible actions), and payoffs. Use the payoff information from the initial description of the problem, but as in class make sure to list payoffs in the order in which the players move. Ex: (1st mover's payoff, 2nd mover's payoff). (6 pts)
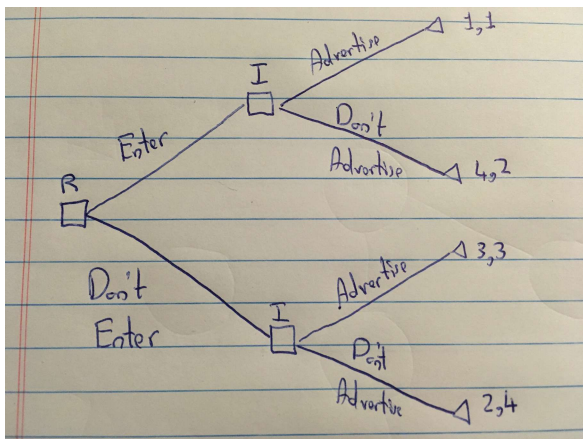
Answer :-

c) What is each firm's payoff in equilibrium in the game in part (b) immediately above? (2 pts)

Answer:-
The payoff for the rival is 4 and the payoff for the incumbent is 2.

d) Compare the Rival's payoffs in both cases (the original game, and the version you drew in part (b). Does this suggest the rival has a first mover advantage, a second mover advantage, neither, or both? Explain. (4 pts)

Answer:-
In the first game, the Rival had a payoff of 3 and in the second game, the payoff was 4. On the other hand, in the first game, the Incumbent had a payoff of 3 and in the second game, the payoff was 2.
Therefore it looks as of if the Rival moves first, he/she will have an advantage over the Incumbent.

e) If there is an advantage to the Rival from moving either first or second, explain in one or two sentences the intuition on why it might arise. If there is no advantage, explain why. (2 pts)

Answer:-
Intuitively looking at the situation, the worst option for the incumbent is to both advertise and the rival to enter. The incumbent prefers to save money because advertising is extremely costly and that's why the Rival gets a first mover advantage.

Question 3

(4 total points). Recall the sequential advertising/entry game from the previous question. Suppose instead that the Incumbent and Rival firms move simultaneously instead of sequentially. Draw this game in its normal (table) form, and find any and all Pure Strategy Nash Equilibria (using any method you wish).

Answer:-

If the Incumbent advertises, then the best option for the Rival is Don't Enter.

If the Incumbent does not advertise, then the best option for the Rival is to Enter.

The Rival does not have a dominant strategy.

If the Rival enters, the best option for the Incumbent is to not advertise.

If the Rival does not enter, the best option for the Incumbent is to not advertise.

The Incumbent therefore has a dominant strategy.

Question 4

a. Is this game constant sum or variable sum? Explain in one sentence. (2 pts)

Answer:-

The game is a variable sum game because the surplus is fixed and does not change.

b. What, if any, are Player 1's dominant strategies?(1 pt)

Answer:-

Player 1 does not have any dominant strategy.

c. What, if any, are Player 2's dominant strategies? (1 pt)

Answer :-

Player 2 does not have any dominant strategy.

d. What strategies, if any, are dominated for Player 1? (2 pts)

Answer :-

Player 1 does not have any dominated strategy.

e. What strategies, if any, are dominated for Player 2? (2 pts)

Answer :-

For Player 2 the Center strategy is dominated.

f. Explain IN WORDS how this game can be solved by eliminating dominated strategies. Make sure your answer includes the ORDER in which strategies get eliminated in this game. If this game cannot be solved using dominance solvability, explain why. (5 pts)

Answer :-

For player 2, every option in Center is worse than the Left strategy. Therefore, Center is dominated and gets eliminated.

Then checking player 1, we can see that every option in the Down strategy is worse than the Middle strategy. Therefore it is eliminated.

For player 2 then, for every option in the Right strategy, the Left strategy is better. Therefore the Right strategy is eliminated for player 2.

For player 1 then, the best strategy is up and therefore the Middle strategy is eliminated for it.

Advertise △ 2,4

④

2

③

	Left	Center	Right
Up	1,2	2,1	1,0
Middle	0,5	1,2	1,4
Down	-1,1	3,0	5,2

Question 5

a. On the above game table, clearly mark the best responses for each player (underlining or circling is ok). (7 pts)

Answer :-

	Column		
	Left	Middle	Right
Top	3,1	7,③	10,2
High	4,⑤	3,0	9,4
Low	2,2	⑤,④	⑪,3
Bottom	⑤,⑥	6,5	8,⑩

Row

b. How many pure strategy Nash Equilibria are there in this game (if any)? What are they? (4 pts)

Answer :-

There are 2 pure strategy Nash Equilibria in the game. They are Column-Middle, Row-Low and Column-Left, Row-Bottom.

c. .A desirable feature of a Nash Equilibrium is that it is "stable". In one or two sentences, explain what this means in the context of the game depicted above. (2 pts)

Answer :-

In the context of the game above stableness means that neither player will get a reward from pursuing another strategy and therefore will not change their strategy. This means that this strategy is the one which is most likely to be followed.