Optimal Dating Strategy :

Albert Cohen

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Abstract

In this paper, we attempt to model a situation where two suitors vie for the attention of an object of affection. We attempt to describe the solution in terms of Game Theory, and especially using the concept of Nash Equilibrium. This game can be used to model the competition between two advertising agencies submitting a proposal bid to a possible client as easily as it models two girls attempting to win the affection of a young man. It is also the belief of the authour that there is an uncertainty involved with different situations (ie advertising vs dating) that may lead to different behaviour of the players involved.

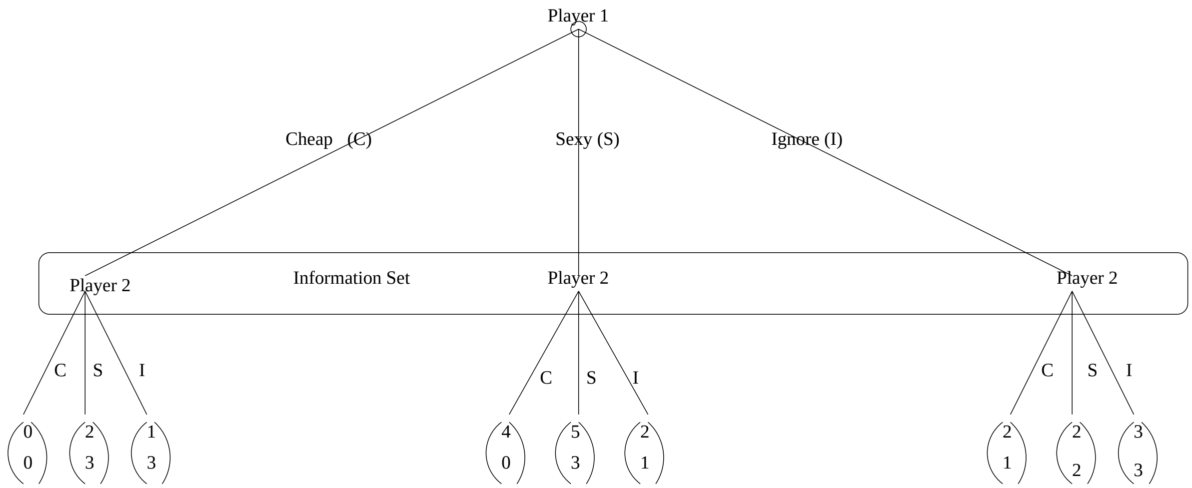

Figure 1: **Extensive Form**: Two suitors, Players 1 and 2, each plan an evening for their sweetheart.(One after the other, and without knowing what the other did.) The three choices are (C) a cheap but fun date at a sports bar, (S) An evening where the lady wears a sexy dress and they go to the opera, or (I) the lady ignores him and doesn't call. The payoff consists of the young man spending his ≤ 8 hours of leisure time the next day shopping with them (separately), and so the payoff is in hours. The game is such that the man generally prefers Player 1 to 2, as evidenced by the payoffs, prefers the the sexy dress and opera, has hardly any interest in sports, but is partially intrigued if one or both of the ladies ignores him. Since Player 2 is at a disadvantage, it is conjectured that this will influence her strategy significantly.

Strategies: Dominant/Dominated/Iteratively Dominated

- C is weakly dominated for Player 1. However, since this is a competetive game, I would argue that ,since the only situation holding C from being strictly dominated is the fact that $u_1(I, S) = u_1(C, S)$, C should still not played by Player 1 because $u_2(I, S) \geq u_2(C, S)$. This should be confirmed by experiment.

- C is strictly dominated for Player 2, hence we can delete it from Player 2's possible strategy. However, no more deletion should occur if we only delete strictly dominated strategies.

Player 2

Player 1		C	S	I
	C	0 0	3 2	3 1
	S	0 4	3 5	1 2
	I	1 2	2 2	3 3

Figure 2: **Strategy Space/Normal Form** This is the matrix form for the payoffs.

Rationalizable Strategies

After the C column is deleted for Player 2, we have the remaining rationalizable strategies: (C, S),(C, I),(S, S),(S, I),(I, S),(I, I). But, it remains to see if C is indeed played by Player 1.

Nash Equilibrium

Out of the rationalizable strategies, there are two best response pairs that form Nash Equilibria: (S, S) and (I, I).(See Figure 3)

Mixed Nash Equilibria

If we assume that C is in fact dominated for Player 1, then we have that only S and I remain as options for the players. Hence, let $\mu = Prob\{$Player 2 plays S $\}$ and $\delta = Prob\{$Player 1 plays S $\}$. Then by our payoff matrix, we see that

$$5\mu + 2(1-\mu) = 2\mu + 3(1-\mu) \tag{1}$$

$$3\delta + 2(1-\delta) = 1\delta + 3(1-\delta) \tag{2}$$

and so $\mu = \frac{1}{4}$, $\delta = \frac{1}{3}$.

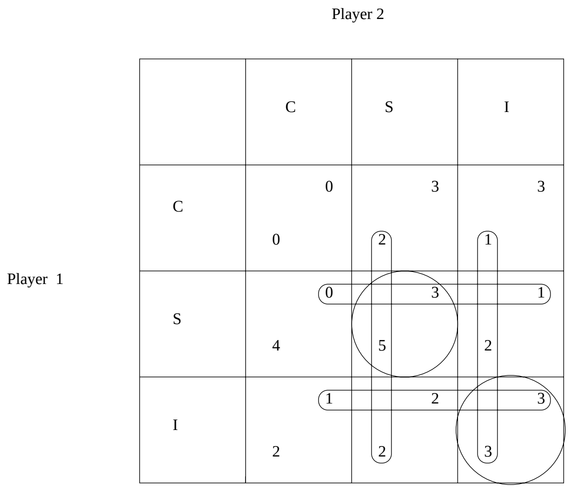

Figure 3: **Nash Equilibria**.

As a very interesting aside, notice that if we played the game with $u_1(S, I) = 3$ instead of $u_1(S, I) = 2$,then our mixed Nash Equilibrium (m.N.E.)would be $\mu = 0$, i.e. that Player 2 should never play the S strategy (it remains that $\delta = \frac{1}{3}$.) Also notice that in this case, S would be a weakly dominant strategy for Player 1.

Preliminary Conclusions

Since the payoff is bigger for Player 1 if she plays S, then it would be expected that she play this strategy. However, since Player 2 is indifferent between either S or I, and since each player does not tell the other what she did the night before, it is assumed that human nature might instruct Player 2 to play I to minimize 1's payoff. Hence, running this experiment should provide interesting results.

Experimental Analysis: Frequency Tables (Strategic Form)
Relative Frequencies

Strategy	Cheap	Sexy	Ignore	Total
Cheap	0	0	0	0
Sexy	0	0.866667	0.066667	0.933333
Ignore	0	0.066667	0	0.066667
Total	0	0.933333	0.066667	1

Absolute Frequencies

Strategy	Cheap	Sexy	Ignore	Total
Cheap	0	0	0	0
Sexy	0	13	1	14
Ignore	0	1	0	1
Total	0	14	1	15

Experimental Analysis: Extensive Form

In the tree form of the game, the outcome was very similar. Out of 16 total rounds played, 12 ended in the (S, S) node, and 4 in the (S, I) node.

Conclusions

As we predicted, the major Nash Equilibrium of (S, S) was by far the dominant outcome (93 percent of the time for each). This makes sense as we would expect Player 1, knowing her advantage, to play a strategy that would benefit her the most. However, (I, I) is also an equilibrium, but it was not picked at all. It could be that Player 2, sensing her disadvantage, would still play strategy S because if she picked I instead, her losses would be significant if Player 1 went ahead with S regardless. So, one could argue that she (Player 2) will go with the most likely N.E. despite any jealousy factors. However, in the *extensive form*, this is a little less clear as the (S, I) strategy / node was chosen 25 percent of the time. In this case, the same reasoning above could hold for Player 1 going for her best strategy all the time (which is true), but now for a quarter of the runs, Player 2 went for a jealousy-induced strategy hoping that Player 1 would weaken her conviction in the Sexy dress strategy. This did not happen, and for this outcome, Player 2 lost significantly, but so did 1. (In fact, 3 hours were lost for Player 1 versus only 2 for Player 2.) In any case, it the calculation for a mixed N.E. predicted only a $(0.25, 0.33)$

frequency for the (S, S) strategy, so our results are surprising in this sense.

References

[1] Microeconomic Theory, Mas-Colell, Whinston, and Green, Oxford

[2] The Book of Love, A. Cohen

Acknowledgements

Three words - Bond. James Bond.