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Carnegie Mellon University
Strategic Corporate Management
45-870M Second Mini 2025

ASSIGNMENT 3 (9 points)

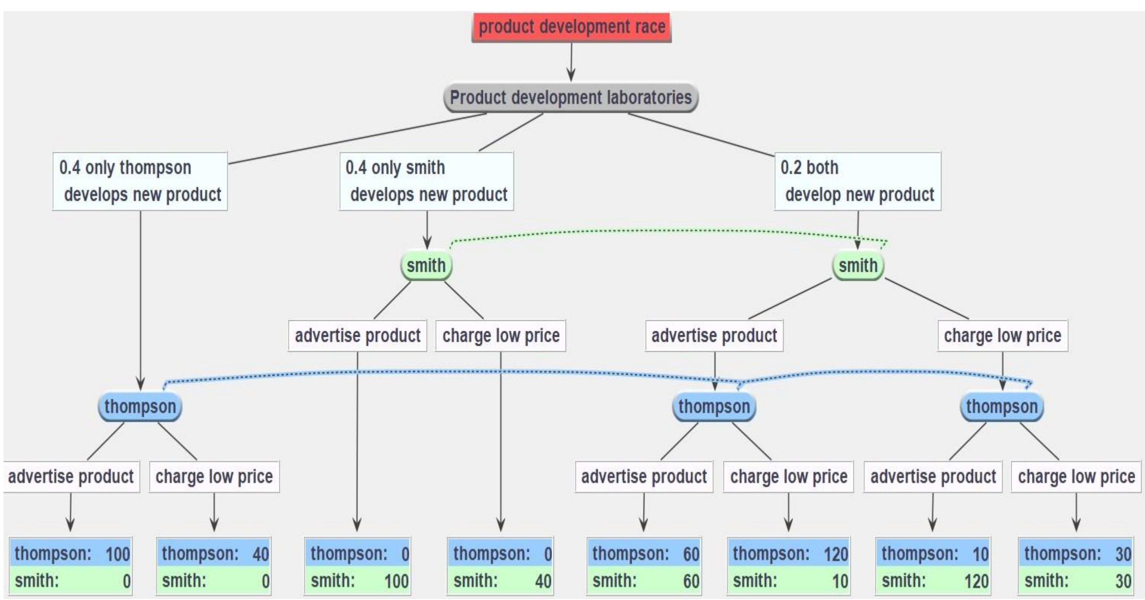
(Due Sunday November 9)

Answer key

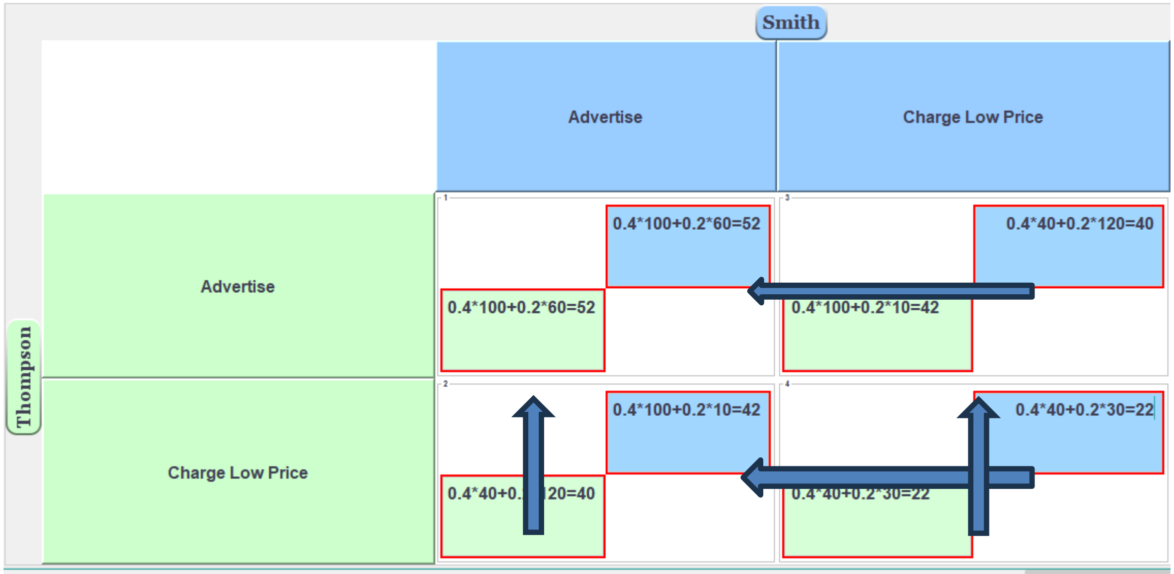
There are three multipart questions and one experiment.

Question 1 (3 points) . . . *generic versus differential advertising*

Often companies do not know precisely how much competition they will face before launching a new product. If successful inventors know they do not face competition for their new products, then marketing the overall product characteristics to increase customer awareness could be a profitable strategy. To the extent that rivals develop similar new products, advertising overall characteristics leads some consumers to purchase rival brands; marketing in a way that differentiates the inventor's product from those of the rivals' might be more attractive.



(a) What is the strategic form? Show the matrix representation of the strategic form that we developed in class. (Use comlabgames; copy and paste the representation into your answer.)



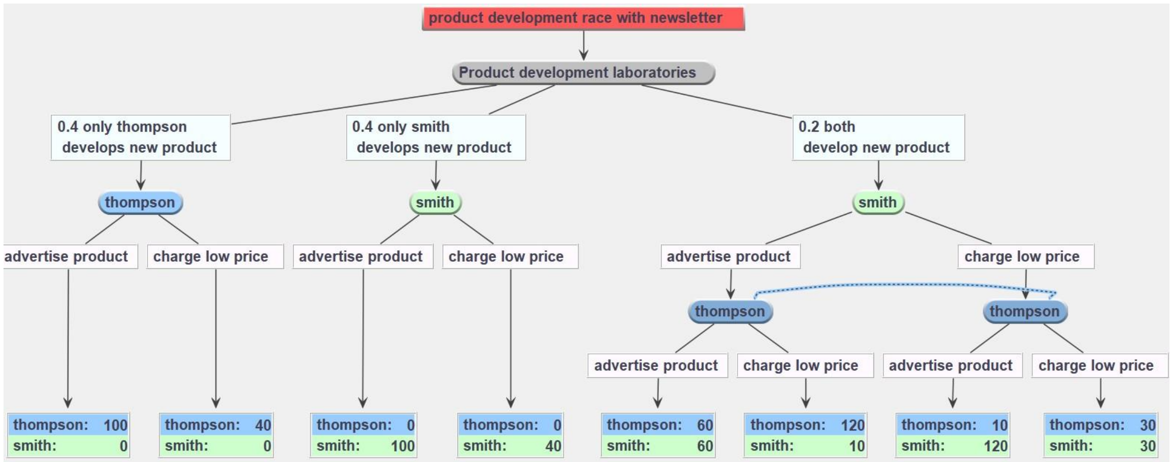
(b) Does each firm have a dominant strategy? Illustrate your answers by showing the best replies on the matrix representation.

Advertise is a dominant strategy for both

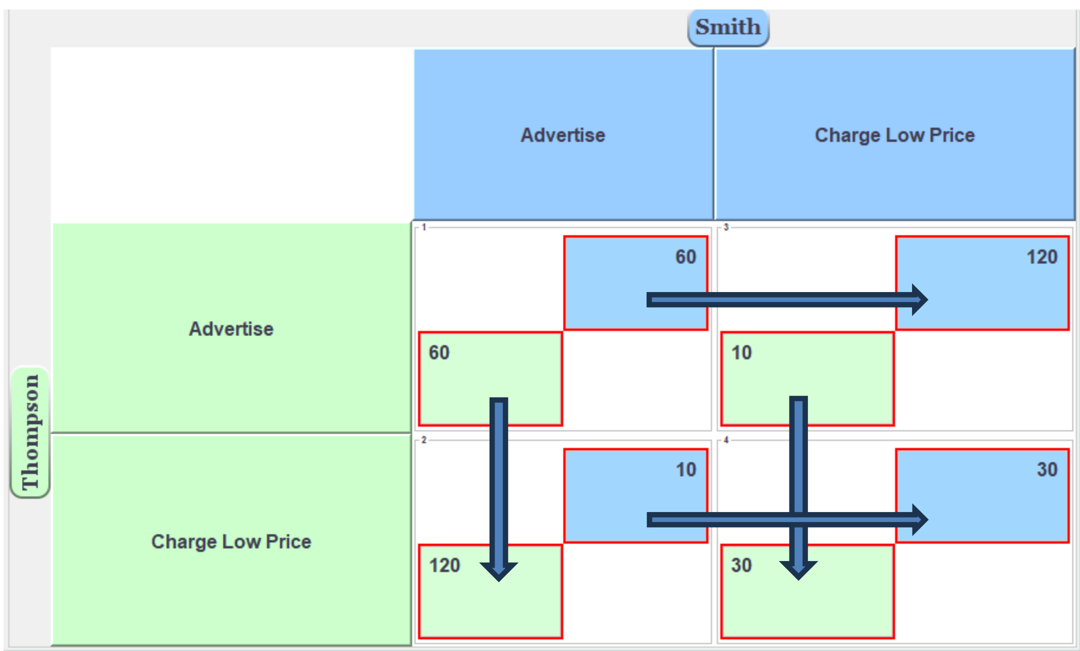
(c) Solve the game. What is the Nash equilibrium outcome?

The only Nash Equilibrium is (Advertise, Advertise)

Now suppose a newsletter is produced to keep firms abreast of the latest developments. Both firms become informed about who has developed the new product before they decide on a pricing and promotion move. The extensive form becomes:



(d) If Thompson is the only firm to develop the product, it should advertise rather than choose a low price, and similarly for Smith. What happens if both firms develop the produce?
This subgame is exactly a 2-by-2 simultaneous move game, since Smith doesn't know Thompson move when it's their time to move and viceversa.

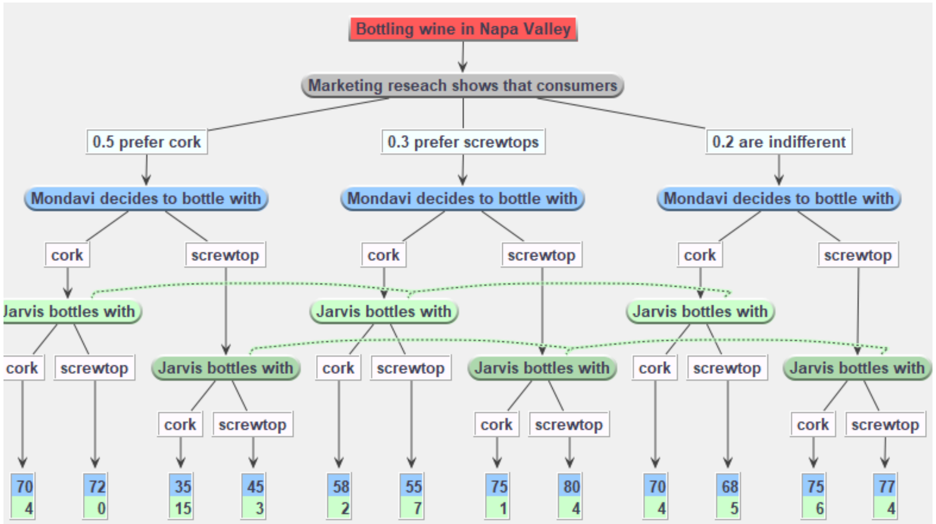


(e) Does the government have an incentive to produce such an industry newsletter? What about the firms? Briefly explain in a few sentences, by showing the expected profits of both firms, with and without the newsletter.
The expected profits for both firm without newsletter are 52; expected profits with newsletter is 46 (0.4*100+0.4*0+0.2*30=46)
If the government cares about low prices, producing the newsletter generates a proability of .2 of having low prices, as opposed to not having a newseltter in which case low prices cannot realize. The firms are better off without the newsletter as shown by their expected payoffs.

(f) Now suppose Smith and Thompson were two profit centers owned by the one firm! Briefly explain the value of having information silos.

Question 2 (3 points) . . . rivals as a source of *information value*

The solution to the game on bottling wine in Lecture 3 shows that rivals can be a valuable source of information. Although Jarvis could undertake its own research into bottling, it eliminates these costs by piggybacking off Mondavi's extensive marketing research. However, Jarvis receives a noisy signal from Mondavi. Jarvis cannot tell whether consumers prefer screwtops or are indifferent. This question investigates much would Jarvis be prepared to pay to conduct its own research and receive a clear signal.

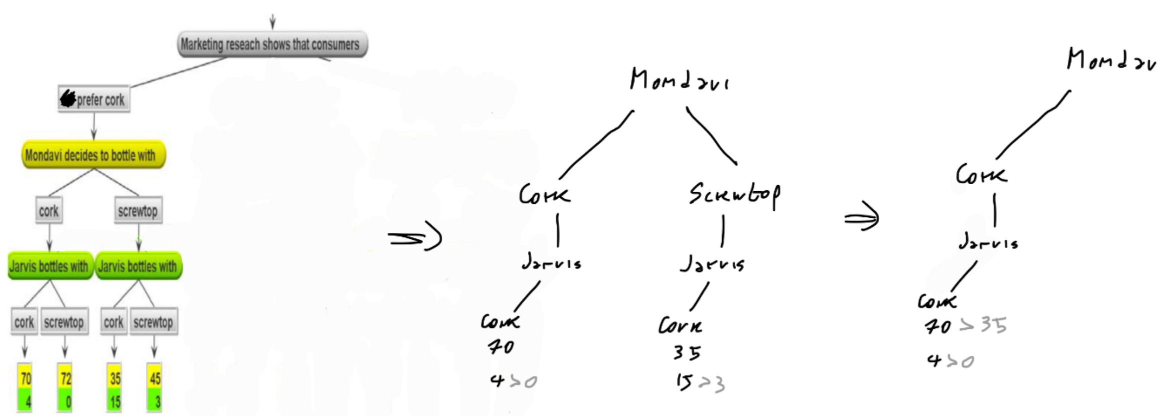


(a) Suppose Jarvis obtains the information that Mondavi has (by buying the report produced for Mondavi, doing its own research, or through industrial espionage). How would that change the game tree illustrated above?

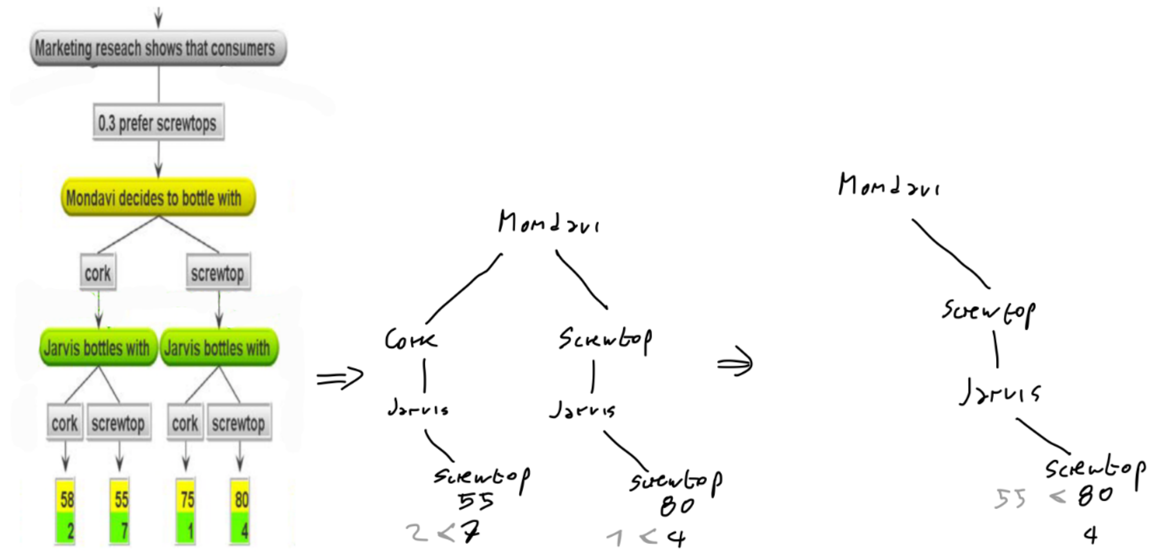
The game tree would collapse into only one of its main branches, such that there is no uncertainty for Jarvis about the result of the marketing research. Consequently, the information sets of Jarvis are singletons and the game has now perfect information.

(b) Solve for the perfect information game you defined in part (a).

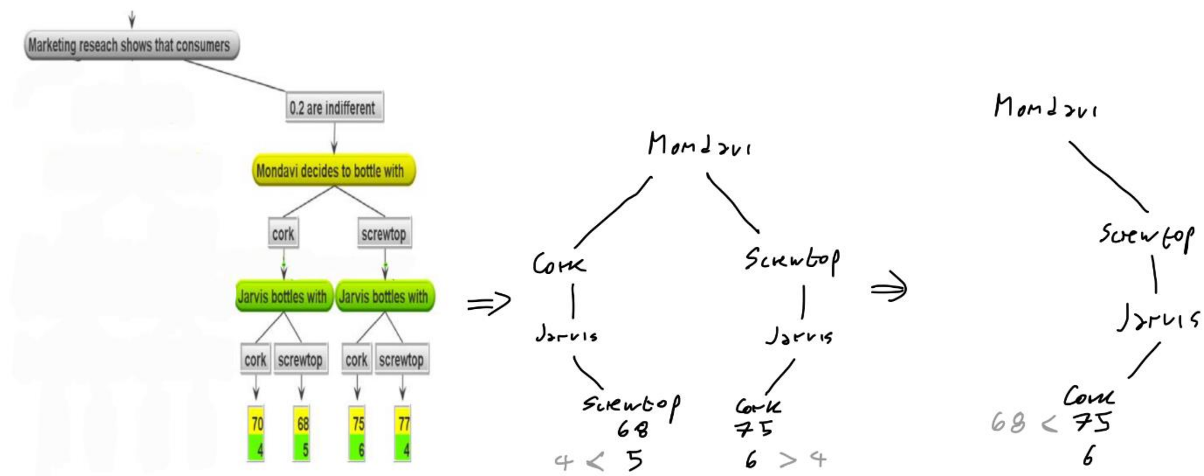
Case 1: research shows consumers prefer cork



Case 2: research shows consumers prefer screwtops



Case 3: research shows consumers are indifferent



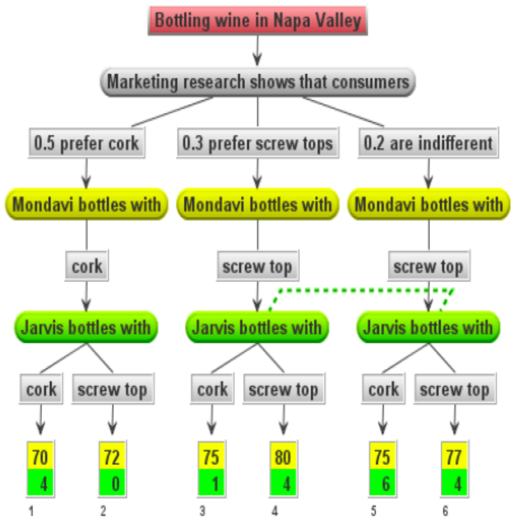
(c) What is the value to Jarvis from obtaining the information Mondavi has at the same time Mondavi does?

(d) What is the maximum amount Jarvis would be willing to pay for this research report?

Answer of (c), (d):

In case 1 above, Jarvis's payoff is 4. In case 2 it's 4. In case 3 it's 6. Before buying the information, Jarvis's knows that buying that information will give it access to a payoff of 4 with probability 0.5+0.3 and a payoff of 6 with probability 0.2. Hence, in expectation, Jarvis obtains a payoff of 0.8*4+0.2*6=4.4 from buying the information.

Note that from the slides we can see that Jarvis should always follow Mondavi's lead. So they Jarvis will choose *cork* if the research shows consumers prefer cork (and Mondavi chooses *cork*) and will choose *screw top* if the research shows consumers are indifferent or prefer screw tops (and Mondavi chooses *screw top*)



If Jarvis can only purchase the information before Mondavi moves, then we should compare the expected value of the entire game with no information with the expected value of the game with information:

Expected payoff from playing the game without buying the information (see lecture 3 slides): 0.5*4+0.5*4=4

Expected payoff from playing the game with the information: 4.4
Hence, Jarvis is willing to pay up to 0.4 for the information.

(e) What is the value to Jarvis from obtaining the information Mondavi obtained if and when Mondavi bottles with screwtops but before Jarvis commits to cork or screwtops?
If Jarvis can wait for Mondavi to make a move before purchasing the information, they can choose to purchase the information only if Mondavy plays screw top, otherwise Mondavi choosing cork reveals unequivocally the result of the research. Then, if Mondavi chooses cork, then Jarvis is willing to pay 0 for the research. If Mondavi chooses screw top, Jarvis needs to compare the expected value of playing screw top without knowing the research result against the expected value of learning the research result and then choosing their move. In the latter case, the dotted lines in the game representation disappear and Jarvis will choose screw top if consumers prefer screw top (because 4>1) and cork if they are indifferent (because 6>4).

Choosing screw top without research information: (0.3*4 + 0.2*4)/(0.2 +0.3)=4.
Expected value of buying information and then choosing: (0.3*4 + 0.2*6)/(0.2 +0.3)=4.8
Hence Jarvis is willing to pay up to 4.8

(f) Explain the difference between your answers in parts (c) and (e)?
In the second case, Jarvis waits and sees if they can obtain the information contained in the research for free, by simply observing what Mondavi does.

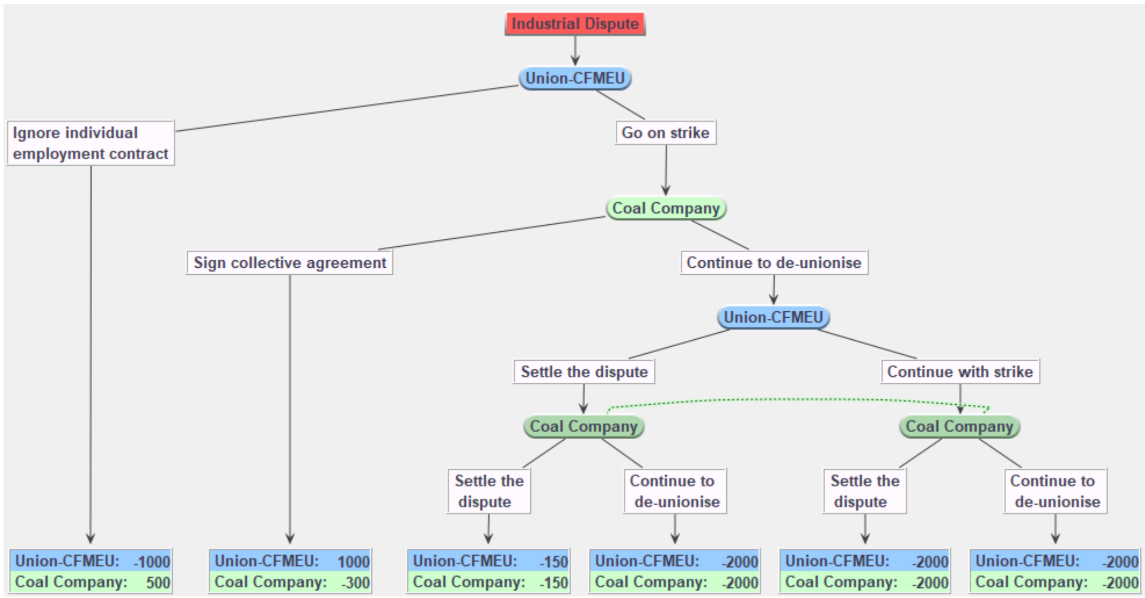
(g) What is the minimum amount Mondavi would offer to share the results of the market research? Explain your reasoning.
Mondavi expected payoff without sharing is (0.5×70)+(0.3×80)+(0.2×77)=74.4

Expected payoff share the info: (70×0.5)+(80×0.3)+(75×0.2)=74
Minimum amount Mondavi would offer is 74.4-74=0.4

(h) Are there potential gains from trade to Mondavi selling the research to Jarvis? Why or why not?
Trading the information before Mondavi learns the outcome. Mondavi will make a gain if the information is sold at at least .4 and Jarvis will make a gain if it buys it for 0.9 or less. This indicates there is a surplus to be split if the information is sold. You can see this also by comparing the sum of the expected payoffs of Mondavi and Jarvis with and without sale of the information.
Mondavi expected payoff without sale + Jarvis expected payoff without sale: 74.4+3.5=77.9.
Mondavi expected payoff with sale + Jarvis expected payoff with sale: 74+4.4=78.4.
Hence the surplus is 78.4-77.9=0.5. The sales price will determine how this surplus is split.

Question 3 (3 points) . . . *industrial dispute*

This game is based on an episode in the coal mining history of Australia. A consortium of employers (coal company) tried to break up the union (Union-CFMEU). They tried to break up the union by making individual agreements with miners in different regions. This would prevent the unions from cross subsidizing the miners working in the older less profitable regions (in the Hunter valley near Sydney) with company profits obtained from the most profitable ones (located in the remote outback of Western Australia). Here is the extensive form game:



(a) Run this game within your **experimental group** four or more times, paste a snapshot into your answers, report the empirical distribution and the best replies to the empirical distribution.

(b) What are the strategies of each player? *(Hint: One strategy of the Union is to first go strike and then if the coal company continues to de-unionize continue with strike.)*
Union has 3 strategies.
(Ignore): ignore individual contract.
(Strike, Settle): first go strike and then if the coal company continues to de-unionize settle the dispute.
(Strike, Strike): first go strike and then if the coal company continues to de-unionize continue with strike.
Coal company has 3 strategies.
(Agreement): if union goes on strike, sign collective agreement.
(De-unionise, Settle): if union goes on strike, continue to de-unionise and then settle the dispute.
(De-unionise, De-unionise): if union goes on strike, continue to de-unionise and then continue to de-unionise.

(c) Use comlabgames to show the strategic form (labelling players, strategies and cell payoffs).

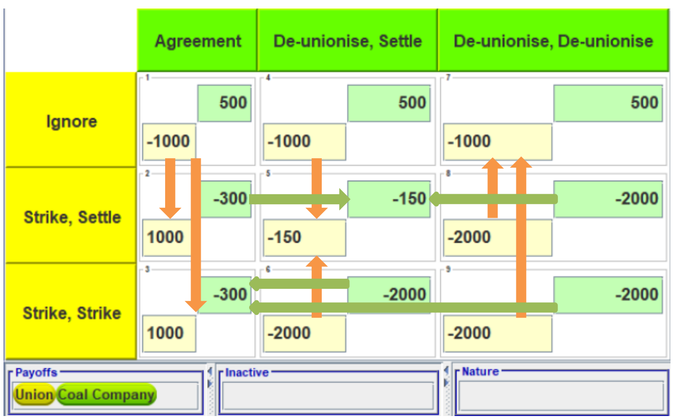
	Agreement	De-unionise, Settle	De-unionise, De-unionise
Ignore	-1000, 500	-1000, 500	-1000, 500
Strike, Settle	1000, -300	-150, -150	-2000, -2000
Strike, Strike	1000, -300	-2000, -2000	-2000, -2000

Payoffs: Union, Coal Company | Inactive | Nature

(d) Use arrows to illustrate the best responses of both players.

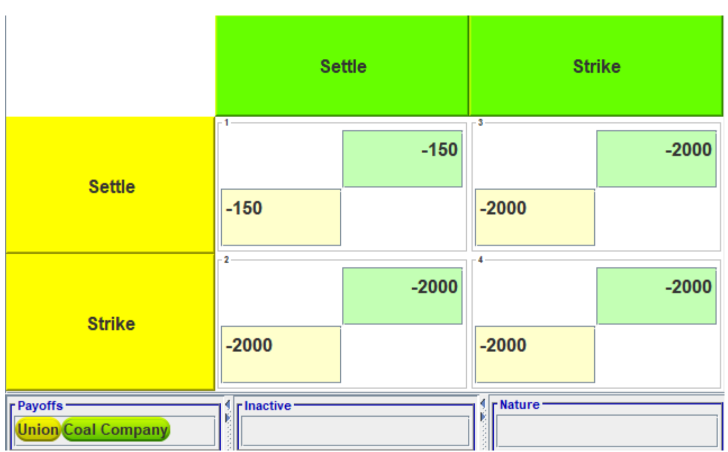
For the union:
If the coal company chooses “Agreement”, the union’s best response is either “Strike, Settle” or “Strike, Strike”.
If the coal company chooses “De-unionise, Settle”, the union’s best response is “Strike, Settle”.
If the coal company chooses “De-unionise, De-unionise”, the union’s best response is “Ignore”.

For the coal company:
If the union chooses “Ignore”, the coal company’s best response is any of his three strategies.
If the union chooses “Strike, Settle”, the coal company’s best response is “De-unionise, Settle”.
If the union chooses “Strike, Strike”, the coal company’s best response is “Agreement”.

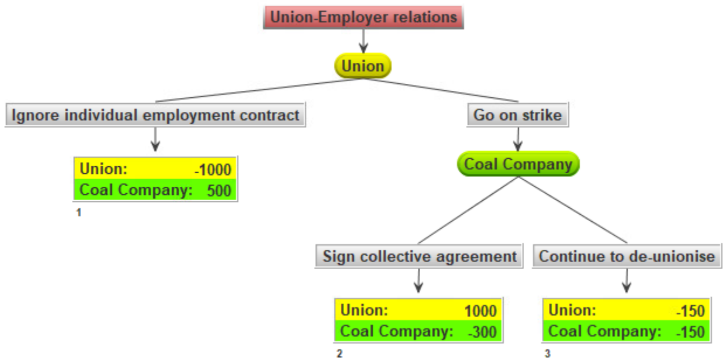


(e) Solve the strategic form of the game. How many pure strategy Nash equilibria are there?
There are three Nash equilibria.
NE1: Union “Ignore”, and coal company “De-unionise, De-unionise”.
NE2: Union “Strike, Settle”, and coal company “De-unionise, Settle”.
NE3: Union “Strike, Strike”, and coal company “Agreement”.

(f) Now solve the subgame that begins when the Union makes its second move.
The subgame is represented by the graph below.
Apparently, the Nash equilibrium in the subgame is (Settle, Settle).



(g) Form a reduced game in extensive form by plugging the solution payoff from part (e) into the node where the union is making its second move.
The reduced game is represented by the graph below.



(h) Use backwards induction to solve the reduced game in extensive form.
Going backwards, the coal company chooses to continue to de-unionise because -300<-150, and the union chooses to go on strike because -1000<-150.

(i) Noting that your answer to in (g) corresponds to one of the Nash equilibria derived in (d), explain why one of the equilibria might give the most plausible prediction.
The corresponding Nash equilibrium is: union "Strike, Settle", and coal company "De-unionise, Settle". This is the most plausible equilibrium because it is subgame perfect.

(j) Based on your analysis above, explain why players who make incredible threats, sometimes portray themselves as slightly crazy?
This is because in the subgame, the choice that they threaten to make is not optimal, which makes the threat incredible.

(k) Is it rational for shareholders to employ a slightly crazy CEO, who might love a fight for its own sake, or more generally with payoffs that are different from the firm's? Briefly explain and illustrate.
No, because the slightly crazy CEO might make a choice that generates unfavorable payoffs to shareholders. In this game for example, if the CEO's payoff to persistently de-unionise is higher than those of the other strategies, the CEO will choose to persistently de-unionise which generates a harmful -2000 payoff to shareholders.