MAT 106 PBL FINAL REVIEW

GAME THEORY

GROUP MEMBERS :

- ABHISHEK HALDER (13BCE1046)
- JAGMOHAN SINGH (13BCE1056)
- PARTH JAWALE (13BCE1059)
- AKHIL REDDY (13BCE1078)
- PRASHANT MOHITE (13BCE1099)

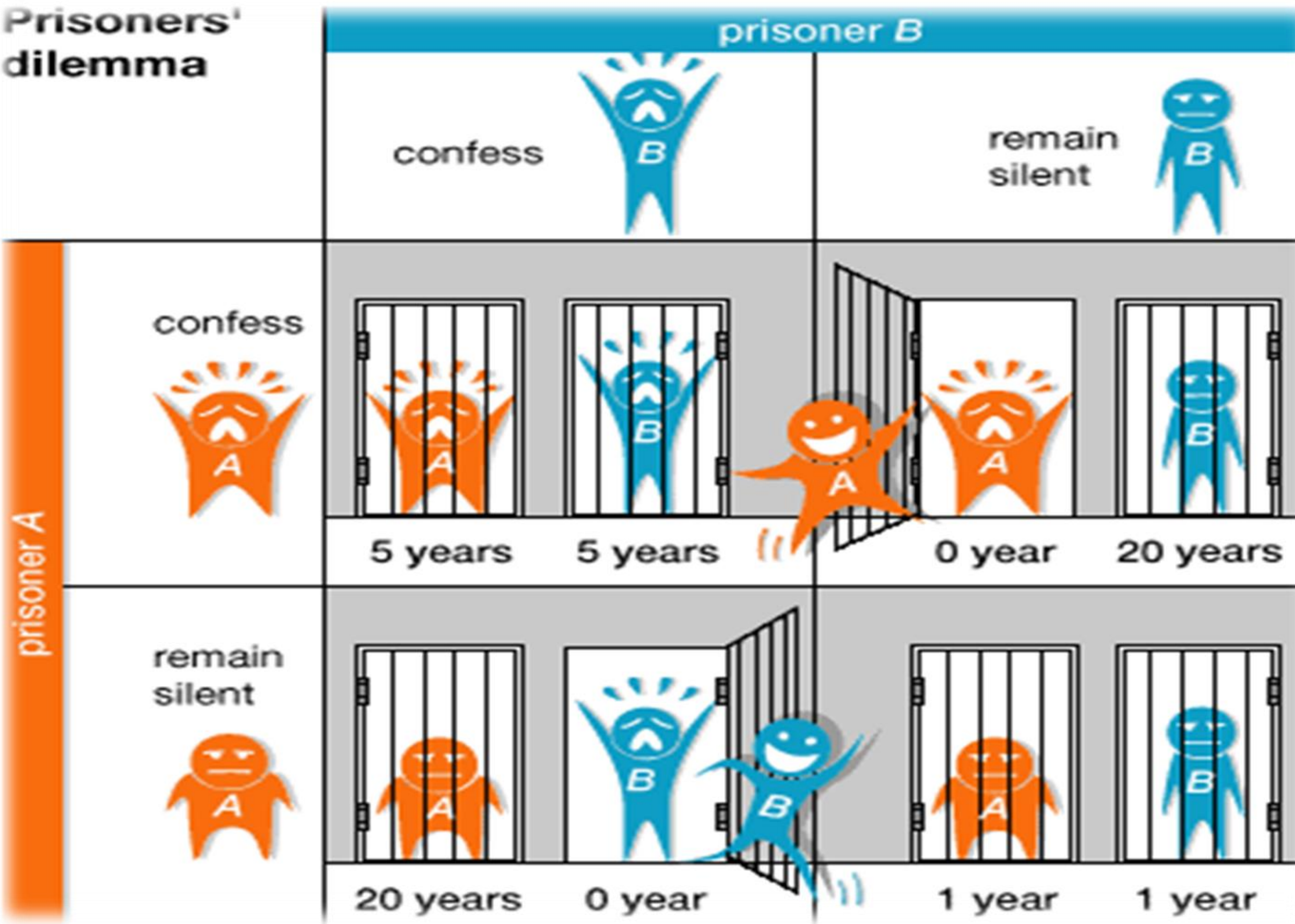
GAME THEORY

- It is mainly concerned with predicting the outcome of games of strategy in which the participants (for example two or more business competing in market) have incomplete information about the other's intentions.
- GAME THEORY analysis has direct relevance to the study of the conduct and behavior of firms in the OLIGOPOLISTIC markets.
- GAME THEORY is the formal study of conflict and cooperation. Game theoretic concepts apply whenever the actions of several agents are interdependent. These agents may be individuals, groups, firms, or any combination of these.
- The concepts of GAME THEORY provide a language to formulate, structure, analyze, and understand strategic scenarios.

PRISONER’S DILEMMA

- The classic example of game theory is the PRISONER’s DILEMMA, a situation where two prisoners are being questioned over their guilt or innocence of a crime
- They have a simple choice , either to CONFESS to the crime (thereby implicating their accomplice) and accept the consequences , or to deny al involvement and hope that their partner does likewise.
- The “PAY-OFF” is measured in terms of years in prison arising from their choices and this is summarized in the table (show on the next page)
- No Communication is permitted between the suspects – in other words , each must make an independent decision , but certainly they will take into account the likely behavior of the other when under interrogation.

PAY-OFF MATRIX



❑ EXPLANATION :

- Two members of a criminal gang are arrested and imprisoned. Each prisoner is in solitary confinement with no means of speaking to or exchanging messages with the other. The police admit they don't have enough evidence to convict the pair on the principal charge. They plan to sentence both to a year in prison on a lesser charge.

- Each prisoner is given the opportunity either to betray the other, by testifying that the other committed the crime, or to cooperate with the other by remaining silent. Here's how it goes:

- If A and B both betray the other, each of them serves 5 years in prison.
- If A betrays B but B remains silent, A will be set free and B will serve 20 years in prison (and vice versa).
- If A and B both remain silent, both of them will only serve 1 year in prison (on the lesser charge).

CODING FOR PRISONER'S DILEMMA

```
%Nash Equilibrium: two player, two strategies, non-symmetric game
%Step 1: Initiate two payoff matrices.
%
P1=[3 0;
4 1];
P2=[3 4;
0 1];

%Step 2: Create an isolated payoff vector (IPV) for each player and
each
%
%Player 1
C1=P1(:,1);
D1=P1(:,2);
%Player 2
C2=P2(1,:);
D2=P2(2,:);
%Step 3: Find the best response functions for each player
%
%Player 1
[br11 bri11]=max(C1);
[br12 bri12]=max(D1);
```

```
%Player 2
[br21 bri21]=max(C2);
[br22 bri22]=max(D2);
%
%Step 4: Find the Nash Equilibrium(s)
%
if (bri11==bri12) %P1 has a strictly dominant strategy
if (bri21==bri22) %P2 has a strictly dominant strategy
nash=[bri11 bri21];
elseif (bri21~=bri22) %P2 does NOT have a strictly dominant strategy
if (bri11==1)
nash=[bri11 bri21];
elseif (bri11==2)
nash=[bri11 bri22];
end;
end;
elseif (bri11~=bri12)
%P1 does NOT have a strictly dominant strategy
if (bri21==bri22)
%P2 has a strictly dominant strategy
if (bri21==1)
nash=[bri11 bri21];
elseif (bri21==2)
nash=[bri12 bri21];
end;
elseif (bri21~=bri22)
%P2 does NOT have a strictly dominant strategy (no
dominant strategies)
if (bri11==bri21)
```

```
if (bri11==1)
nash1=[bri11 bri21];
elseif (bri11==2)
if (bri12==1)
nash1=[bri12 bri21];
elseif (bri12==2)
nash1=[0 0];
end;
end;

elseif (bri11~=bri21)
nash1=[0 0];
end;
if (bri12==bri22)
if (bri12==2)
nash2=[bri12 bri22];
elseif (bri12==1)
if (bri11==2)
nash2=[bri11 bri22];
elseif (bri11==1)
nash2=[0 0];
end;
end;
elseif (bri12~=bri22)
nash2=[0 0];
end;
if (nash1==nash2)
nash=nash1;
elseif (nash1~=nash2)
nash=[nash1;
nash2];
end;
end;
end;
%
%Step 5: Display the Nash Equilibrium output.
%
```

EXPLANATION OF CODE

- The first step in coding this model is to break the game matrix down into two sub-matrices, one representing the payoffs for each player. Player one's payoff matrix is named P1 and player two's is named P2.

- Next, we create an isolated payoff vector (IPV) for each player and each strategy. In this problem player one has two IPVs, C1 and D1, and player two has two IPVs, C2 and D2. Each IPV takes the other player's strategy as given and then returns the payoffs corresponding to each of their own strategies..

- Once the IPVs were created I determined the best responses for each individual given the other player's choice of strategy. The best responses are found by determining the largest scalar in each IPV. To do this the max function was used.

- One stipulation to this program is that the players cannot be indifferent between two possible strategies given the other player's strategy choice. That is, the scalars cannot be equal in any given IPV. This is a result of the max function, as it cannot distinguish between two equal scalars.
- The final step in solving this problem involves finding the Nash Equilibrium. This is the most complex step of the model both in terms of logic and code.

From a logic perspective, this part is founded on the game theoretic concept of dominance. A strategy is dominant if it is always played regardless of theother player's choice of strategy. For example, in the Prisoner's Dilemma game defect is a dominant strategy. In a two by two game if at least one of the players has a dominant strategy then theequilibrium solution becomes very simple; the player(s) with a dominant strategy play that strategy and the other player plays her best response to that strategy. If there are no dominant strategies then the solution becomes more complex. To make things less confusing I will first define some terms:

• First best response: an individual's best response given the other player is playing their first strategy (in the PD game this would mean the other player is cooperating)

• Second best response: an individual's best response given the other player is playing their second strategy (in the PD game this would mean the other play is defecting)

• Best response is one: the individual's best response is to play the first strategy (in the PD gamethis means they will cooperate)

• Best response is two: the individual's best response is to play the second strategy (in the PDgame this means they will defect)

• NE={1,2}: the Nash Equilibrium is for player one to play the first strategy and player two to play
the second strategy