AGTA HW1

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0.1 Question 1

Given the matrix:

$$\begin{pmatrix} (6,5) & (4,8) & (6,4) & (9,2) \\ (4,6) & (7,4) & (7,5) & (4,4) \\ (4,7) & (4,4) & (9,5) & (2,6) \\ (5,9) & (4,10) & (4,9) & (8,9) \end{pmatrix}$$

To compute Nash equilibrium we start by removing dominated strategies.

1. Column 4 is weakly dominated by Column 1.
2. Column 3 is weakly dominated by Column 1.
3. Row 4 is is weakly dominated by Row 1.

Removing the dominated strategies we are left with:

$$\begin{pmatrix} (6,5) & (4,8) \\ (4,6) & (7,4) \\ (4,7) & (4,4) \end{pmatrix}$$

Row 3 is dominated by row 1 and 2. This leaves us with the following game:

$$\begin{array}{cc} & \begin{array}{cc} A & B \end{array} \\ \begin{array}{c} C \\ D \end{array} & \begin{pmatrix} (6,5) & (4,8) \\ (4,6) & (7,4) \end{pmatrix} \end{array}$$

There is no pure strategy nash equilibrium. The game cannot be reduced to a single strategy, i.e there is no strict dominant strategy for both players. Nash's theorem however states that every finite game does have a mixed nash equilibrium.

Let q be the probability that player 2 plays strategy A and $(1-q)$ the probability player 2 plays strategy B. Let p be the probability that player 1 plays strategy C and $(1-p)$ the probability player 1 plays strategy D.

Pay off for player 1:

$$6q + 4(1-q) = 4q + 7(1-q) \; 13q = 8q + 3 \; q = 3/5$$

Pay off for player 2

$$\begin{gathered}5p + 6(1-p) = 8p + 4(1-p) \\ -p + 6 = 4p + 4 \\ 5p = 2 \\ p = 2/5\end{gathered}$$

Profiles:
$x_1 = (2/5, 3/50, 0)$
$x_2 = (3/5, 2/5, 0, 0)$

0.2 Question 2