1. Consider the following strategic game:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>l</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>m</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>r</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

a. Is any action of either player strictly dominated? Strategy \( m \) for player 1 is dominated.

b. Find the Nash Equilibrium of the game. (Give both the equilibrium action profiles and the payoffs associated with them.) 2 NE: \((l, M)\) with payoffs \((1, 2)\) and \((r, R)\) with payoffs \((2, 2)\).

2. The inverse demand function is \( p = 200 - 2(q_1 + q_2) \). Each firm maximizes its profit. Firm 1’s program is

\[
\max_{q_1} (200 - 2(q_1 + q_2))q_1 - 20q_1
\]

\[
FOC : 200 - 4q_1 - 2q_2 - 20 = 0
\]

\[
q_1 = 45 - \frac{1}{2}q_2
\]

The best response function of firm 1 is

\[
q_1(q_2) = 45 - \frac{1}{2}q_2
\]

Idem for firm 2 (symmetric firm)

\[
q_2(q_1) = 45 - \frac{1}{2}q_1
\]

The Cournot equilibrium is determine as follows

\[
q_1 = 45 - \frac{1}{2}(45 - \frac{1}{2}q_1)
\]

and thus

\[
q_1^c = q_2^c = 30
\]

If we had a cartel instead, firms would have behave as a monopoly. The program of the monopoly is

\[
\max_{q} (200 - 2q)q - 20q
\]

\[
FOC : 200 - 4q - 20 = 0
\]

\[
q^m = 45 < q_1^c + q_2^c = 60
\]

3.
1. If Martin plays $A$, then Malone plays 1; If Martin plays $B$, then Malone plays 1 (1 is a dominant strategy).

2. If Malone plays 1, then Martin plays $A$; If Malone plays 2, then Martin plays $A$ ($A$ is a dominant strategy)

3. Nash equilibrium is $(A, 1)$ and the payoffs are $(4, 4)$.

4. Yes. explain

4. Consider the following Prisoners’ Dilemma.

<table>
<thead>
<tr>
<th></th>
<th>Confess</th>
<th>Don’t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confess</td>
<td>$-1, -1$</td>
<td>$3, -3$</td>
</tr>
<tr>
<td>Don’t</td>
<td>$-3, 3$</td>
<td>$2, 2$</td>
</tr>
</tbody>
</table>

1. One shot game.
   
   (a) Nash Equilibrium: (confess, confess)
   
   (b) Yes, they could both get a higher payoff if they agree to play (don’t, don’t). But it is not an equilibrium.

2. Repeated Game. Suppose two players play this simultaneous move game twice, observing the outcome of the first play before the second play begins. Suppose the payoff for the entire game is simply the sum of the payoffs from the two stages (no discounting).

   (a) Same (confess, confess).
   
   (b) Equilibrium: same (confess, confess).

5. Perloff, fourth edition, problem 34 page 418

Using Equation 12.2,

$$p_{US}(1 - 1/2) = 10 = p_J(1 - 1/5)$$

$$p_{US} = \$20$$

$$p_J = \$12.50$$

6. Perloff, fourth edition, question 3 page 464

a. There are two Nash equilibria (the off diagonals). If either firm produces 20 while the other produces 10, neither player has an incentive to change strategies given the strategy of the other player.
b. If firm 1 can choose first, it will commit to selling 10 units, and firm 2 sells 20 units. If firm 1 were to choose 20 units, firm 2 would choose to produce 10 units, reducing firm 1’s payoff by $10.

c. If firm 2 can choose first, it will sell 10 units, and firm 1 will sell 20. If firm 2 were to produce 20 units, firm 1 would produce only 10, reducing firm 2’s payoff by $25.


a) If there is a collusion, firm 1 should produce all output due to its lower marginal cost. The monopoly price and output levels are determined by

\[ MR = 120 - 2Q \]
\[ MC = 20 \]
\[ 120 - 2Q = 20 \]
\[ Q^* = 50 \]
\[ p^* = 70 \]

b) To calculate the Cournot equilibrium, derive the response function and solve each by setting \( q_i \) equal to the appropriate marginal cost for each firm. Then, solve the response functions simultaneously to determine output.

\[ p = 120 - q_1 - q_2 \]
\[ MR'_1 = 120 - 2q_1 - q_2 \]
\[ MR'_2 = 120 - q_1 - 2q_2 \]
\[ 120 - 2q_1 - q_2 = 20 \]
\[ q_1 = 50 - \frac{1}{2} q_2 \]
\[ 120 - q_1 - 2q_2 = 40 \]
\[ q_2 = 40 - \frac{1}{2} q_1 \]
\[ q_1^* = 40 \]
\[ q_2^* = 20 \]
\[ Q^* = 60 \]
\[ p^* = 60 \]