1. Suppose that Pepsi and Coke are competing in a horizontally differentiated Bertrand market and setting prices. The demand curves are as follows:

$$Q_C = 40 - 5P_C + 4P_P$$

$$Q_P = 100 - 2P_P + P_C$$

Coke face marginal cost $MC_C = 12$ and Pepsi faces marginal cost $MC_P = 8$.

   (a) Write the equation for the demand for coke in terms of price P_C as a function of P_P and Q_C.

   (b) Determine the marginal revenue for Coke as a function of P_P and Q_C.

   (c) Find the equation that tells how much Coke would produce for any price P_P using the above.

   (d) Find the reaction function for Coke (P_C as a function of P_P) using your answer above.

   (e) Find the reaction function for Pepsi.

   (f) Determine the Bertrand equilibrium.

2. Suppose there are two firms with constant marginal cost $MC = 10$ and the market demand is $P = 120 - 2Q$.

   (a) Calculate the market price and profits for each firm in each of the following settings:

   - Cournot duopoly
   - Bertrand duopoly
   - Cartel

   (b) Using part a), construct a 3×3 payoff matrix where the firms are choosing prices. The actions available to each of two players are to charge the price from the three settings above. If there is a tie, they split the demand. If one has a lower price, the firm with the lower price gets all of the demand.

   (c) What are the Nash equilibria of this 3×3 game?

3. Suppose two players play the following prisoner's dilemma for 10 periods (periods 1 through 10).

Player 1 \ Player 2	C	D
C	2, 2	-1, 3
D	3, -1	0, 0

   Suppose that players simultaneously choose their strategy before the repeated game, and can't change it once the repeated game has started. Players can choose one of the three following strategies as defined in class:

   - Always Defect
   - Grim-Trigger
   - Tit-For-Tat

   (a) Draw the 3×3 matrix game with the payoffs for each strategy pair calculated over the 10 periods. (Each row represents one of the 3 strategies for player 1 and each column represents one of the the 3 strategies for player 2.)

   (b) What are the pure-strategy Nash equilibria of game in part (a)?

   (c) Now suppose now that player 1 make a mistake in period 2. That is if his strategy is supposed to play C then he accidentally plays D, and if his strategy is supposed to play D then he accidentally plays C. Draw the 3×3 matrix game with the payoffs for each strategy pair calculated over the 10 periods.

   (d) What are the pure-strategy Nash equilibria of game in part (c)?

   (e) Now consider the new strategy called Win-Stay, Lose Shift (WSLS):

   - Start with C
   - If the other person plays C, then I repeat MY last action
   - If the other person plays D, then I switch MY last action

   What sequence of actions is played if both players play WSLS against each other, and player 1 makes a mistake in period 2.

   (f) Is this better than when both players play TFT against each other, and player 1 makes a mistake in period 2?

4. Two gas stations are competing on one corner. Each firm is trying to pick a strategy. The market conditions are such that they face the following payoffs:

Station 1 \ Station 2	C	D	E
A	0, 4	2, 5	5, 3
B	1, 2	3, 1	4, 0

   (a) Does either stations have any dominant or dominated strategies?

   (b) If the stations choose their actions simultaneously, what are the possible Nash equilibria, and what would be the payoffs?

   (c) If station 1 moves first, what is the Nash equilibrium? Did they increase their payoff over part (b)?

   (d) If station 2 moves first, what is the Nash equilibrium? Did they increase their payoff over part (b)?