Answers to the Practice Problems from Chapter 12 and Chapter 13 (Exam is comprehensive!)

1. Questions for Review page 468 number 3

Pro: Too many brands of any single produce signals excess capacity, implying an output level smaller than one that would be minimizing average cost
Con: Consumers value the freedom to choose among a wide variety of competing products.

2. Questions for Review page 468 number 4

A Cournot equilibrium is stable because each firm is producing the amount that maximizes its profits, given what its competitors are producing. If all firms behave this way, no firm has an incentive to change its output. Without collusion, firms find it difficult to agree to reduce output. Once one firm reduces its output, other firms have an incentive to increase output and increase profits at the expense of the firm that is limiting its sales.

3. Questions for Review page 468 number 6

Both are oligopoly models in which firms produce a homogenous good. In the Cournot model, each firm assumes its rivals will not change the quantity produced. In the Bertrand model, each firm assumes its rivals will not change the price they charge. In both models, each firm takes some aspect of its rivals behavior (either quantity or price) as fixed when making its own decision. The difference between the two is that in the Bertrand model firms end up producing where P = MC, whereas, in the Cournot model the firms will produce more than monopoly output, but less than the perfectly competitive output.

4. Exercises page 469 number 6

$\pi_1 = 300Q_1 - Q_1^2 - Q_1Q_2 - 60Q_1$

a) $\dfrac{d\pi_1}{dQ_1} = 240 - 2Q_1 - Q_2$

→ Firm 1's Best Response function (reaction curve) = $Q_1 = 120 - \frac{1}{2}Q_2$

→ By symmetry: $Q_2 = 120 - \frac{1}{2}Q_1$

Simultaneously solving for the Cournot Nash Equlibrium:
$Q_1 = Q_2 = 80; P = 140; \pi_1 = \pi_2 = 6{,}400$

b) If they collude, they will split the monopoly output, from the best response function above $Q^{Monopoly} = 120$ (could also solve MR = MC → 300 – 2Q = 60); since firms split this quantity
$Q_1 = Q_2 = 60; P = 180; \pi_1 = \pi_2 = 7{,}200$

c) If firm 1 were a monopolist $Q^{Monopoly} = 120$; $P^{Monopoly} = 180$; $\pi^{monopolist} = 14{,}400$

d) Assuming firms agree to produce 60 (splitting the monopoly quantity); if firm 1 cheats, it will produce $Q_1 = 120 - \frac{1}{2}Q_2 = 120 - \frac{1}{2}60 = 90$; now the industry quantity is Q = 60 + 90 = 150 so the new price is P = 300 – 150 = 150; now firms will earn different profits:
$\pi_2 = 5{,}400; \pi_1 = 8{,}100$. Firm 1 has increased its profits at the expense of firm 2 by "cheating" on the agreement.

5. Exercises page 469 number 7
    a) (i) In a Cournot equilibrium you must think about the effects on the reaction functions. When firm A experiences an increase in MC, their reaction function will shifts inwards. The quantity produce by firm A will decrease and the quantity produced by firm B will increase. Total quantity produced will tend to decrease and price will increase.

       (ii) In a collusive equilibrium, the two firms will collectively act like a monopolist. When MC of firm A increases, firm A will reduce their production. This will increase price and cause firm B to increase production. Price will be higher and total quantity produced will be lower.

       (iii) Given the good is homogenous, both will produce where P = MC. Firm A will increase price to $80 and firm B will keep its price at $50. Assuming firm B can produce enough output (they are not capacity constrained), they will supply the entire market.

    b) (i) The increase in the MC of both firms will shift both reaction functions inward. Both firms will decrease the quantity produced and price will increase.

       (ii) When MC increases, both firms will produce less and price will increase, as in the monopoly case.

       (iii) As in the above cases, prices will increase and quantity produced will decrease (but both firms will be in the market).

    c) (i) In this case, both reaction functions will shift outward and both will produce a higher quantity; price will tend to increase.

       (ii) Both firms will increase the quantity produced as demand and marginal revenue increase. Price will also tend to increase.

       (iii) Both firms will supply more output. Given that MC is constant, the price will not change.

6. Questions for Review page 511 number 4

A maximin strategy is one in which each player determines the worst outcome for each of the opponent's actions and chooses the option that maximizes the minimum gain that can be earned. Unlike the Nash Equilibrium, the maximin solution does not require players to react to an opponent's choice. If no dominant strategy exists (in which case outcomes depend on the opponent's behavior), players can reduce the uncertainty inherent in relying on the opponent's rationality by conservatively following a maximin strategy. The maximin solution is more likely than the Nash solution in chases where there is a higher probability of irrational (non-optimizing) behavior.

7. Exercises page 511 number 3
    a) With a maximin strategy, a firm determines the worst outcome for each option, then chooses the option that maximizes the payoff among the worst outcomes. If firm A chooses H, the worst payoff would occur if firm B chooses H (A earns 50). If firm A chooses L, the worst payoff would occur if firm B chooses L (A earns 15). With a maximin strategy, firm A will choose H. If firm B chooses L,

the worst payoff would occur if firm A chooses L (B earns 20). If firm B chooses H, the worst payoff would occur if firm A chooses H (B earns 40). With a maximin strategy, B chooses H. So both firms choose H under maximin strategy.

b) If firm A can commit first, it will choose H, and firm B will choose L. This gives firm A a payoff of 60. If firm A chose L, firm B would choose H and firm A would only receive 55. If firm B commits first, it would choose H, because it knows firm A will choose L.

8. Exercises page 512 number 5
   a) The NE is (Second, First). There is no incentive for either party to change from this outcome.

   b) The maximin equilibrium is (Second, First)

   c) If network 1 moves first, (Second, First) is the sequential equilibrium. If network 2 moves first, (Second, First) is the sequential equilibrium.

9. Exercises page 512 number 6
   a) There are two pure strategy NE: (A,C) and (C,A)

   b) The maximin equilibrium is (A,A)

   c) If firm 1 plays it maximin strategy of A, and firm B knows this, Firm 2 will get the highest payoff playing C.