1. Draw the following for a firm in a competitive industry. Assume that the firm faces diminishing marginal product at some point. Remember to label all curves and axes.
a. Fixed cost and average fixed cost.
b. Marginal cost
c. Average variable cost and average total cost.
d. Identify the price ranges that will induce entry, exit and shutdown assuming all firms face identical cost curves.
e. Assuming firms are producing at minimum efficient scale, draw the industry long run supply curve in parallel with or in reference to the firm level curves from above.

2. A major proposed industry in the future is the provision of global satellite wifi. However, the actual willingness to pay for such a service is unknown. Assume there's a 40% chance that there are 1 billion people willing to pay $100/year for a service that would cost $60/year to provide and a 60% chance that those people would be willing to pay $10/year for a service that would cost $60/year to provide. Assume that the enterprise involved with this risky industry has an interest rate or discount rate of 20%.
a. What is the expected value, annually, of providing this service?
b. Assume that you could spend $75 billion to launch a testbed of the program, that could then either be scrapped if the willingness to pay were $10 or continue at normal cost afterward (for simplicity, assume that the program will last forever and generate constant annual returns if it is continued) if the willingness to pay were $100. What is the net expected value of this testbed?

3. Two gas stations in a rural town can engage in collusion over pricing. Because drivers often just stop at the first station they see as they go through town, price competition is not that severe in the first place. Assume either station can price gas at $0.30 above average total cost or $0.50 above average total cost. If they have equal prices, they split the market. If they have unequal prices, the lower price station gets 75% of the market (assume for simplicity no change in the size of the market; price elasticity of demand is very low for short term changes in the price of oil).
a. Draw the normal form representation of this game. Identify the key aspects of the game.
b. Identify the dominant strategy, if any, for each player.
c. Identify any Nash equilibria.

4. Draw a demand, marginal revenue and marginal cost curve for a monopoly firm. Be sure to label axes and curves.

a. Identify efficient and equilibrium quantity exchanged.
b. Identify monopoly price.
c. Explain why I am not asking for a supply curve.

5. Explain what is the relationship between marginal cost and average total costs for a firm or industry exhibiting each of the following:
a. Economies of scale.
b. Constant returns to scale.
c. Diseconomies of scale.

6. Assume that the economy is facing the zero lower bound.
a. Explain how the Federal Reserve might engage in expansionary monetary policy and what that will do when the economy is facing the zero lower bound.
b. Explain how expansionary fiscal policy might influence the economy when facing the zero lower bound.

7. A farmer can either invest in irrigation for their farm or not. There's a 30% chance that they will receive adequate rain such that the irrigation is not necessary, and a 70% chance that the irrigation will be useful if acquired. Assume that the farmer will receive $5,000 if their crops are adequately watered, and $1,000 otherwise. Irrigation costs $3,000. For simplicity, assume this is a one-off game and that nature is not perverse.
a. Draw the extensive form of this game, with the farmer acting first and nature second.
b. What is the expected value of each strategy for the farmer?
c. What is the expected value of perfect information on the weather?

8. Assume that all participants in the following have an interest rate or discount rate of 10%. A firm could either finance an operation by selling 1% of a constant stream of income of $50 million per year forever (an equity exchange) or by selling a 5 year bond with a 15% coupon rate and a face value of $3 million.
a. What is the present value of the equity?
b. What is the present value of the bond?

9. Assume a constant marginal cost of $0.01/kwh for hydro and $0.09/kwh for natural gas given installed capacity. Assume that installed capacity can be bought at the beginning of the year and sold at the end of the year at the same price and that the discount rate or interest rate is 8.76% and that there are 8760 hours in a year. A kilowatt of natural gas capacity costs $1000 and a kilowatt of hydro capacity costs $10,000. Because you can buy and sell the capacity at the same price this means that the fixed cost of installed capacity is just the opportunity cost of capital, or the interest rate times the purchase price of the capacity.
a. What is the average total cost of producing 8760 kilowatt hours in a year using one kilowatt of installed hydro capacity?
b. What is the average total cost of producing 8760 kilowatt hours in a year using one kilowatt of installed natural gas capacity?

10. Assume that the nominal interest rate is 8% in 2020, with inflation at 3%.
a. According to the Fisher effect, what will happen to the nominal interest rate if inflation goes to 8%?
b. If someone borrowed $1 million in 2020 at 8% (promising to pay $1,080,000 in one year) and paid back the loan one year later when inflation had unexpectedly gone to 8%, what would be the real interest rate on this loan?