Part A: *True/False/Uncertain, and Justify*

1. (Khanna) Jay raises fish in two ponds, Cayuga and Seneca, located on his property. Currently, he divides his time equally between Cayuga and Seneca, which results in harvests of 1,000 pounds of fish per year from Cayuga and 2,000 pounds of fish per year from Seneca. (These yields, and any others he is capable of harvesting from his two ponds, can be sustained indefinitely.) TRUE or FALSE: It follows that Jay's current allocation of effort between the two ponds cannot be optimal. **Explain**.

2. (Pape) There is a society of N people who all value more candy to less. There is a finite amount of candy, which has been allocated pareto optimally.
   Then, a new law is passed, requiring everyone numbered 2, ..., N to give one piece of candy to person 1. **Claim:** This new allocation is not pareto optimal.

3. (Pape) Suppose that person A has fixed preferences over the elements of some set X. Suppose that person A's strict preferences are not always transitive. Suppose person B knew person A's preferences. Then, person B could offer person A a series of choices that would result in person B getting all of person A's money.

4. (Yang) Both the Paache index and consumer's surplus are accurate measurements of welfare change.

5. (Yang) Because of the Walras Law, we can place the price vector on a simplex in general equilibrium analysis.

Part B

6. (Khanna) Mili is like all managers in a perfectly competitive industry, except in one respect: because of his great sense of humor, people are willing to work for her for 25% of the going wage rate. All other firms in the industry have short-run total cost curves given by

$$STC(Q) = M + 10Q + wQ^2$$

where M is the salary paid to ordinary managers and w is the going wage rate for the industry. If all firms in the industry face an output price of 20, and $w = 2$, how much more will Mili be paid than the other managers in the industry? **Explain**.

7. (Khanna) The production function of a firm is defined by

$$f(K,L)=\begin{cases} KL/(K+L) & \text{if} \quad (K+L)>0 \\ 0 & \text{if} \quad (K+L)=0 \end{cases}$$

where capital (K) and labor (L) are the two inputs. Capital can be hired at a rental rate of $r>0$, and labor can be hired at a wage rate of $w>0$.

a) In the short run, the amount of capital is fixed at $K=\alpha>0$. Obtain the short run cost function of the firm, showing your procedure clearly.

b) Obtain the long run cost function as an envelope of the family of short run cost functions, showing your procedure clearly.

8. (Pape) Find all nash equilibria of the following game:

	L	R
U	3,1	0,0
D	1,0	2,2

Now, suppose Row moves first, and Column can observe Row's move. Find all Nash Equilibria of the new game. Which NE are subgame perfect? Show that they are SP.

9. (Pape) Suppose a rational agent is choosing between the following two options:

A: yields $x with certainty

B: μ chance of $(x − a)
(1-μ) chance of $(x + b)

Where $0<\mu<1$ and a,b > 0.

Suppose μ and a are fixed. What is the smallest b such that all risk-averse agents would prefer A over B? **Explain.**

10. (Yang) Two farmers, A and B, live 8 and 12 miles, respectively, from a river and are separated by 15 miles along the river. Pump houses cost P dollars each and must be located on the river. Laying pipe costs $100 per mile. Once the pipe is laid and pump houses installed, the water is available at no extra cost.
Do farmers have an incentive to minimize the total (to both farmers) cost of obtaining water?
If one pump house is used to supply both farmers, show that it will be located 6 miles from the point on the river closest to farm A. What will the cost of water be for each farmer and totally in terms of P?
Suppose the farmers build their own pumps. What will the cost to each be and the total cost?

11. (Yang) Consider an economy with one consumer and one firm. The firm produces a good with labor as the sole input; the consumer enjoys the good and leisure. Production function of the firm is $f(L)=L^{1/2}$; utility function of the consumer is $u(x_1,x_2)=\ln x_1 + \ln x_2$. The total labor endowment is 1. Calculate the Walrasian equilibrium of the economy.

12. (Pape) Prove/Argue that the market allocation in which there is a monopolist is not pareto optimal. Assume the consumers are price-takers, there is perfect information about the product, no transaction costs, etc; i.e. assume all other assumptions of perfect competition hold. Be specific: make sure your argument explicitly references the definition of pareto optimality and shows how that definition fails to apply.

13. (Pape) A consumer's preferences over x_1 (apples) and x_2 (oranges) are represented by the utility function:
$$u(x_1, x_2) = x_1 x_2 + 10 x_2$$
The price of one pound of apples is $1 and the price of one pound of oranges is $2. The consumer's wealth is $60.

Apples and oranges are rationed. Along with the money payment, the purchase of each apple costs 2 ration tickets, while each orange costs 1 ration ticket. The consumer is allocated 30 ration tickets.

(a) Draw the feasible set and find the optimal basket of consumption.
(b) Suppose the consumer can buy or sell ration tickets at the price of $1 per ticket. Draw the feasible set in comparison with (a). Find the commodity bundle that the consumer will choose.
(c) Suppose there are transaction costs, so that ration tickets can be bought for $1 but sold for $0.75 only. Draw the feasible set and find the consumer's optimum.

14. (Yang) Please state and outline the proof of the Negishi theorem

15. (Yang) There are n identical firms in an industry facing a downward demand function $Q = a - bp$. Please find the Cournot equilibrium price and firm's output. Discuss special cases $n = 1$ and $n = \infty$. (Make further parametric assumptions you consider necessary)