

Write your name on the cover of the test booklet and nowhere else. Failure to follow these directions will cost you 1 point. The test has 150 points (to be scaled up to 200 points) and is scheduled to take 75 minutes. Therefore, expect to spend 1 minute for every 2 points. For example, a 16-point question should take 8 minutes. I will allow some extra time, but I will not allow much.

1) (10 points) Do EITHER Part A OR Part B.

- A) Is the $U(x, y, z) = x^{1/3}y^{1/3}z^{1/3}$ a legitimate utility function? Explain your logic.
- B) Why was Nash's work so revolutionary?

2) (12 points) Do EITHER Part A OR Part B.

- A) Draw an indifference curve and budget constraint diagram to show maximizing utility subject to a budget constraint gives the same quantities as would be gotten by finding the minimal income necessary to have a certain level of utility. Explain the economics of why they are the same.
- B) For both the Von Stackelberg follower and the leader, state whether that firm uses a Lagrangian in its profit maximization. Explain why each firm makes its choice.

3) (20 points) Find all Nash equilibria in the following matrix. Prove that you found all and prove they are Nash equilibria. Find the cooperative equilibrium. Explain how you found it.

Payoff Matrix		Player 1		
		High price	Medium Price	Low Price
Player 2	High Price	15 9	13 6	14 34
	Low Price	11 8	12 7	10 35

4) (36 points) Suppose that both firms are facing the following demand and total cost functions: $P = 101 - (Q_1 + Q_2)$ and $TC_i = Q_i + (Q_i^2)/2$. Use this to derive the best response function for Firm 1 and the equilibrium output for each firm, assuming that the firms are Cournot style firms. Show all work.

5) (36 points) Suppose that labor costs \$8/hour and capital costs \$18/unit. If the firm's production function is given by $Q = 2K^{1/2}L^{1/2}$, then derive formulas for the cost-minimizing amount of capital and labor used to produce a quantity Q . Use that to derive the total cost, average cost, and marginal cost functions. Show all work.

6) (36 points) Suppose that your utility function is given by $U(x, y, z) = x^{1/2} + y^{1/2} + z^{1/2}$. The price of a xylophone is \$10/unit. The price of a yak is \$20/unit, and the price of a zebra is \$20/unit. Your income is \$300. The zoning puts a limit on the total number of animals you can own. You cannot own more than two animals total. Find the utility maximizing consumption of the three goods. How much will utility increase if the limit on the number of animals increases?