

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.

Show all work on all questions.

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

A) Is the $U(x, y, z) = x^{4/3} + y^{-1} + z^{1/3}$ a legitimate utility function? Explain your logic.

B) What is the economic reason why must utility functions have *decreasing returns to scale*?

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

A) Suppose a firm's total cost function is $TC = Q^2 + 4Q^{1/2} + \ln(Q)$. What are the marginal cost and average cost functions? Show all work.

B) What is the inter-temporal budget constraint for consumption and income over a three year period? Briefly explain how you came to that conclusion.

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	25 9	23 6	34 33
	Low Price	7 8	22 21	30 35

4) (36 points) Suppose that both firms are facing the following demand and total cost functions:

$P = 82 - \frac{1}{2}(Q_1 + Q_2)$ and $TC_i = 2Q_i + \frac{(Q_i^2)}{2}$. 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. What are the outputs of the two firms and the market price? Show all work.

5) (36 points) Suppose that labor costs \$8/hour and capital costs \$18/unit and the firm's production function is given by $Q = 2K^{1/2}L^{1/2}$. Derive formulas for the output maximizing amount of capital and labor used for a total cost of \$144 and calculate the value of λ . What is the economic interpretation of λ ? Show all work.

6) (36 points) Suppose you are a Von Stackleberg leading firm. You have figured out that the following firm produces $Q_F = 25 - \frac{1}{2}Q_L$. If the price is given by $P = 50 - (Q_L + Q_F)$ and the total cost function is given by $TC_L = 20 + Q_L$, then find the profit maximizing price and quantities for the two firms. Show all work.