

Place your name on the back of this sheet of paper and nowhere else. Staple your answers on the front of this sheet of paper. Failure to follow these directions will cost you 1 point. If you use double-sided printing or print on the back of scrap paper, I will give you one additional point.

1) (20 points) Suppose the firm has a production function of  $Q = K^{1/2}L^{1/4}$ . If the wage rate is \$12/L and the rental rate is \$3/K, then what are the total cost, marginal cost, and average total cost functions? Show all work.

2) (35 points) Suppose the industry demand curve is given by  $P = \frac{1}{4}(Q_1 + Q_2)$ . The firms' costs curves are given by  $TC_i = 3 + Q_i + Q_i^2$ . Derive firm i's best response function for the Cournot model. Find the Cournot model's values for  $Q_1$ ,  $P$ , and  $\Pi_1$ . Show all work. Find the Von Stackleberg equilibrium values for  $Q_1$ ,  $Q_2$ , and  $P$ . Show all work.

3) (35 points) Suppose the industry demand curve is given by  $P = 19 - (Q_1 + Q_2)$ . If the total cost function for firm i is given by  $TC_i = Q_i^2 - Q_i + 5$ , then what is Firm 1's Cournot style best response function? Find the Cournot equilibrium values for  $Q_1$ ,  $P$ , and  $\Pi_1$ . Find the Von Stackleberg equilibrium values for  $Q_1$ ,  $Q_2$ , and  $P$ . Show all work.

4) (10 points) Why did we use Lagrangians in the Von Stackleberg model, but not in the Cournot model?