

**Answer all questions, showing all your work. Try to use diagrams wherever possible.  
Time allowed: 2 hours. Each question is worth 20 points. Good luck!**

1. There are 100 firms in the perfectly competitive widget industry. Each firm has a cost function given by

$$C(q) = 0.5q^2 + 10q + 5,$$

where  $q$  is its output level per period. Demand for widgets per period is

$$Q_d = 1,100 - 50p,$$

where  $p$  is the price of widgets.

- Find the short run market supply curve of widgets.
  - Find the short run equilibrium price and quantity produced per period.
  - Suppose government imposes a per unit excise tax of \$3 per widget. What would now be the equilibrium price and quantity produced of widgets? How much tax revenue would the government collect? What is the deadweight loss of this tax?
  - What per unit excise tax  $t$  would maximize government's tax revenue? How much revenue could the government collect in this scenario?
2. Consider an exchange economy, with two consumers, A and B, and two commodities, X and Y. Initially, consumer A has 150 units of X and 30 units of Y, while consumer B has 50 units of X and 70 units of Y. The preferences of consumers A and B are represented by the utility functions

$$U_A(X_A, Y_A) = \min \left[ \frac{X_A}{2}, Y_A \right] \quad \text{and} \quad U_B(X_B, Y_B) = 4X_B + 3Y_B.$$

respectively.

- Construct the Edgeworth Box. Label the axes. Label the endowment point with an "E". Label the set of Pareto-efficient allocations with a "PS". Draw the indifference curves for consumer A and for consumer B that pass through E.
- Find the set of allocations which are both Pareto efficient and provide at least as much utility for each person as the initial endowment. Identify both endpoints of this set.
- Calculate the competitive (Walrasian) equilibrium price ratio and the equilibrium allocation. Explain fully!

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3. Widget Corp is the only producer of widgets. The inverse demand curve for widgets is

$$p = 100 - 3Q + 4\sqrt{A}$$

where  $p$  and  $Q$  are the price and quantity traded of widgets and  $A$  is the amount the Widget Corp. spends on advertising each period. Widget Corp's cost function is

$$C = 4Q^2 + 10Q + A$$

- (a) Find the values of  $Q$  and  $A$  that would allow Widget Corp to maximize its profits. What will be  $p$  and how much profit will Widget Corp make per period?
- (b) What is the Lerner index of the degree of monopoly? Calculate its value for Widget Corp.
4. Able Corp is the only firm that produces gadgets. It has a choice to use either of two techniques of production, 1 and 2. The cost functions associated with these two techniques are, respectively
- $$C_1(q) = 10 + 8q \quad \text{and} \quad C_2(q) = 60 + 2q,$$
- where  $q$  is the firm's output level. The market demand for gadgets is
- $$Q = 20 - p.$$
- (a) Which of the two techniques of production will Able adopt in order to maximize its profits? What will be the values of  $Q$  and  $p$  and how much profit will Able make?
- (b) Suppose that Able discovers, before it has chosen its technique of production, that Baker Corp. is thinking of entering the gadget industry. If Baker enters, it would have access only to technique 1, and the two firms would engage in Cournot competition. Which technique of production would Able adopt now?
- (c) In which of the scenarios (a) or (b) is society better off? Explain clearly by calculating welfare levels in the two scenarios.
5. There are 2 lakes and 20 fishermen in Lakeland. The value of the total catch on each lake depends upon the number of fishermen fishing on it, according to:

$$Q_x = 10L_x - \frac{1}{2}L_x^2 \quad \text{and} \quad Q_y = 5L_y$$

where  $L_x$  and  $L_y$  are the number of fishermen fishing on lakes X and Y respectively. The fishermen can choose which lake to fish on.

- (a) How many fishermen will choose to fish on each lake and what will be the total catch?
- (b) What is the efficient allocation of fishermen between the two lakes? How much would be the total catch in this case?
- (c) Suppose the government could charge a license fee for each fisherman on each lake. What license fees should the government set in order to achieve the efficient solution?