14.03 Exam 3 Fall 2000

DO NOT OPEN THIS EXAM UNTIL TIME IS ANNOUNCED!

There are 95 points on this exam and you have 120 minutes to complete it. The points can be used as a guideline for how many minutes to spend on each problem (i.e, 1 ¼ minutes per point). If you are uncertain of the answer to a problem, move on to the next problem and return to the question at the end of the exam, time permitting.

The questions are ordered as followed (with approximate times):

Three 10 point questions (12 minutes each)

One 15 point question (20 minutes)

One 20 point question (24 minutes)

One 30 point question (40 minutes)

THE EXAM WILL END PROMPTLY AT 3:30pm. WHEN TIME IS CALLED YOU MUST PUT DOWN YOUR PENCILS AND CLOSE YOUR EXAMS IMMEDIATELY. IN FAIRNESS TO ALL, IF YOU ARE SEEN WRITING AFTER TIME IS CALLED, WE WILL BE REQUIRED TO DOCK POINTS FROM YOUR EXAM.

Question 1: 10 points

After learning of the Tyler, Murnane, and Willet study demonstrating that the pure labor market signaling value of the GED is approximately $1,500, the GED Testing Service decides to lower the score required to pass the GED from 100 points to 50 points.

Assume as in the Tyler, Murnane and Willet study that the GED acts only as a labor market signal, i.e., acquiring a GED does not affect an individual's productivity at work.

a. How would you expect this change (lowering the passing score) to affect the average wages of GED holders: increase, decrease, or remain the same AND WHY? [Feel free to include a figure.]

b. How would you expect this change (lowering the passing score) to affect the high school dropout rate (i.e., the share of high school students who drop out before completing their degree): would it increase, decrease, or remain the same AND WHY?

Question 2: (10 points)

Microsoft Money is a personal finance program with zero marginal cost of production. There are two types of consumers: MBAs, whose total demand for Money is given by $Q_M(P) = 100 - P$, and economics PhDs, whose total demand for Money is given by $Q_P(P) = 50 - 2P$.

a) Microsoft cannot tell MBAs and PhDs apart, so it must charge a single price for Money. What is the profit-maximizing price? What are Microsoft's profits? What is the consumer surplus for MBAs? What is the consumer surplus for PhDs? (Hint: consider that Microsoft can either serve both markets (by setting a price less than 25) or only the MBA market (by setting the price above 25).)

b) A marketing wizard at Microsoft comes up with an idea for a new version of Money called Money for Economists. Money for Economists is exactly like Money except it does not allow annual incomes in excess of $100,000 to be inputted. This change does not affect the demand of economics PhDs, but it means that Money for Economists is completely useless to MBAs.

What is the profit-maximizing price of Money? What is the profit-maximizing price of Money for Economists? What are Microsoft's profits? What is the consumer surplus for MBAs? What is the consumer surplus for PhDs? How does this outcome compare (in the Pareto sense) to the outcome in part a)?

Question 3: (10 points)

For this question you need to know the following facts about the online auction business:

- eBay is by far the largest online auction site. In 1999 approximately 340,000 auctions closed every day on eBay, while only 88,000 auctions closed every day on Yahoo, the second-largest site.
- eBay charges sellers a listing fee and a percentage commission on the sales price. Yahoo does not charge fees to sellers.

Provide *brief* answers to the following questions based on the above facts and what you have learned in class.

a) Many more sellers use eBay rather than Yahoo even though eBay is more expensive for sellers than Yahoo is. Why?

b) Consider the following news article:

> As the leading online auction site, eBay should be a true believer in free markets. But in recent weeks, the Silicon Valley company, which has almost 70% of the consumer Internet-auction market, has sounded like an indignant monopolist protecting its turf. It is trying to stop websites that allow users to search for products across a variety of online auction services from gaining access to its auction database.
>
> At AuctionWatch and Bidder's Edge, the leaders in the new field of “universal search” auction sites, users type in a term, such as "beanie babies" or "PowerBook", which is automatically submitted to the search engines of hundreds of auction sites. The services then list the ongoing auctions for those items.
>
> There are several reasons why eBay objects to such "unauthorised intrusions". They could bog down its computers and, in the case of AuctionWatch, would deliver incomplete results, the firm argues. More important, eBay considers most of the auction data to be its intellectual property--and the advertising-financed search sites to be little more than online parasites.

Please provide an economic explanation (different from the ones given in the article) for why eBay wants to limit the development of universal-search auction sites. [One to three sentences will do.]

Question 4: (15 points)

The demand for Coke is $Q_c(p_c, p_p) = 24 - 3p_c + p_p$, and the demand for Pepsi is $Q_p(p_p, p_c) = 24 - 3p_p + p_c$, where p_c is the price of Coke, and p_p is the price of Pepsi. Assume that the production cost for both Coke and Pepsi is zero, which means that profits are equal to revenues.

a) If Coke and Pepsi agree to maximize their joint profits, what prices will they set?

b) Since the agreement in part a) violates the antitrust laws, Coke and Pepsi must set their prices non-cooperatively. What are the Nash Equilibrium prices of the one-shot, simultaneous-move game?

c) In reality, Coke and Pepsi interact repeatedly over time. Consider the infinitely repeated price-setting game. The discount rate for both firms is d (i.e., \$1 received one period in the future is worth \$$d$ today). Is there a subgame perfect equilibrium in which both firms set the joint-profit maximizing prices each period? If so, describe the strategies that support this outcome and specify the values of d for which these strategies are an equilibrium.

Question 5: (20 points)

Suppose that there are two types of workers in the labor force, low ability (Low) and high ability (High) workers, where the fraction of High workers is l. A worker knows her type. If High workers are employed by a firm they can produce q_H units of output in one year, and Low workers produce q_L units of output per year, where $q_H > q_L > 0$. If a worker of any ability level does not work for a firm, she can work at home and, although less productive, she can still produce $c \cdot q_i$ per year, where c<1, and i is either H or L, for High and Low workers respectively. Each worker works for just one year and then she retires. Assume finally that one unit of output, either produced at home or in a firm, sells for $1.

a) Suppose for now that a firm can observe the ability of the workers it hires. Further assume that there are two perfectly competitive firms that use the same production technology that employs only labor. The profit that a firm makes for each worker it hires is therefore equal to the value of the output produced by that worker's type minus the wage paid to that worker. Perfect competition implies that the profit made on each worker has to be zero in equilibrium. Determine the wage that the firms are willing to offer to each type of workers. Are workers willing to accept the job offers at those wages, or would they rather produce at home? Compute the total output in the economy (scaled by the number of workers) in one year.

b) Suppose from now on that there is asymmetric information, that is firms have no way to know workers' ability. Since firms cannot distinguish between the two types of workers, they offer only one wage rate, which, by perfect competition, in equilibrium has to be equal to the expected productivity of the workers that accept the job offers. If the firms believed that only Low workers would accept the job offers, what wage should they pay? Would Low workers accept this wage, or would they rather work at home?

c) If the firm believed that both types of workers would accept the job offers, what would the offered wage be? Would Low workers accept this offer? Would High workers accept the offer? What would High worker's decision depend on?

d) If l = 1/2, c= 3/4, q_H = 4 and q_L = 1 what is the equilibrium wage and what types of workers are employed in the firms in equilibrium?

e) Compute the total output in the economy if the equilibrium is the one obtained in part (d). Compare your result to the one you derived in part (a). Explain how asymmetric information has affected the equilibrium in this economy.

Question 6: (30 points)

YOU CAN SOLVE THIS QUESTION EVEN THOUGH YOU DID NOT SOLVE THE PREVIOUS ONE. DO NOT BE ALARMED BY THE LENGTH OF THE QUESTION: IT IS MEANT TO GUIDE YOU TO THE SOLUTION.

The setting is the same as in the previous question, except that there is no possibility of home production. There are two types of workers in the labor force, low ability (Low) and high ability (High) workers, where the fraction of High workers is l. When High workers are employed by a firm they can produce q_H units of output in one year, and Low workers produce q_L units of output per year, where $q_H > q_L > 0$. Each worker works for just one year and then she retires. One unit of output sells for \$1. Workers know their type, but firms cannot observe the type of the workers they hire (asymmetric information).

Suppose now that firms decide to *screen* the workers' ability by letting them choose from a menu of labor contracts. Each contract specifies the wage rate and the number of extra-time hours that a worker must work for the firm in one year (i.e., the number of hours beyond the regular working time). Assume for simplicity that the number of extra hours does not affect the yearly production of each type, which remains q_H and q_L for High and Low types, respectively, even if they work for zero extra hours in one year.

The only effect of the number of extra hours is to reduce a worker's utility, which is given by

$$U_i(w,h) = w - \frac{h}{q_i}$$

where *i* is either *H* or *L*, *w* is the wage, and *h* is the number of extra hours in one year. Notice that High workers suffer a lower utility loss than Low workers for each working hour.

The timing of the interaction between firms and workers is as follows:

Stage 1: Two competitive firms simultaneously announce sets of offered labor contracts. A contract is a pair (*h*, *w*). The competitive interaction between firms is such that the profit that they make on each worker they hire <u>has to be zero in equilibrium</u> (the profit on each worker is equal to the value of the worker's production minus the wage paid to the worker. Remember that the number of working hours does not affect the firms' profits).

Stage 2: Given the offers made by firms, workers of each type choose which contract to accept (remember that we are ruling out the possibility of home production, so that workers have to be employed by firms). They choose the contract that gives them higher utility, and if they are indifferent between two contracts, they choose the one with fewer extra hours.

a) Draw the indifference curves of each type of workers in the (*h*, *w*) plane. (Hint: note that the number of extra hours is like a Bad for workers.)

b) From now on, suppose that the economy is in a Separating equilibrium. That is, each firm offers two contracts (h^H, w^H) and (h^L, w^L), such that High workers choose (h^H, w^H) and Low workers choose (h^L, w^L). Given that competition drives profits to zero, what are the equilibrium values of w^H and w^L? Draw the zero-profit (straight) lines for each type of worker in the (h, w) plane. In the same graph highlight the two regions of contracts (h, w) for which firms could make positive profits on High and Low workers, if they could deviate to those contracts.

For the next parts remember to always draw the zero-profit lines in the graphs: it will help you find the solutions.

c) In this equilibrium, what is the number of extra hours h^L that Low workers should work? (Hint: draw the Low worker's indifference curve going through a contract (h, w^L), where w^L is the one you determined in part (b), and h is a generic strictly positive number of extra hours. Is there any profitable deviation for firms, which would attract all Low workers? What does competition between firms imply for the existence of these profit opportunities?)

d) Now we want you to determine the number of extra hours h^H that High types will work in equilibrium. First draw the indifference curve of Low workers going through the contract (h^L, w^L), which you have determined in parts (b) and (c). In a separating equilibrium the High type's contract (h^H, w^H) is such that Low types prefer their own contract (h^L, w^L). Considering this, and using the value of w^H that you determined in part (b), what is the minimum value of extra hours that High types should be assigned? Can h^H be any larger than this minimum value? If yes, how larger? If not, why not? (Hint: consider the profitable deviations available to the firms if h^H is larger than this minimum value.)

e) Explain intuitively how this screening mechanism has helped the firms to get around the problem of asymmetric information and to distinguish between the two types of workers.

f) Could a Pooling equilibrium exist in this setting? That is, an equilibrium in which firms offer only one contract (h^P, w^P), where w^P is equal to the average productive ability of workers in the population, and h^P is a generic positive number of extra hours. (Hint: in the same kind of graph that you used before, consider the profitable deviations that would attract all High workers. What does competition imply for the existence of these profit opportunities?)