

Test 1
Economics 136 – Human Resources
Spring 2008
Prof. Julian Betts

April 22, 2008

Name: _____

Student ID _____

There are 3 written problems in this test, worth a total of 25 points. Please write neatly. If you place the answer to a question in an odd place, such as the back of the page, please indicate this clearly, for the sake of the graders.

If you use pencil, the exam cannot be regraded. If you do submit your test for regrading, you must do within the time and other guidelines listed in the syllabus.

SHOW ALL YOUR WORK!

You have 80 minutes. Good luck.

For the graders:

1.	_____	/15
2.	_____	/8
3.	_____	/8
4.	_____	/14
SUM	_____	/45

STUDENT CONSENT FOR RELEASE OF STUDENT INFORMATION
(Buckley Waiver)

I hereby authorize the UCSD Economics Department to return my graded final examination/research paper by placing it in a location accessible to all students in the course. I understand that the return of my examination/research paper as described above may result in disclosure of personally identifiable information, that is not public information as defined in UCSD PPM 160-2, and I hereby consent to the disclosure of such information.

Quarter_____ Course_____ Date_____

Instructor_____

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1. (15 points) Steve Jobs runs Apple, formerly known as Apple Computer. Jobs left Apple for a period of time before coming back to run the company. During his absence, Apple's sales and profits temporarily plummeted. It seems clear that Steve Jobs is absolutely essential to the firm, acting as the main creative force. Experience has taught him that as the company expands he gets spread too thin, and productivity falls. However, he has also discovered that software engineers from regular "Low Quality" universities are perfect substitutes for software engineers from fancy pants universities, which we will call "High Quality" universities. It is just that workers from the Lower Quality universities are about two-thirds as productive.

Overall the production function for Apple appears to be
 $Q = \{2L + 3H\}^{1/2}$

where Q is output per hour and L and H are the numbers of software engineers from Lower Quality universities and Higher Quality universities respectively.

a) (3 points) Suppose that Jobs increases employment from some initial levels L and H to 4L and 4H. Calculate the ratio of output in this situation to that with the initial level of output.

b) Is this an example of
_____ Constant Returns to Scale
_____ Diminishing Returns
_____ Increasing Returns to Scale

Explain the source of the type of returns that you identified above, using one or two sentences of intuition. (2 points)

c) Calculate the marginal product of workers of either type, and verify that for any level of H and L, the ratio of marginal products of the low to the high quality workers is 2/3. (2 points)

d) Suppose that there is no capital cost in this business, so that the total cost of hiring one worker with low or high skills is given by the corresponding wage rates W_L and W_H . Write down a rule that explains which type(s) of workers to hire for a given wage ratio W_L/W_H . (2 points)

e) Suppose that currently the hourly wage for the two type of workers is $W_L=\$30$ and $W_H=\$40$. Draw a graph of L vs. H that illustrates the firm's optimal choice of L and H workers (from low and high quality universities) for a given output Q^* . (You don't need to worry about the exact number for output.) Hint: the slope of the isoquant at any point is related to the marginal products of the two types of workers. Knowing this, what does your answer to part c) tell you about the shape of the isoquant? (4 points)

f) Based on the production function and your answer to e) do engineers from High Quality and Low Quality universities appear to work independently of each other? Explain. (2)

2) (8 points) You own an oil firm that expects to stay in business for 10 years, after which time the plot of land you have rights to will not have any oil left. You want to hire a petroleum engineer to take care of the equipment in the oilfield, and you expect that you can hire him or her for 10 years.

You have two candidates. The first, Candidate A has ten years' experience and comes with solid job recommendations. Given her level of experience you would need to pay her an average of \$130,000 per year. You are certain that she can bring in revenues of \$140,000 per year for each of the next ten years.

Candidate B has zero experience but comes with great recommendations from her math and engineering professors as an accomplished and creative mathematical mind. Given her lack of experience, on average you would pay her \$100,000 per year. You decide that there is a 0.8 chance that this person would bring in revenues of \$150,000 per year through better choice of drilling sites and maintenance of pumps. However, there is a small (0.2) probability that in spite of her higher ability, she would be a disaster, solely due to her lack of experience, and would reduce revenues by \$1,000,000 per year.

Assume that after one year you can figure out whether worker B is high or low productivity. If she is high productivity you can keep her on staff for another 9 years at a salary of \$100,000. If she is low productivity, you fire her and never hire another petroleum engineer during the remaining 9 years before the oil field is emptied.

a) What is the expected profit from hiring A? From hiring B? Which would you prefer? Show your work. (5)

b) Now suppose that you have discovered that there is *only one year of oil left in the oil field*. Which engineer, A or B, should you hire now? Show your work and provide some intuition for whether your answer differs from or is the same as your answer to a). (3)

3) (8 points) Suppose that the labor force in your region consists of three types of workers whose productivity ranges between \$8 and \$16 an hour as shown below. The column on the right shows the proportion of the population that is in each category. At present there is only one type of firm, which pays a fixed salary.

Worker Type	Productivity per hour	Proportion of the population
A	\$16	0.25
B	\$12	0.5
C	\$8	0.25

Note that these firms earn zero profits per worker, although they will presumably earn the average return on their capital.

a) What is the salary that these firms would all have to offer to ensure zero profits and that as many workers as possible were working for them? The workers have no alternative except to work for these fixed-salary firms. Explain and show your work. (2)

b) Suppose that some firms decide to start paying a piece rate. Because it is costly to monitor output, these “piece rate” firms deduct \$2 per hour for the costs of monitoring. Their goal is to hire the greatest proportion of the population that they can. Assume that through competition, these piece-rate firms earn zero profits per worker. Which types of workers above will choose to work for these piece-rate firms, and what will each type of worker earn at the piece rate firms? Which workers will remain with the fixed-salary firms, and what will their rate of pay be now? Assume that fixed salary firms always attempt to maximize the share of the workforce they employ. Show your work. (6 points)

4. (14 points) Your boss tells you to design a probationary wage system under which workers earn W_1 during period 1 and W_2 in period 2. Your goal is to make skilled workers want to work for your firm, and to prevent unskilled workers from working for your firm. To simplify the math, let's assume that your goal is to leave unskilled workers indifferent between applying and not applying. Assume that workers maximize the sum of earnings over 2 periods, and that their discount rate=0. Unskilled and skilled workers' wages in the general labor market are:

$$W_U \text{ and } W_S = W_U + G.$$

After one period, you will keep all workers you believe to be skilled and fire all those you believe to be unskilled. However, there is a problem: there is a probability P that at the end of period 1 an unskilled worker will be identified as "skilled" and will not be fired.

a) Before you solve anything mathematically, give some intuition to your boss. Should W_1 be higher or lower than W_2 ? Why? (3 points)

b) Derive the values of W_1 and W_2 that will make skilled workers want to work at your firm, and which will leave less skilled workers indifferent between applying and not applying. Show your work and explain each step in words. (6)

c) Calculate the derivatives $\partial W_1 / \partial P$ and $\partial W_2 / \partial P$ and make sure to indicate whether they are each positive or negative. Give a sentence or two of intuition for your findings. (5 points)