Test 2
Economics 136 – Human Resources
Fall 2003
Prof. Julian Betts

November 18, 2003

Name: _____

Student ID _____

There are 4 written problems in this exam, worth a total of 53 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.   _____/8
2.   _____/13
3.   _____/19
4.   _____/13
SUM _____/53

1. (8 points) You have three workers at your firm and two divisions, Steel Products and Unfinished Steel (labeled as SP & US below). By rotating workers through both divisions, you have determined that the addition to net revenues generated by each worker is as follows:

Worker	Net revenues in SP	Net revenues in US
1	25	30
2	199	200
3	50	35

a) (3 points) If your company is flexible enough to assign workers to either division completely as it pleases, what would be the profit-maximizing allocation of workers be? What would revenues be?

b) (5 points) Your company needs one worker in Unfinished Steel and two in Steel Products. First, state the rule that your company should follow to maximize profits. Then, use this rule to prove that it is optimal to assign the worker who is least productive in Unfinished Steel to that division. Explain in a sentence why this seemingly ridiculous worker assignment actually makes sense. What happens to total revenues here compared to a)?

2. (13 points) A person is trying to decide whether to return to college. She expects to work two more years before retiring. If she does not return to college, she expects to earn $40,000 each year. If she goes to college then she will earn nothing this year but $100,000 in the following year before retirement. Tuition and books would cost $10,000. She discounts income and costs that occur next year with a discount rate of r.

a) Calculate the present discounted value of the two paths, college and no college. (4)

b) (7) Find the discount rate (let's call this particular value r*) at which the present discounted value of the two paths, college and no college, are equal. Before solving your equation for r*, re-arrange your equation to clearly show the costs of attending college on the left-hand side of the equation and the benefits on the right-hand side of the equation. Explain what each cost and benefit in this re-arranged equation represents, in a word or two. Then solve for r*. Would a person with a discount rate of r* strictly prefer to attend college one more year, strictly prefer not to attend college one more year, or be indifferent?

c) (2) If the person had a discount rate above r* would this person strictly prefer to attend college one more year, strictly prefer not to attend college, or be indifferent? Answer the same question a second time for a person who had a discount rate *below* r*.

3. (19 points) Suppose that you have been hired into a company that wants to switch from a straight salary to a piece rate. You have been asked to design a compensation scheme where earnings = a + bE where E is worker effort. Based on past experimentation with worker quit rates under different salary levels and work loads, your company estimates that the utility of workers can be expressed as

$U = \text{earnings} - 4E - E^2$ where the last two terms reflect the disutility of effort.
Currently, workers will quit unless $U \geq 0$.

Production per worker per unit of time at your company is given by $Q=6E$. Output sells at \$2 per unit. In addition to labor costs, there are material costs that rise with worker effort, of \$4E.

a) Solve the worker's problem, given earnings of $a + bE$. Confirm that you have solved for the utility maximum. (4 points)

b) Write down the firm's profit maximization problem, and then solve for a, b, optimal effort E* that results, and profits per worker. Prove that your solution maximizes profits. (8)

c) On the next page, draw a diagram that illustrates your solution. The diagram should clearly indicate three lines, one for the disutility of effort, second for the compensation = a + bE and a third showing net output. You should show the general shapes of lines (linear, convex, concave) without worrying about plotting the lines exactly as you would on graph paper. Indicate the size of intercepts. Also endicate clearly where the optimal effort level is, and how profits are determined. (4)

d) (3) Explain how the company could obtain identical output and profits per worker by instead setting a production quota and firing workers if they produced below this quota. What is the salary per period the firm would have to set to make workers willing to work for the firm under this scenario?

4. You have just been hired as a software engineer by Paranoid Software Inc. The owner is extremely concerned that competing firms will listen in on employees' conversations electronically and steal some of Paranoid's ideas. To combat this risk, the owner of Paranoid develops his own constantly changing language of code words that all technical employees must learn. This language, "Techspeak", serves two purposes. First, outsiders will never be able to understand these code words, lowering the chances that outsiders can steal Paranoid's ideas. Second, once software engineers learn Techspeak, they can communicate their ideas to other employees much more quickly. No employees at other firms can either understand Techspeak or, even if they knew the language, use it productively at the other firms.

Employees work for the firm for a maximum of two periods. During period 1, when training in Techspeak occurs, the value marginal product of a worker is $60,000 per year. In period 2, after the training, the value marginal product rises to $100,000 per year. The average earnings over two periods in other firms is $80,000 a year.

a) (3) Does Techspeak sound more like general or specific human capital? Explain.

b) (4) Suppose that the boss of Paranoid informally proposes that new software employees be paid their value marginal product each period, namely $60,000 in period 1 and $100,000 in period 2. What potential problem does this create for you as the employee? Be specific.

c) (4) A group of Paranoid Software engineers suggest that instead, they should be paid the industry average annual salary of $80,000 per year in both periods. Does this create any potential problems for Paranoid Software? Be specific.

d) (2) Describe in general terms what a compromise between the two types of suggested compensation in parts b) and c) might look like. (Under the compromise, both Paranoid's owner and Paranoid's engineers would be willing to accept the wages set for periods 1 and 2.)