Final Exam
Economics 136 – Human Resources
Spring 2003
Prof. Julian Betts

June 11, 2003

Name: _____

Student ID _____

There are 7 written problems in this exam. 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 3 hours. Good luck. Please check that your test has 11 pages, including this first page. There should be no completely blank pages.

For the graders:

1.   _____/19
2.   _____/10
3.   _____/7
4.   _____/16
5.   _____/25
6.   _____/10
7.   _____/13
SUM _____/100

1. (19 points) a) At Acme Widgets, your firm can sell as many widgets as it wants in a world market. It currently uses 50-year-old equipment to make widgets. It can use either unskilled or skilled labor, at a daily cost of $48/day or $80/day respectively. Each worker, regardless of skill, uses one piece of machinery which costs $2/day. Output per day for the unskilled and skilled worker will be 2 and 3 respectively.

　　　Work out the total cost per day of hiring a worker of either type. Which type of worker is best for Acme Widgets to hire? Show your work. (5 points)

b) Suppose that currently the world market price for widgets is $25/widget. What will profits be per worker given your answer to a)? Should the firm stay open? (2)

c) Now suppose that a new computerized type of equipment becomes available. Now, unskilled and skilled workers at your firm can produce 4 and 8 units of output per day. However, the cost per worker per day from this new type of equipment is $16. Repeat your analysis of parts a) and b), working out which type of worker you should hire, and profits per worker that result. Should the firm stay open? (7)

d) Draw a diagram that shows the two solutions that you obtain in parts a and c. The vertical and horizontal axes should show the number of unskilled and skilled workers hired respectively, and the graph should also show and clearly label isoquants and isocosts under the old and new technologies. To make it specific, show one isoquant and one isocost for each technology choice, in each case showing combinations of the two types of workers that will produce 24 widgets per day. Also clearly indicate the profit-maximizing combination of the two types of workers under the old and new technology scenarios. (You do NOT need to indicate the total cost on each isocost line but do indicate the slopes.) (5)

2. (10 points) a) List 2 advantages of piece rates over fixed salaries, and 4 disadvantages. (6 points)

b) List two advantages of using promotion tournaments instead of piece rates, and two disadvantages of tournaments. (4 points)

3. (7 points) a) Suppose that there are two firms in a local economy. One offers a fixed salary of S per day, and the second offers a piece rate that increases linearly with the worker's productivity. Draw a graph of earnings per day vs. worker productivity that shows earnings that a worker of a given productivity can earn at either firm, and then clearly indicate which types of workers apply to the salary firm and which apply to the piece rate firm. (Hint: Assume that there is a monitoring cost per worker per day of $1 at the firm that offers piece rates.) (5 points)

b) Can you say for sure which firm will have higher profits per worker? Why or why not? (2 points)

4. (16 points) Senior management asks you to devise a promotion tournament for two workers, where the worker who produces more earns W_1 and the worker who produces less earns a smaller amount W_2. The two workers have identical productivity (on average) and the same utility function:

$U = E(wage_i) - m_i^2$ for workers i=k,j where m_i is effort.

Each worker's output is given by
$q_i = m_i + e_i$ where m is effort and e is a random luck factor. Each unit of output brings in $20 of revenues to your company. There are no costs apart from labor.

$x = e_k - e_j$ takes on values between –4 and +4 with a uniform probability distribution.
       To ensure that both workers accept the job, you must pay an expected wage for a given level of effort to ensure that expected utility equals 0.
Solve the workers' problems and the firm's problem. Calculate the firm's expected profits and check whether the firm will want to stay in business. DEFINE ALL NEW VARIABLES THAT YOU USE THAT ARE NOT MENTIONED IN THIS QUESTION. (16 points)

5. (25 points) Suppose that a firm will hire a worker for up to 5 periods, after which the worker retires. The firm has to provide *firm-specific* training in periods 1 and 2, which boosts the worker's Value Marginal Product (VMP) in periods 3 to 5, such that VMP by period is 7,7,12,12,12. The worker can choose to work for this firm or can work for a firm that provides no training, earning 10 each of the 5 periods before retirement.

Assume that neither the worker nor the firm discount future cash flows. Thus, this firm has a present value of VMP that equals that of other firms: because the discount rate is zero, PV=7+7+12+12+12=10+10+10+10+10.

a) One option is for the firm to make the worker pay for the entire costs of the specific training, and then boost his pay in periods 3 to 5 to reflect the increase in productivity that results in periods 3 to 5, so that his wages are his VMP each period: 7,7,12,12,12.

Explain clearly why the worker would not want this. For full points explain what the firm will be tempted to do when wages are set this way. (3)

b) A second option is for the firm to bear the entire costs of the training, and then to "pay itself back" in later periods, so that the wages it pays are 10 in each period.

Explain clearly why the firm would not want this. For full points explain what the worker will be tempted to do when wages are set this way. (3)

c) A good compromise is for both the worker and firm to share in the training costs in periods 1 and 2, with both the worker and firm sharing in the rents that accrue in periods 3 to 5. Here is one example: the wages in periods 1 to 5 could be set to $8.50,$8.50,$11,$11,$11. **(This pay rate applies for questions c,d and e below.)**

Verify that in this situation the present value of the firm's profits is 0 i.e. the firm makes normal profits. Also verify that the worker's total pay over 5 periods is the same as if he had instead taken the alternative job that pays $10 each period. (Hint: Recall that both worker and firm have a discount rate of 0.) (2)

d) The firm's rent at the start of age t for a worker, R(t), is defined as the present value of the sum of VMP - wages from age t through period 5. Let's call the rent to the firm over the entire 5 periods R(1). In part c) you proved that R(1)=0. Now calculate R(2), R(3), R(4) and R(5). For example, R(4) is the sum of VMP-wage in period 4 plus VMP - wage in period 5. Finally, draw a graph of R against age t, plotting the values you obtained for t=1 through t=5. (7)

e) Suppose that a one period recession hits this firm, so that the VMP of ALL workers at the firm regardless of age falls by $1.75 for the current period only before returning to normal. Re-draw your graph of rent R(t) against t, reflecting a downward shift of $1.75 in the rents associated with a worker of any age from 1 through 5. (3)

f) Use this graph to decide whether
i) the firm will want to hire any new young workers (t=1) (YES/NO) (1 point)

ii) whether the firm will want to lay off any of the other workers (aged 2 through 5). Explain. (4)

If the firm made any layoffs as under item ii), are there any legal considerations that could get the firm into trouble? The firm operates in the United States. (Be as specific as possible!) (2)

6. (10 points) a) Explain as clearly as possible the theory of education as a signal of ability. For full points use a specific example with a diagram. (7)

b) Suppose that government is contemplating subsidizing education to encourage all workers to acquire more education. Under the theory of signaling, would this increase the average productivity of workers? What about under the theory of human capital? So which of these two theories provides better support for the notion that government subsidies of education will make the labor force more productive? (3)

7. (13 points) a) Draw a graph that shows VMP(t) vs age (t) for a typical worker, along with a typically shaped line showing the relation between the worker's best alternative, Alt(t) and age t. You can use "T" to indicate the normal retirement age. (3)

b) Use this graph to explain why, if the firm pays a wage W(t)=VMP(t), older workers near retirement may have a quite large incentive to shirk (i.e. goof off) on the job. What is the solution to this incentive problem that we discussed in class? (6)

c) Use your answer to b) to explain Lazear's theory of why retirement used to be mandatory. (4)