## FINAL EXAMINATION  VERSION B

INSTRUCTIONS:  This exam is closed-book, closed-notes.  Simple calculators are permitted, but graphing calculators, calculators with alphabetical keyboards, computers, wireless devices and mobile phones are NOT permitted.  Point values for each question are noted in brackets.  Maximum total points are 200.

**I.  Multiple choice:**  Please circle the one best answer to each question.  [2 pts each, 42 pts total]

(1) If the wage is higher than the equilibrium wage for some reason, then the labor market will experience
a.  excess demand.
b.  excess supply.
c.  both of the above.
d.  none of the above.

(2) A person who is not currently working, but last looked for a job six weeks ago, would be classified in the U.S. as
a.  employed.
b.  unemployed.
c.  out of the labor force.

(3) Consider a cash grant welfare program, where a person is given $3000 that is reduced by $0.50 for every $1.00 of labor earnings.  According to economic theory, this program would cause
a.  an increase in work hours by those already working.
b.  a decrease in work hours by those already working.
c.  an increase in labor force participation.
d.  a decrease in consumption.

(4) A profit-maximizing firm in a competitive labor market will
a.  adjust its wage until the wage equals value of marginal product.
b.  adjust other inputs until the wage equals value of marginal product.
c.  adjust its employment level until the wage equals value of marginal product

(5) Among U.S. states, those states with the lowest average wage a century ago have seen the
a.  slowest subsequent wage growth.
b.  fastest subsequent wage growth.
c.  the same wage growth as other states.

(6) A "non-compete" agreement is
a.  an agreement between an employer and a worker to settle disputes amicably.
b.  an agreement among employers not to compete for workers.
c.  an agreement among workers not to compete for jobs.
d.  an agreement between an employer and a worker that the worker will not work for another employer in the same industry after leaving this job.

(7) Consider a diagram with the wage on the vertical axis and risk of injury on the horizontal axis.  If for some strange reason workers *preferred* risky jobs to safe jobs, their indifference curves would be
a.  upward-sloping curves.
b.  downward-sloping curves.
c.  upward-sloping 45-degree lines.
d.  vertical lines.
e.  horizontal lines.

(8) If more-able persons tend to get more education than other persons, then ordinary least squares regression of earnings on schooling will tend to
a.  estimate the returns to schooling without bias.
b.  underestimate the returns to schooling.
c.  overestimate the returns to schooling.
d.  Cannot be determined from information given.

(9) A rising value of the Gini coefficient would imply that
a.  average income has increased.
b.  average income has decreased.
c.  income has become more equal.
d.  income has become more unequal.

(10) Since about 1980 in the U.S.,
a.  wage inequality has increased within groups of workers with the same education and experience.
b.  the returns to education have increased.
c.  the returns to experience have increased.
d.  all of the above.

(11) A worker is more likely to move,
a. the older the worker is.
b. the more education the worker has.
c. both (a) and (b).
d. neither (a) nor (b).

(12) Becker's theory of customer discrimination predicts labor-market segregation
a. by plant.
b. by shift.
c. by firm.
d. by job assignment.

(13) States were permitted to pass "right-to-work" laws allowing workers to opt out of joining unions and paying union dues under the
a. Norris-LaGuardia Act of 1932.
b. Wagner Act of 1935.
c. Taft-Hartley Act of 1947.
d. Landrum-Griffin Act of 1959.

(14) The efficient bargaining model of unionism assumes that the
a. the employer and the union bargain over both the wage and the employment level.
b. the employer sets the wage, and then the union chooses the employment level.
c. the union sets the wage, and then the employer chooses the employment level.
d. None of the above.

(15) Which pay scheme pays workers *less* than their value of marginal product, initially?
a. piece rates.
b. time rates.
c. tournaments.
d. delayed compensation.
e. efficiency wages.

(16) According to the efficiency-wage explanation for dual labor markets, wages are higher in the primary sector because, in that sector,
a. workers are protected by unions.
b. jobs require more human capital.
c. workers are more able.
d. jobs are more difficult to supervise.

(17) Which sector usually has the highest unemployment rate?
a. Manufacturing.
b. Professional and business services.
c. Construction.
d. Education and health care.

(18) Which education group usually has the highest unemployment rate?
a. advanced degree.
b. bachelor's degree.
c. high school diploma and some college.
d. only high school diploma.
e. no high school diploma.

(19) If unemployed workers do not have the skills to fill the available jobs, this is called
a. frictional unemployment.
b. seasonal unemployment.
c. structural unemployment.
d. cyclical unemployment.

(20) The diagram below shows the unemployment-vacancies curve (sometimes called the Beveridge curve).  During a recession,
a. the economy moves along the curve, up and to the left.
b. the economy moves along the curve, down and to the right.
c. the whole curve shifts up and to the right.
d. the whole curve shifts down and to the left.
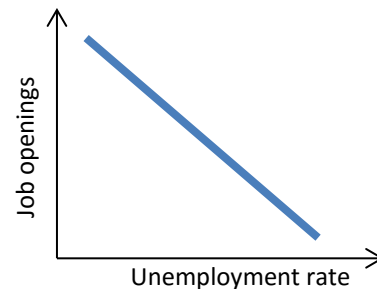


(21) When unemployment benefits end, then
a. the worker's reservation wage will increase.
b. the expected time till a new job is found will increase.
c. the average wage at the new job will increase.
d. All of the above.
e. None of the above.

**II. Problems:** Please insert your answer to each question in the box provided.  You may use margins and graphs for scratch work.  Only the answers in the boxes will be graded.

(1) [Individual labor supply—optimal choice: 12 pts]  Let  L  denote the days of leisure Amy enjoys per month and let  C  denote her dollars of consumption.  Suppose Amy's utility function is  $U = C(L-10)$.  A little calculus shows that her marginal utility of consumption is  $MU_C = L-10$  and her marginal utility of leisure is  $MU_L = C$.  She has $200 in monthly nonlabor income and 30 days per month available for work or leisure.

  a. [2 pts] Give a formula in terms of C and L for Amy's marginal rate of substitution of leisure for consumption (MRS).

  b. Compute Amy's reservation wage per day.

Suppose Amy can work as many days as she likes at a wage of $100 per day.

  c. Give an equation for her monthly budget constraint in terms of  L  and  C.

  d. How much leisure  L  and consumption  C  will she choose to enjoy per month?

  e. [1 pt] How many days will she choose to work per month?

(2) [LR labor demand—scale and substitution effects: 16 pts]  Midwest Manufacturing Company uses labor and capital to make snowshovels.  The graph below shows Midwest's isoquants, two true isocost lines, and one hypothetical isocost line parallel to isocost line #2.
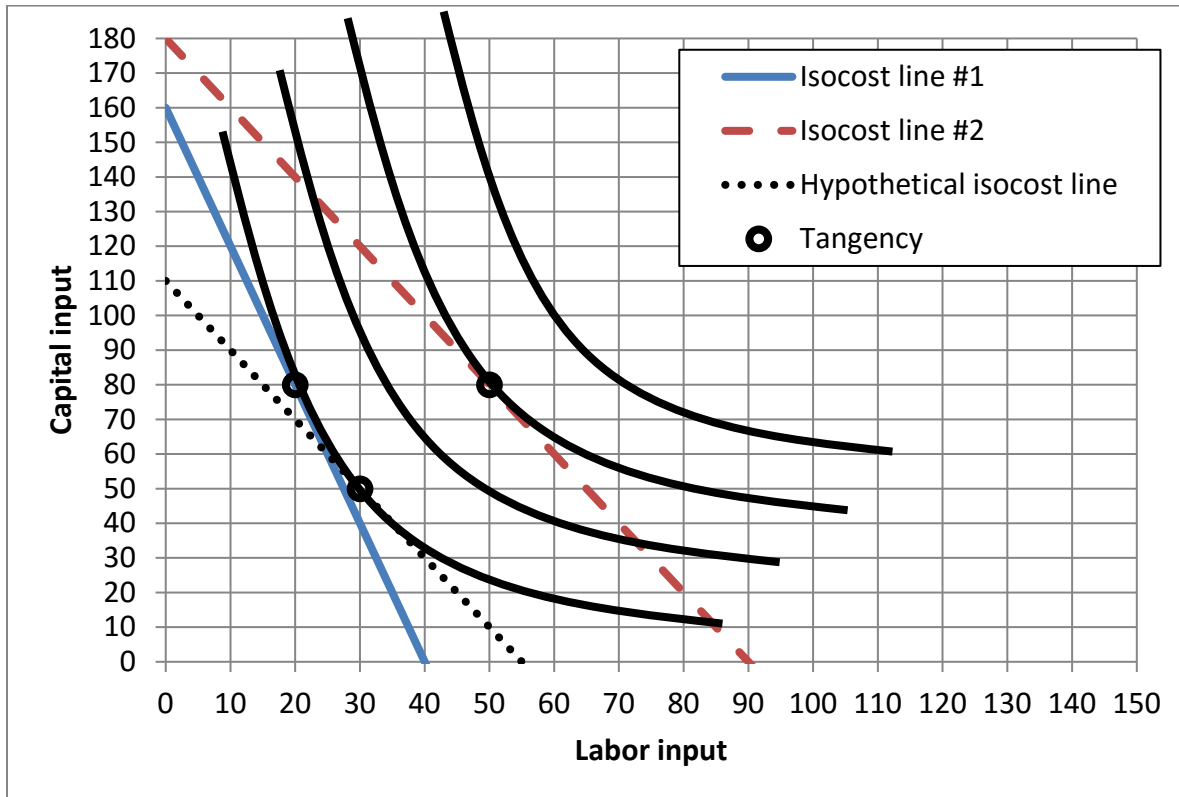


The price of capital used by Midwest is always $10.  However, the wage (the price of labor) changes.

a. Initially, Midwest is on isocost line #1.  What is the wage on isocost line #1?

$

b. Then in response to a change in the price of labor, Midwest moves to isocost line #2.  What is the wage on isocost line #2?

$

Consider the effects of this change in the wage on Midwest's use of labor input.

c. Does the substitution effect cause Midwest to use *more* labor or *less* labor input?

d. How much?  That is, give the change in labor input caused by the substitution effect of the wage change.

units

e. Does the scale effect cause Midwest to use *more* labor or *less* labor input?

f. How much?  That is, give the change in labor input caused by the scale effect of the wage change.

units

g. Does the total effect cause Midwest to use *more* labor or *less* labor input?

h. How much?  That is, give the change in labor input caused by the total effect of the wage change.

units

(3) [Mandated benefits: 16 pts]  The graph below shows demand and supply for workers in a particular labor market.
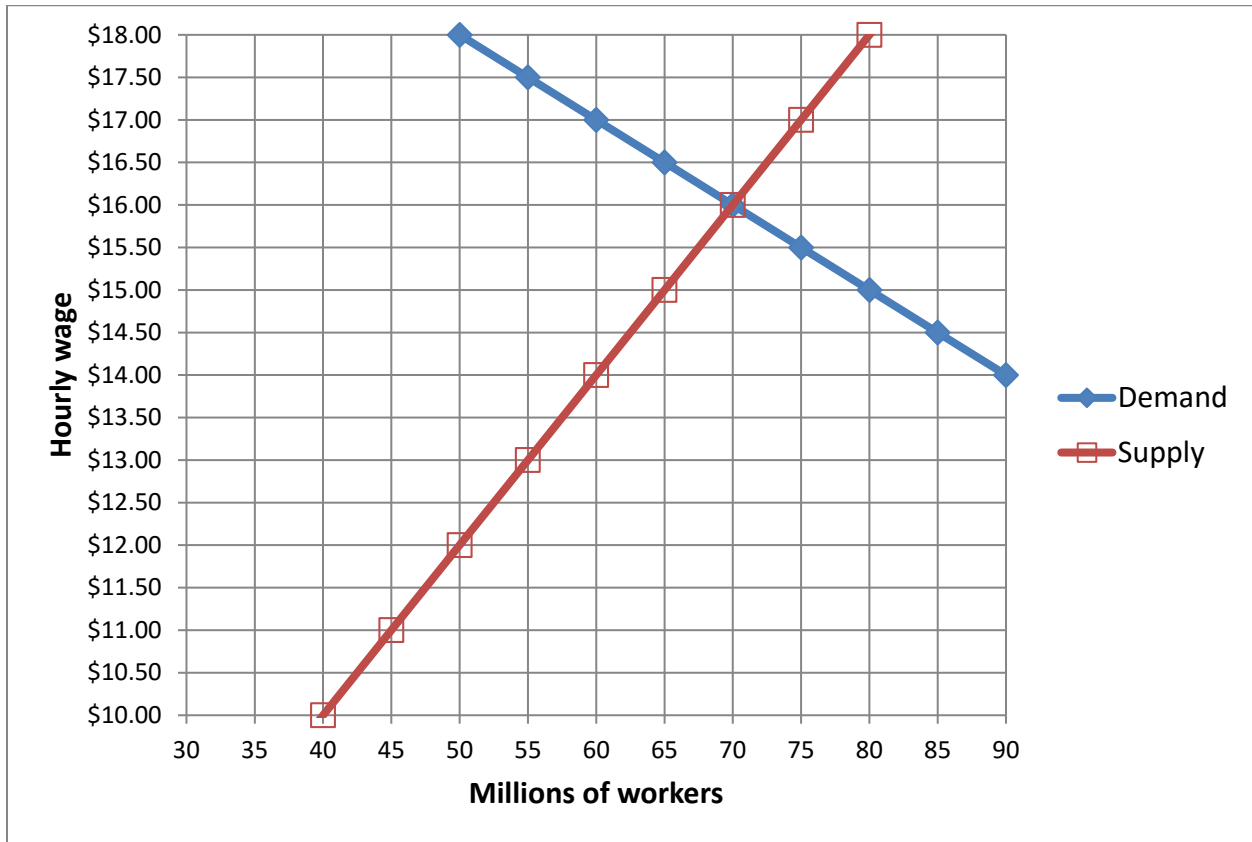


Suppose the government requires employers to provide regular rest breaks for workers.  These breaks cost employers $3 per hour in lost output.  First assume the breaks are of no value to workers.

a. Which curve shifts:  *demand* or *supply* ?

b. Using a straightedge, draw and label the new curve in the graph above.

c. Find the new equilibrium level of employment.

million

d. Find the new equilibrium wage.

$

Second assume the breaks are worth $1.50 per hour to workers.

e. Now which curve shifts:  *demand* or *supply* ?

f. Using a straightedge, draw and label the new curve in the graph above.

g. Find the new equilibrium level of employment.

million

h. Find the new equilibrium wage.

$

(4) [Elasticity of labor demand: 8 pts]  Suppose the demand for fast-food workers in Des Moines has an elasticity of -0.2.  Now suppose an increase in the minimum wage raises these workers' wage by 10 percent, but the demand curve does not shift.

a. Will the number of jobs for fast-food workers *increase* or *decrease*?

b. By how much?

%

c. Will the total income of fast-food workers (or their wage bill) *increase* or *decrease*?

d. By how much?

%

(5) [VSL, safety regulation: 6 pts]  The following regression equation has been fitted to data on a large sample of workers:

$$\text{annual earnings} = -7533 + 3247\,S + 943\,R$$

where  $S$ = total education in years, and  $R$ = annual occupational death rate per 10,000 workers.

a. Compute the value of a statistical life implied by these estimates.  Show your work and circle your final answer.

Suppose a particular factory employs a large number of workers.  A special ventilating system, designed to reduce workers' exposure to noxious fumes, would cost $1 million per year.  It is estimated that the system would reduce the factory's average annual death rate from 1.3 to 1.1 persons per year.

b. Compute the cost of the system per statistical life saved.  Show your work and circle your final answer.

c. Given the numbers you have computed above, should the system be required?  Why or why not?

(6) [Simple model of schooling decision: 16 pts]  Suppose a person lives for two periods and must choose between two careers.  If the person chooses "no college," the person earns $100,000 in the first period and then $100,000 in the second period.  If the person chooses "college," the person earns nothing in the first period and pays college costs of $50,000, and then earns $262,000 in the second period.

First, suppose the person's discount rate between the two periods is  **r = 10%.**

    a. [4 pts] Compute the net present value as of the first period of "no college."  Show your work and circle your final answer.

    b. [4 pts] Compute the net present value as of the first period of "college."  Show your work and circle your final answer.

    c. [2 pts]  Which career will the person choose:  "no college" or "college"?

Next, consider the discount rate  r*  between the two periods would make the person exactly indifferent between the two careers.

    d. [4 pts] Compute  r*.  Show your work and circle your final answer.

    e. [2 pts] If the person's discount rate were *less* than  r* (found in part d) would that person choose "no college" or "college"?

(7) [Shifts in relative supply and demand by skill: 8 pts]  The graph below shows demand and supply for college-educated workers *relative* to high-school-educated workers.  Here $E_C$ is the number of college-educated workers, $E_H$ is the number of high-school-educated workers, $W_C$ is the average wage of college-educated workers, and $W_H$ is the average wage of high-school-educated workers.
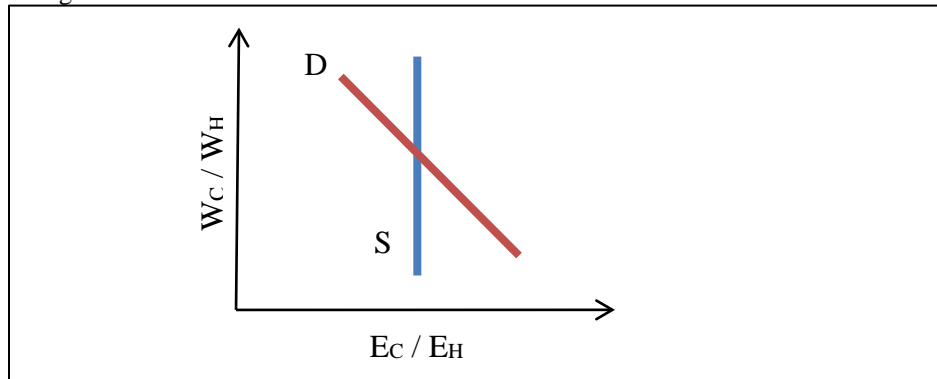


The elasticity along the relative demand curve is called the *elasticity of substitution*, defined as

$$\left| \frac{\% \ change \ (E_C/E_H)}{\% \ change \ (W_C/W_H)} \right| ,$$

and is estimated to be about 1.6.  Relative supply, by contrast, is perfectly inelastic in the short run.  Now, over time, supply has shifted right as more people attend college.  In particular, from 1980 to 2000, $(E_C / E_H)$ increased by 2.28 percent per year.

a. [2 pts] If nothing else changed, would the relative wage $(W_C / W_H)$ increase or decrease?

b. [2 pts] By how much per year?  Give an answer to three significant digits.

%

c. [ 4 pts] In fact, the relative wage $(W_C / W_H)$ increased by 1.04 percent per year over this period.  How do you account for this discrepancy?

(8) [Immigration surplus:  8 pts]  The graph below depicts the demand for low-skilled workers in the U.S.
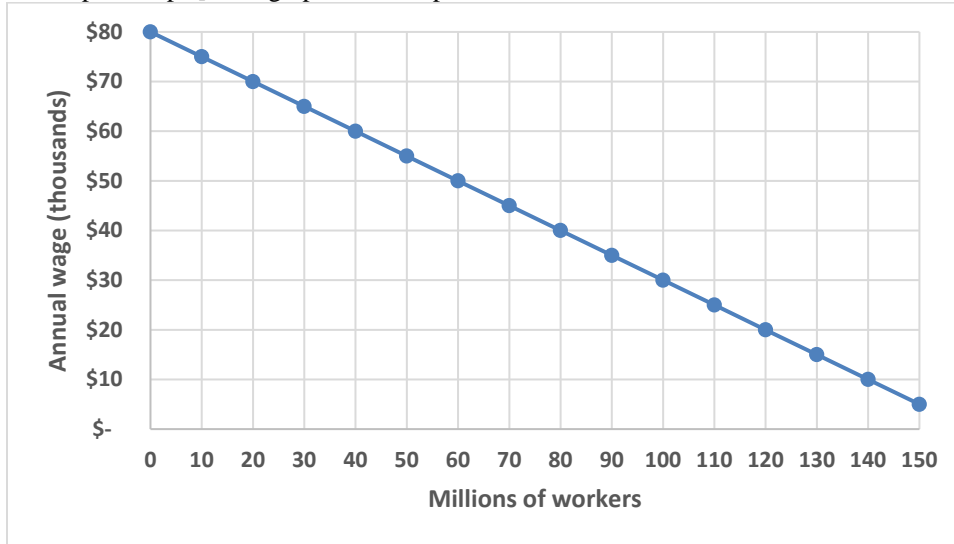


Suppose there are 60 million low-skilled native workers who supply labor inelastically.  Suppose that 40 million low-skilled workers would enter the U.S. and supply labor inelastically if the U.S. allowed free immigration. Compute the following.

a. Compute the equilibrium wage without immigration.

| $ | thousand |
|---|---|

b. Compute the equilibrium wage with free immigration.

| $ | thousand |
|---|---|

c. Compute the amount of surplus that would be transferred from native U.S. workers to U.S. employers under free immigration.

| $ | billion |
|---|---|

d. Compute the immigration surplus—the net benefit to native U.S. workers and employers from free immigration.

| $ | billion |
|---|---|

(9) [Oaxaca decomposition: 6 pts]  Suppose we have computed the following statistics using data on hourly wages (W) and schooling (S) for a large sample of green and blue workers:

|  | Regression equation | Average years of schooling |
|---|---|---|
| Green workers | $\ln(W_G) = 1.1 + 0.12\, S_G$ | 15 |
| Blue workers | $\ln(W_B) = 0.9 + 0.10\, S_B$ | 14 |

a. Compute the raw log wage differential—that is, $\overline{\ln(W_G)} - \overline{\ln(W_B)}$ .

b. Compute the log wage differential due to schooling.

c. Compute the log wage differential due to discrimination in the labor market, in Oaxaca's definition.

(10) [Monopsony wage discrimination:  16 pts]  A certain employer enjoys monopsony power over two groups of workers.  Supply of green workers to this employer is given by  $w_G = 4 + (E_G/50)$.  Supply of blue workers to the same employer is given by  $w_B = 2 + (E_B/30)$.  The value of marginal product of all workers is constant and equal to **$18**.

a. Recall that if labor supply is a straight line, then marginal labor cost is also a straight line, with the same intercept and twice the slope of labor supply.  Give the equation for marginal labor cost for each group of workers.

$MLC_G =$                              $MLC_B =$

b. What level of employment  ($E_G$ and $E_B$)  will the employer choose for each group?

c. What wage  ($w_G$ and $w_B$)  will the employer pay each group?

d. Suppose the government imposes a minimum wage of $12 for all workers.  Now what level of employment ($E_G$ and $E_B$)  will the employer choose for each group?

(11) [Monopoly unionism: 10 pts]  Suppose labor demand (VMP) by a particular firm is given by  $W = 40 - 0.1\,E$, where W is the hourly wage and E is employment (number of workers).  The competitive wage is $W_C = \$15$.
  a. Compute the competitive level of employment.  Show your work and circle your final answer.

  b. *Using a straightedge,* graph and label the labor demand curve in the graph below.  Also plot a horizontal line at $W_C$, which is effectively the firm's labor supply curve.
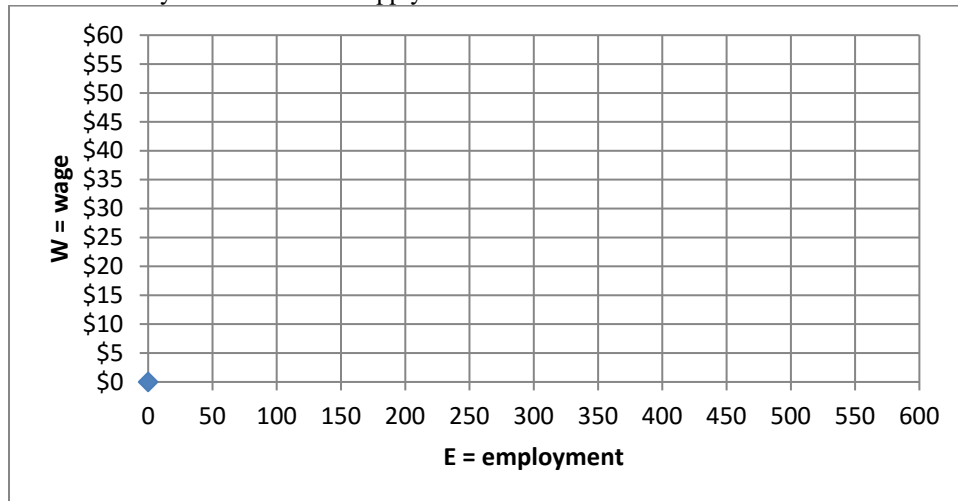
Assume the firm faces a monopoly union, whose utility function is given by  $U = W \times E$.  (This assumption is sometimes called "wage-bill maximization.")  A little calculus shows that the union's marginal utility of employment is  $MU_E = W$  and its marginal utility of wages is  $MU_W = E$ .

  c. Compute the wage set by the union and the resulting level of employment.  [Hint: Set the union's MRS = $MU_E/MU_W$ equal to the |slope| of the labor demand curve.]  Show your work and circle your final answers.

  d. Plot this outcome in the graph above and label it "Wage-bill max."
  e. Compute the efficiency loss from this outcome.  Circle your final answer.

(12) [Piece rates and time rates: 10 pts]  Brenda assembles toys at two possible employers.  Firm #1 pays a piece rate: **$0.30  per toy**.  Firm #2 simply pays a time rate of **$12 per hour** and fires anyone who does not assemble at least 30 toys per hour.

Brenda's marginal cost of effort to assemble toys is $MC = 0.002 N + 0.2$ , where N is the number of toys assembled per hour.  It can be shown using integral calculus that Brenda's total cost of effort per hour is $TC = 0.001 N^2 + 0.2 N$ .  Suppose Brenda worked at Firm #1.

a. How many toys would she assemble per hour?

b. What would be her hourly pay? — $

c. What would be her net benefit at Firm #1 (that is, hourly pay minus total cost of effort per hour). — $

Suppose Brenda worked at Firm #2.

d. What would be her net benefit at Firm #2 (that is, hourly pay minus total cost of effort per hour). — $

e. Which employer will Brenda prefer?

(13) [Markov model: 10 pts]  Suppose people move between employment and unemployment every month according to the following Markov transition matrix.  Note that two numbers are missing.

|  |  | To | |
|---|---|---|---|
|  |  | Employment | Unemployment |
| From | Employment | (a) | 0.02 |
|  | Unemployment | 0.38 | (b) |

a. What number belongs in place of (a)?

b. What number belongs in place of (b)?

c. What percent of employed people lose or leave their jobs or every month? — %

d. What percent of unemployed people find jobs every month? — %

e. Compute the steady-state unemployment rate. — %

(14) [Job search:  10 pts]  An unemployed worker is searching for a job.  Suppose the marginal benefit of further search, as a function of the wage offer in hand, is  $MB = 50 - W$,  and the marginal cost of further search, as a function of the wage offer in hand, is  $MC = 6 + 3W$.

a. What is the worker's reservation wage?

b. Would the worker accept a job at $12 per hour?  Why or why not?

Suppose unemployment insurance benefits were *decreased*.

c. Which curve would shift:  MB or MC?  Why?

d. Would the reservation wage increase or decrease?  Why?

e. Would the average time to find a new job increase or decrease?  Why?

**III.  Critical thinking:**  Write a one-paragraph essay answering *only one* question below (your choice).  [4 pts]

(1) Consider workers at a hospital.  Give an example of *general training* that the employer might provide and explain why this training is *general*.  Give an example of *specific training* that the employer might provide and explain why this training is *specific*.

(2) In 1776, Adam Smith argued that one reason for differences in pay across jobs was "the agreeableness or disagreeableness of the employments themselves."[1]  What modern theory of wage differentials did Smith anticipate?  Why is it necessary to pay workers higher wages if their job is "disagreeable"?

Circle the question you are answering and write your answer below.  Full credit requires correct economic reasoning, legible writing, good grammar including complete sentences, and accurate spelling.

[end of exam]

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[1] Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations,* New York:  Modern Library (1937) [1776], p. 100.