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**EXAMINATION 1 VERSION B**  
**"Labor Supply and Demand"**  
**February 25, 2019**

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 100.

**I. Multiple choice:** Please circle the one best answer to each question. [1 pts each, 11 pts total]

(1) If the wage is lower 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 coefficient estimate is conventionally considered statistically significant if its

- a. p-value is greater than 2.
- b. standard error is less than 0.05.
- c.  $R^2$  value is greater than 0.9.
- d. t-statistic is greater than 2.

(3) 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.

(4) Which group experienced the largest decrease in labor force participation from 1950 to 2000?

- a. older men.
- b. married men.
- c. older women.
- d. married women.

(5) The shape and position of a worker's budget constraint depend on the worker's

- a. wage.
- b. nonlabor income.
- c. total available time.
- d. all of the above.

(6) If a person chooses to work any hours at all, then at that person's optimal bundle, the marginal rate of substitution equals

- a. dollars of consumption.
- b. hours of leisure.
- c. nonlabor income.
- d. utility.
- e. the wage.

(7) Consider a wage subsidy program, where a person is given \$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 slight decrease in work hours by those already working.
- c. an increase in labor force participation.
- d. a decrease in labor force participation.

(8) The modern economic theory of fertility attributes falling fertility rates to

- a. rising worker productivity.
- b. increased selfishness of potential parents.
- c. increases in income.
- d. increases in the "price" or cost of raising children.

(9) A profit-maximizing firm in a competitive labor market will

- a. adjust its employment level until the wage equals value of marginal product.
- b. adjust its wage until the wage equals value of marginal product.
- c. adjust other inputs until the wage equals value of marginal product.

(10) If only one firm enjoys a wage decrease, it will increase its employment of labor \_\_\_\_\_ it would if all firms in the same industry enjoyed the same wage increase.

- a. less than.
- b. more than.
- c. just as much as.

(11) An increase in the firm's fixed costs of employing each worker will likely

- a. decrease the number of part-time workers and increase the number of full-time workers.
- b. increase the number of part-time workers and decrease the number of full-time workers.
- c. increase both the number of part-time workers and the number of full-time workers.

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**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. Work carefully—partial credit is not normally given in this section.

(1) [Elasticity of labor demand: 8 pts] Suppose the demand for construction laborers in Des Moines has an elasticity of -0.4. Now suppose that their wage decreases by 5 percent, but the demand curve does not shift.

- a. Will the number of jobs for laborers *increase* or *decrease*?
- b. By how much?
- c. Will the total income of laborers (or their wage bill) *increase* or *decrease*?
- d. By how much?

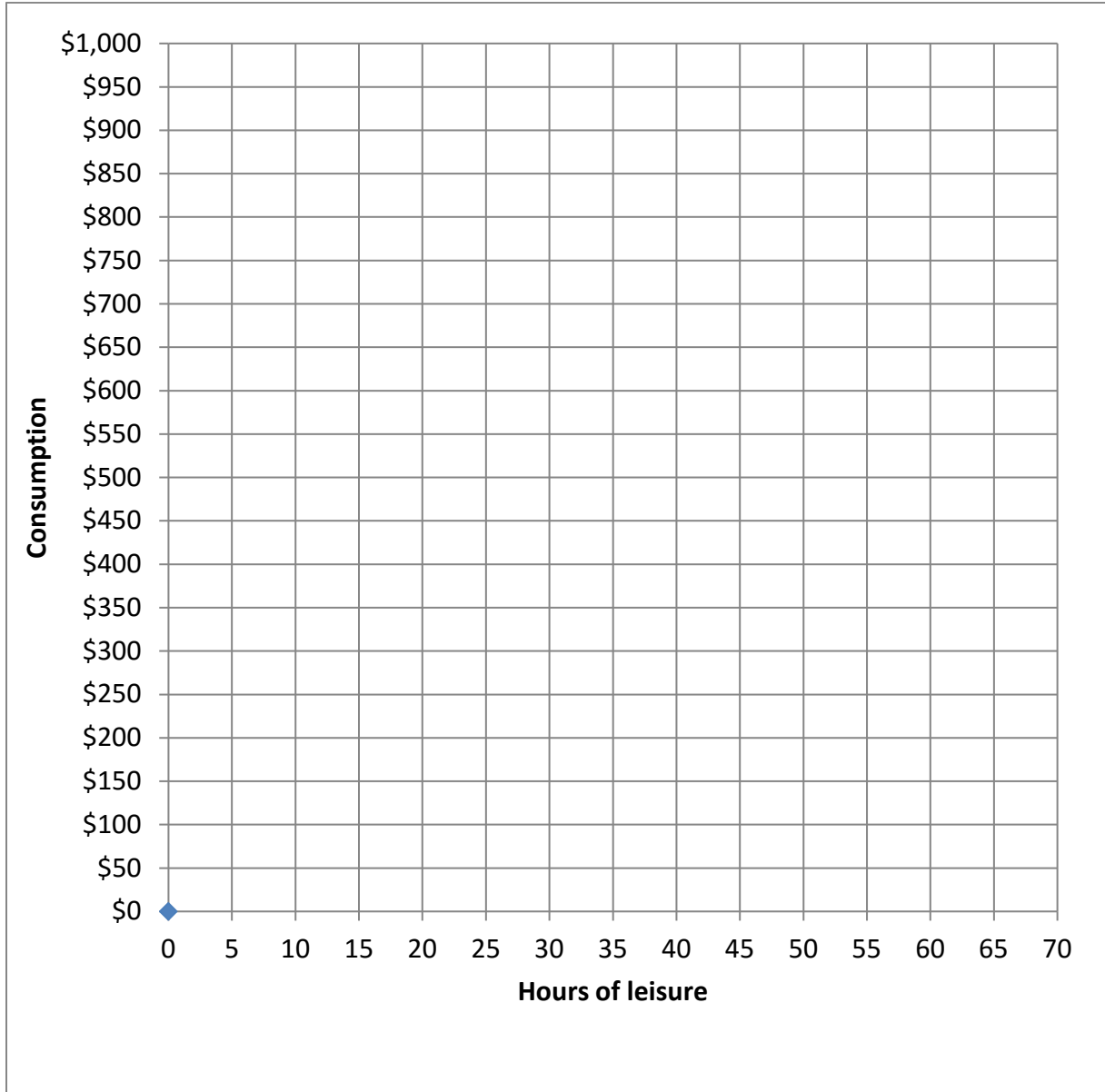
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(2) [Measuring the labor force: 6 pts] The U.S. Bureau of Labor Statistics reported that in December 2018, 156.9 million people were employed, 6.3 million people were unemployed, and 95.6 million working-age people were not in the labor force.

- a. Compute the unemployment rate to the nearest tenth of a percentage point.
- b. Compute the employment rate (or employment-to-population ratio) to the nearest tenth of a percentage point.
- c. Compute the labor force participation rate to the nearest tenth of a percentage point.

	%
	%
	%

(3) [Budget constraint: 6 pts] Suppose Adam has 60 hours of time available each week for work or leisure, has no nonlabor income, and can earn a wage of \$20 per hour. However, Adam faces a graduated income tax. After the first \$400 in earnings, further earnings up to \$800 are taxed at a rate of 25%. After the first \$800 in (pre-tax) earnings, any further earnings are taxed at a rate of 50%. *Using a straightedge*, draw a graph of Adam's weekly budget constraint. Label the endowment point and any other kink points.



(4) [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.

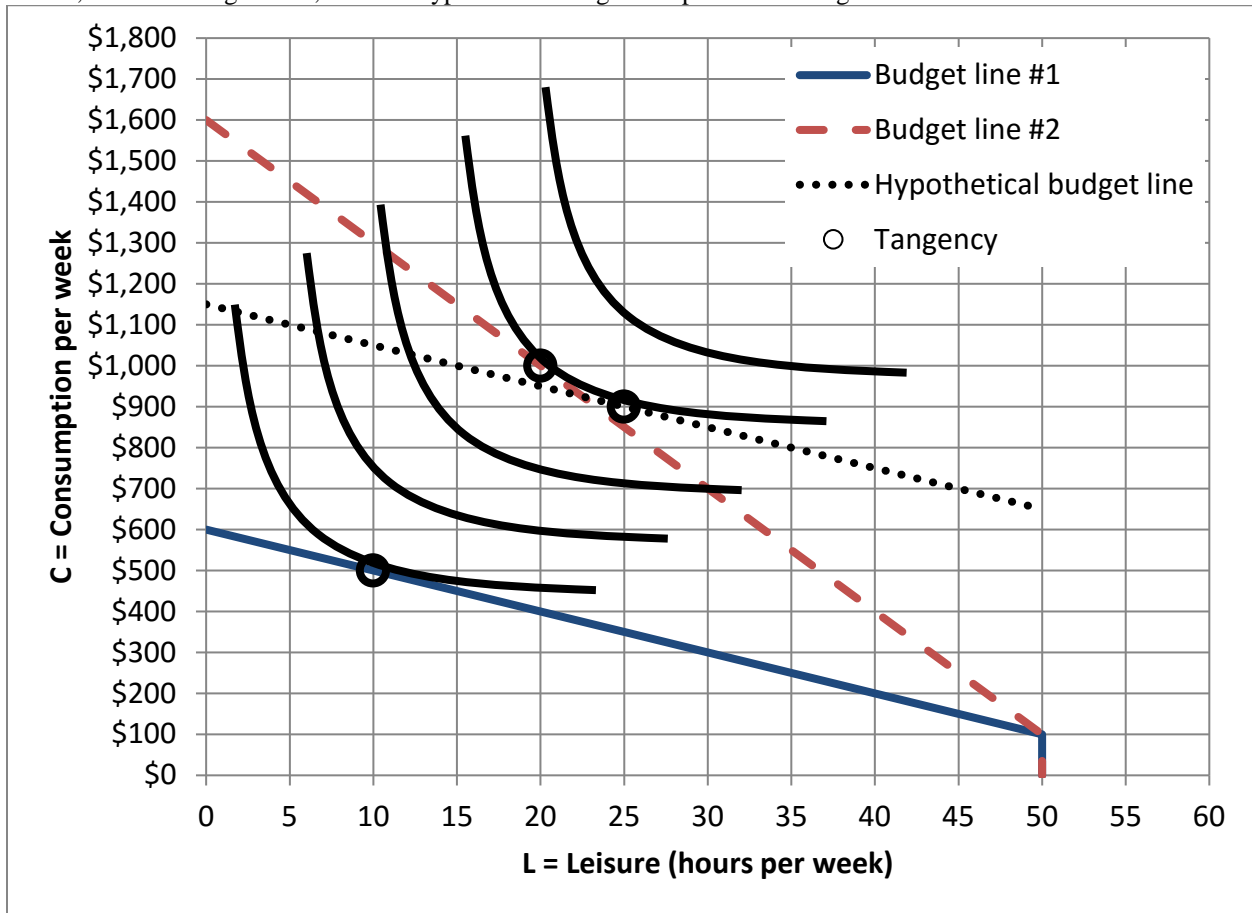
Suppose Amy can work as many days as she likes at a wage of \$100 per day.

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?

(5) [Individual labor supply—income and substitution effects: 22 pts] The graph below shows Aaron’s indifference curves, two true budget lines, and one hypothetical budget line parallel to budget line #1.



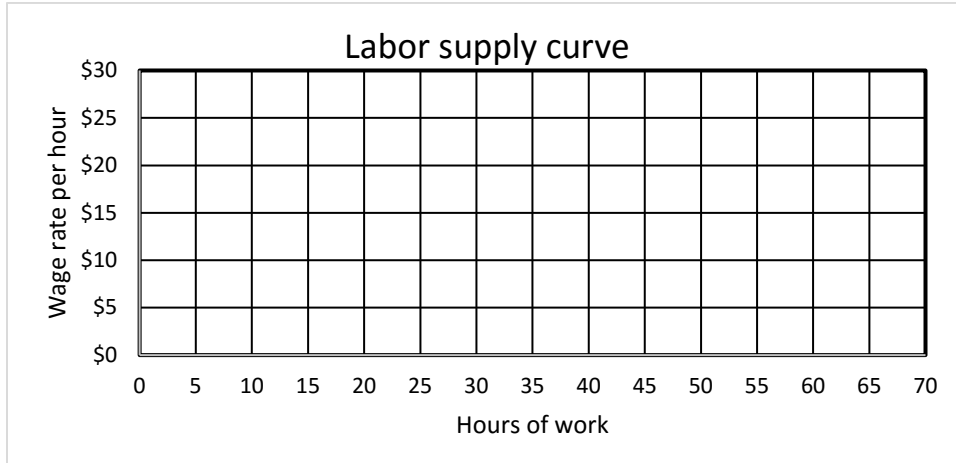
- According to this graph, what is Aaron’s total available time for work or leisure?
- How much nonlabor income does Aaron enjoy?
- What is Aaron’s wage rate on budget line #1?
- What is Aaron’s wage rate on budget line #2?

	hours
\$	
\$	per hour
\$	per hour

Consider Aaron’s response to the change in the wage rate from budget line #1 to budget line #2.

- Does the *income effect* of this change cause Aaron to work *more* or to work *less*?
- Compute the change in hours of work due to the *income effect* alone.
- Does the *substitution effect* of this change cause Aaron to work *more* or to work *less*?
- Compute the change in hours of work due to the *substitution effect* alone.
- Does the *total effect* of this change cause Aaron to work *more* or to work *less*?
- Compute the total change in hours of work caused by the change in the wage rate.
- Using the information in this indifference-curve graph, plot two points on Aaron’s *labor supply curve* in the graph below and sketch the curve.

	hours
	hours
	hours
	hours



(6) [SR labor demand: 9 pts] Suppose TrueBlue Manufacturing Company has the following production function.

$$q = 20 (K E)^{1/2} .$$

A little calculus shows that the marginal product of labor is

$$MP_E = 10 (K/E)^{1/2} .$$

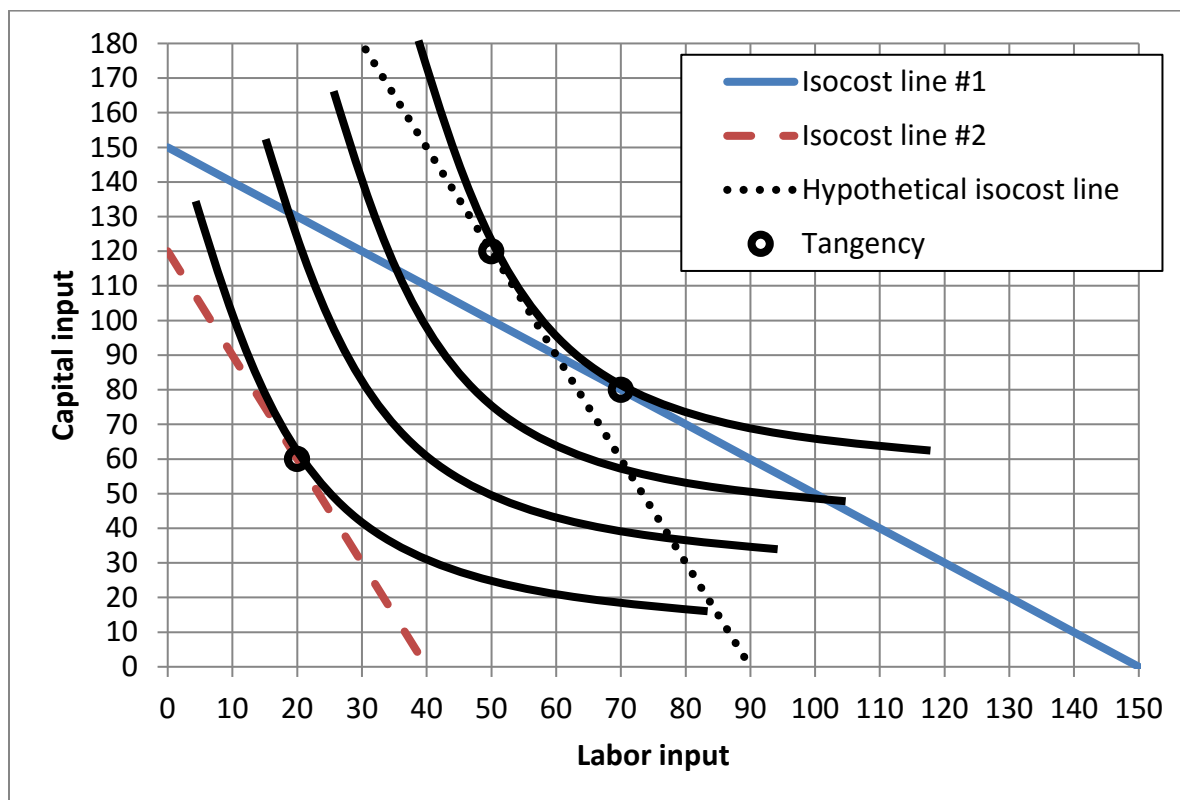
The price of output is \$5, the wage is \$20 per hour, and the price of capital is \$50 per hour. The capital stock is fixed at  $K=16$  units.

a. How much labor  $E$  should TrueBlue employ in the short run?

b. How much output  $q$  will TrueBlue produce?

c. How much profit will TrueBlue enjoy?

(7) [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.
- 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.
- 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
units
units

(8) [Hicks-Marshall rules: 6 pts]

- a. Industry A and Industry B are similar, except that the elasticity of demand for their products is different. The elasticity of demand for the product of Industry A is -0.6. The elasticity of demand for the product of Industry B is -4.0. Which industry will have *more elastic demand for labor*, according to the Hicks-Marshall rules?
- b. Industry C and Industry D are similar, except that labor's share of total cost is 90% in Industry C and 40% in Industry D. Which industry will have *more elastic demand for labor*, according to the Hicks-Marshall rules?<sup>1</sup>
- c. Industry E and Industry F are similar, except that the elasticity of substitution of labor for capital is 1.5 in Industry E, and 0.6 in Industry F. Which industry will have *more elastic demand for labor*, according to the Hicks-Marshall rules?


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

- (1) Suppose the minimum wage rises by 10%, and as a result the total income of minimum-wage workers increases by 8%. Assume the demand curve for minimum-wage workers does not shift. Compute the *elasticity of demand* for minimum-wage workers.
- (2) To test the effectiveness of a new program to help low-income people find jobs, 4860 people receiving TANF<sup>2</sup> (a welfare program) were divided into two groups. The first group stayed on the TANF program from 1999 to 2000. In 1999, 27.7% of them worked. In 2000, 35.7% of them worked. The second group was shifted from TANF in 1999 to NIT<sup>3</sup> (the new program) in 2000. In 1999, 28.0% of them worked. In 2000, 45.5% of them worked. Use the difference-in-differences approach to compute the *change in the percentage of people who worked* caused by the new program.

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. Label all curves and axes.

[end of exam]

<sup>1</sup> Assume as usual that in both industries, the elasticity of product demand is larger in absolute value than the elasticity of substitution in production.

<sup>2</sup> TANF = Temporary Aid to Needy Families.

<sup>3</sup> NIT = Negative Income Tax.