## EXAMINATION 1 VERSION A
"Labor Supply and Demand"
February 27, 2018

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) The demand for labor is called "derived demand" because it
a. is computed by taking derivatives.
b. is derived from society's human values.
c. depends on the demand for goods and services.
d. can be derived from workers' preferences.

(2) Which labor demand curve below is *more* elastic?
a. Demand curve A.
b. Demand curve B.
c. Both have the same elasticity because they pass through the same point.
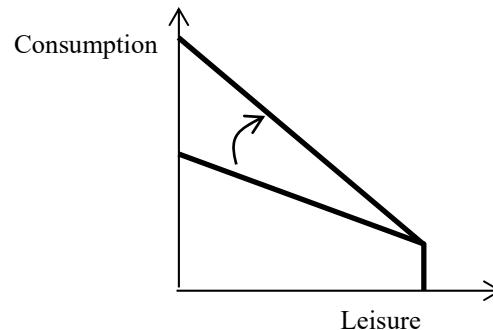d. Cannot be determined from information given.
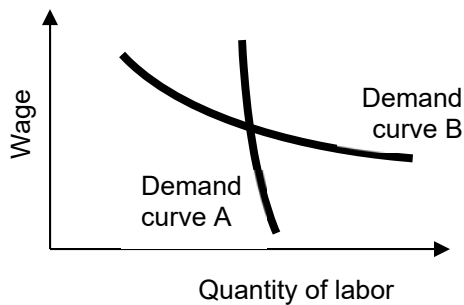
(3) Suppose log(W) = 7.5 + 0.08 S . If S increases by one unit, then
a. W increases by 7.5 units.
b. W increases by 7.5 percent.
c. W increases by 0.08 units.
d. W increases by 8 percent.
e. W increases by 0.08 percent.

(4) On a graph with consumption on the vertical axis and leisure hours on the horizontal axis, a worker's indifference curve connects combinations or bundles that
a. cost the same amount.
b. are equally preferred.
c. have the same marginal rate of substitution.
d. yield the same total income.

(5) The absolute value of the slope of a worker's indifference curve is called the
a. marginal utility.
b. marginal product.
c. marginal rate of substitution.
d. wage.

(6) In the graph below, the budget constraint is changing because of
a. an increase in the wage.
b. a decrease in the wage.
c. an increase in nonlabor income.
d. a decrease in nonlabor income.
e. a change in preferences.

(7) If the wage increases, the *substitution* effect will push the worker to
a.   increase work hours.
b.   decrease work hours.
c.   maintain work hours exactly constant.
d.   either increase or decrease work hours—answer cannot be determined from information given.

(8) When all firms in an industry simultaneously enjoy a wage decrease, their
a.   production functions shift up.
b.   value-of-marginal-product curves shift down.
c.   isoquant curves rotate.
d.   marginal product curves become steeper.

(9) Suppose a firm produces output using both labor and capital, and suppose the price of capital *falls*. Then amount of labor hired
a.   increases due to the substitution effect but decreases due to the scale effect.
b.   decreases due to the substitution effect but increases due to the scale effect.
c.   increases due to both substitution and scale effects.
d.   decreases due to both substitution and scale effects.

(10) Labor demand is less elastic in the short run than in the long run because
a.   firms pay less attention to short-run profit than to long-run profit.
b.   isocost curves become steeper as the wage increases.
c.   labor is a normal good.
d.   firms cannot substitute capital for labor in the short run.

(11) An increase in the firm's fixed costs of employing each worker will likely
a.   increase the number of part-time workers and decrease the number of full-time workers.
b.   decrease the number of part-time workers and increase the number of full-time workers.
c.   increase both the number of part-time workers and the number of full-time workers.

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 carpenters by construction companies in Des Moines has an elasticity of -0.6. Now suppose the wage for carpenters increases by 5 percent, but the demand curve does not shift.

a. Will the number of carpenters demanded *increase* or *decrease*?

b. By how much?   %

c. Will the total income of carpenters (or the wage bill) *increase* or *decrease*?

d. By how much?   %

(2) [Measuring the labor force: 6 pts] The U.S. Bureau of Labor Statistics reported that in September 2017, 154.3 million people were employed, 6.8 million people were unemployed, and 94.5 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 Ana has 60 hours of time available each week for work or leisure, enjoys weekly nonlabor income of $100, and can earn a wage of $10 per hour. However, if Ana works more than 40 hours per week, she is paid "time and a half" for those extra hours. This means her wage on the first 40 hours she works is $10, but her wage on subsequent hours is $15 per hour. *Using a straightedge,* draw a graph of Ana's weekly budget constraint. Label the endowment point and any other kink points.
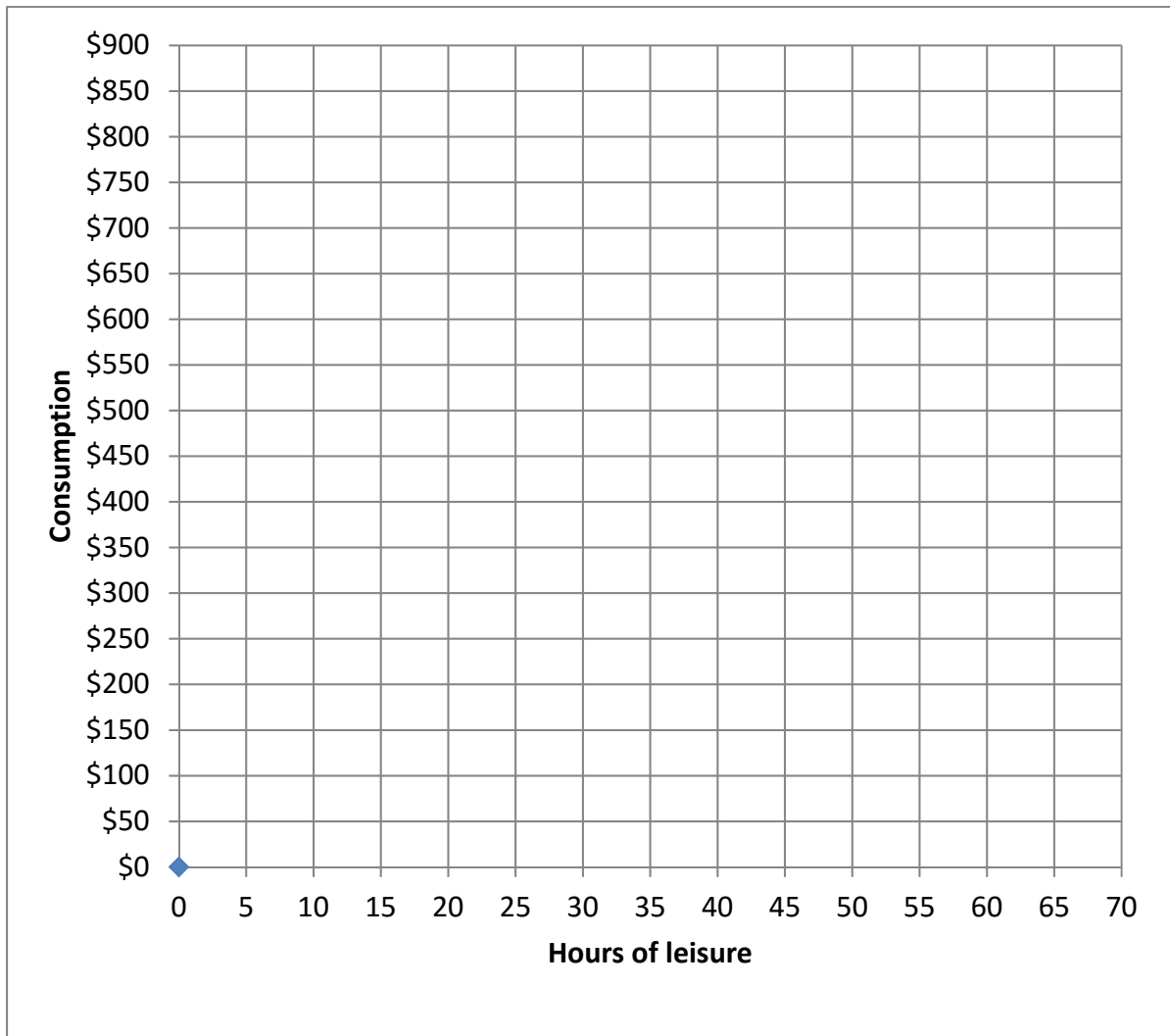
(4) [Individual labor supply—optimal choice: 12 pts] Let L denote the weekly hours of leisure Abe enjoys and let C denote the dollars of consumption. Suppose Abe's utility function is $U = (C-10)(L-20)$. A little calculus shows that his marginal utility of consumption is $MU_C = L-20$ and his marginal utility of leisure is $MU_L = C-10$. He has $90 in weekly nonlabor income and 60 hours per week available for work or leisure.

a. Compute Abe's reservation wage.

Suppose Abe can work as many hours as he likes at an hourly wage of $20 per hour.

b. Give an equation for his budget constraint in terms of L and C.

c. How much leisure L and consumption C will he choose to enjoy?

d. How many hours will he choose to work?

(5) [Individual labor supply—income and substitution effects: 22 pts] The graph below shows Alison's indifference curves, two true budget lines, and one hypothetical budget line parallel to budget line #1.
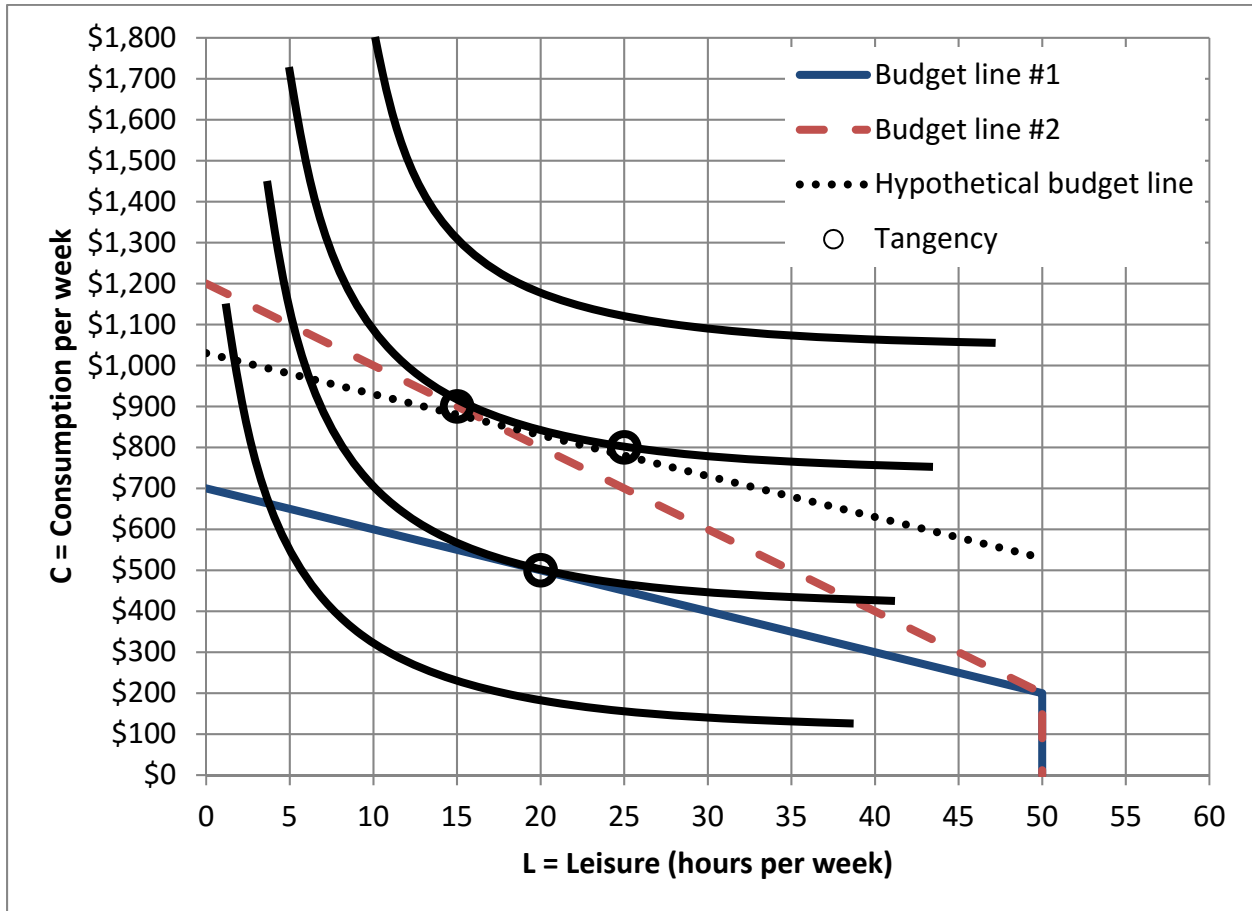
a. According to this graph, what is Alison's total available time for work or leisure?

	hours

b. How much nonlabor income does Alison enjoy?

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c. What is Alison's wage rate on budget line #1?

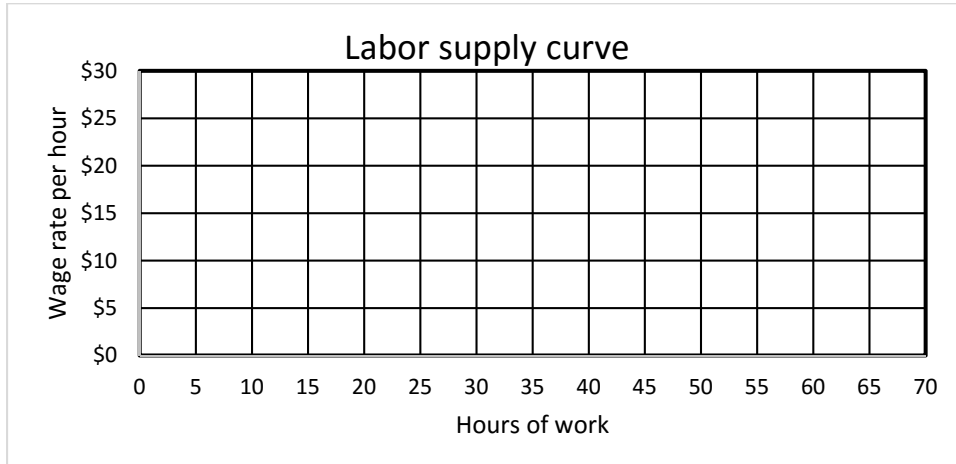| $	per hour

d. What is Alison's wage rate on budget line #2?

$	per hour

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

e. Does the *income effect* of this change cause Alison to work *more* or to work *less*?

f. Compute the change in hours of work due to the *income effect* alone.

	hours

g. Does the *substitution effect* of this change cause Alison to work *more* or to work *less*?

h. Compute the change in hours of work due to the *substitution effect* alone.

	hours

i. Does the *total effect* of this change cause Alison to work *more* or to work *less*?

j. Compute the total change in hours of work caused by the change in the wage rate.

	hours

k. Using the information in this indifference-curve graph, plot two points on Alison's *labor supply curve* in the graph below and sketch the curve.

Labor supply curve

(6) [SR labor demand: 9 pts] Suppose United Manufacturing Company has the following production function.
$$q = 3 \, (K \, E)^{1/2} .$$
A little calculus shows that the marginal product of labor is
$$MP_E = (3/2) \, (K/E)^{1/2} .$$
The price of output is $20, the wage is $15 per hour, and the price of capital is $50. The capital stock is fixed at K=40 units.

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

b. How much output q will United produce?

c. How much profit will United enjoy?

(7) [LR labor demand—scale and substitution effects: 16 pts] Bulldog Manufacturing Company uses labor and capital to make windshield scrapers. The graph below shows Bulldog's isoquants, two true isocost lines, and one hypothetical isocost line parallel to isocost line #2.
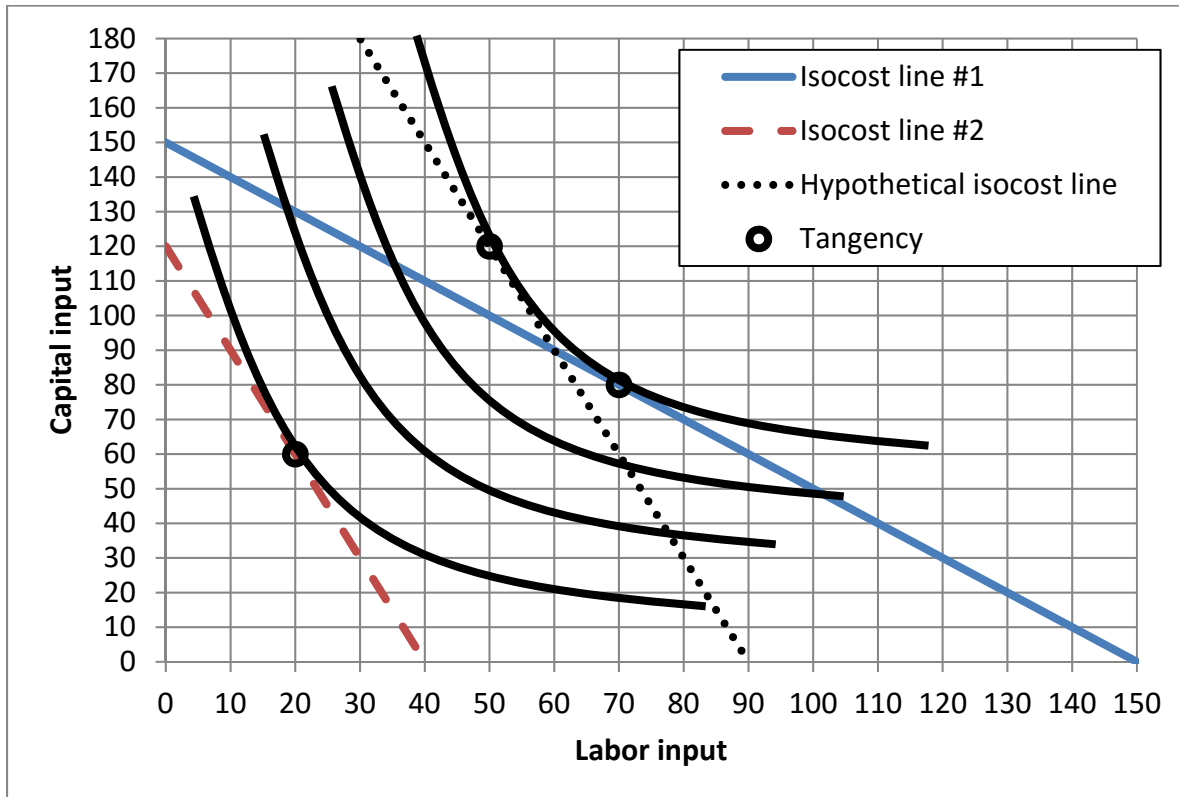
The price of capital used by Bulldog is always $10. However, the wage (the price of labor) changes.

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

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

$

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

c. Does the substitution effect cause Bulldog 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 Bulldog 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 Bulldog 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

(8) [Hicks-Marshall rules: 6 pts]
   a. Industry #1 and Industry #2 are similar, except that the elasticity of substitution of labor for capital is 2.1 in Industry #1 and 0.9 in Industry #2. Which industry will have *more elastic demand for labor*, according to the Hicks-Marshall rules?
   b. Industry #3 and Industry #4 are similar, except that the elasticity of demand for their products is different. The elasticity of demand for the product of Industry #3 is -0.8. The elasticity of demand for the product of Industry #4 is -3.5. Which industry will have *more elastic demand for labor*, according to the Hicks-Marshall rules?
   c. Industry #5 and Industry #6 are similar, except that labor's share of total cost is 80% in Industry #5 and 50% in Industry #6. Which industry will have *more elastic demand for labor*, according to the Hicks-Marshall rules?[1]

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

(1) Can the unemployment rate fall while the employment rate (or employment-to-population ratio) remains constant? If you think the answer is "yes," give a numerical example. If you think the answer is "no," explain why not.
(2) Which supply curve is more elastic—the supply of labor to the entire economy, or the supply of labor to a particular employer like Walmart? Why?

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]

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[1] Assume as usual that in both industries, the elasticity of product demand is larger in absolute value than the elasticity of substitution in production.