Exam 1
Solutions

ECON 380
Spring 2017
UNC Chapel Hill

Name: _____

ONYEN: _____

Honor Code Signature: _____

Directions:

- For multiple choice questions, clearly circle the answer choice which best answers the question.
- For short answer questions, show all of your work and justify your answers where needed.
- Round answers to the nearest hundredth.
- Assume preferences are transitive, complete, and monotone.
- Assume that utility functions exhibit diminishing marginal returns to consumption.
- Assume that leisure is income normal.
- Points available: 50
- Write legibly, write legibly, write legibly!
- Good luck! ☺

Multiple Choice [2 pts each]

Use the following information to answer questions 1-4:

Suppose there are 25,000 individuals living in Candyland. 5,000 of these individuals are under age 16 **[Not in P]**. Of the remaining 20,000 individuals,

- 8,000 work full-time in the private sector **E**
- 2,000 work full-time in the public sector (non-military) **E**
- 2,000 work part-time. 15% of these part-time workers would prefer to work full-time **E. 300 are part-time for "economic reasons"**
- 5,000 have been laid off in the last six months. Of these laid off individuals, 4,000 have actively sought work since being laid off, while 1,000 searched for work immediately after being laid off, but not in the last four weeks. **4,000 U, 1,000 O - marginally attached**
- 1,000 do not have formal employment and instead choose to stay home to care for children **O**
- 2,000 are incarcerated. **Not in P**

P = 18,000. E = 12,000, U = 4,000 ⇒ LF = 16,000.

1. The labor force participation rate according to BLS standards is _____.
   (a) 89%
   (b) 80%
   (c) 64%
   (d) 85%
   (e) 75%

   Solution: LFPR = LF/P = 16,000/18,000 = 89%.

2. The **U3** unemployment rate according to BLS standards is _____.
   (a) 25%
   (b) 31%
   (c) 20%
   (d) 29%
   (e) 22%

   Solution: U3 = U/LF = 4,000/16,000 = 25%

3. The **U5** unemployment rate according to BLS standards is _____.
   (a) 25%
   (b) 31%
   (c) 20%
   (d) 29%
   (e) 22%

Solution: U5 = (U + marginally attached)/(LF + marginally attached) = 5,000/17,000 = 29%

4. The **U6** unemployment rate according to BLS standards is _____.
   (a) 25%
   (b) 31%
   (c) 20%
   (d) 29%
   (e) 22%

   Solution: U6 = (U + marginally attached + part-time for economic reasons)/(LF + marginally attached) = 5,300/17,000 = 31%

5. Elizabeth has rational preferences over bundles of consumption and leisure represented by a utility function $U(C, L)$. If her preferences satisfy the assumption of monotonicity, how many of the following statements **must** be true?

   - $U(\$120, 10) > U(\$100, 10)$
   - $U(\$100, 20) > U(\$90, 30)$
   - $U(\$90, 40) > U(\$120, 20)$
   - $U(\$130, 20) > U(\$120, 10)$

   (a) 2
   (b) 1
   (c) 0
   (d) 3
   (e) 4

   Solution: To satisfy monotonicity, Elizabeth's utility function must show that:

   (i) Increasing C or L individually (holding the other variable constant) will either keep utility the same or increase it

   (ii) Increasing both C and L will increase utility

   Thinking of going from the bundle on the right to the bundle on the left:

   - Statement 1: Does not need to be true - utility could remain the same since only C was increased
   - Statement 2: Does not need to be true - C increased, but L did not remain constant
   - Statement 3: Does not need to be true - L increased, but C did not remain constant
   - Statement 4: Must be true - both C and L increased, so utility must increase.

6. Tom earns \$15 per hour, regardless of the number of hours he works, and faces a tax rate of 15%. Additionally, Tom pays \$3 per hour in child care expenses for each hour he works and receives \$200 in child support payments each week. There are 110 hours in a week for Tom to allocate between work and leisure. Which of the following represents the equation for Tom's weekly budget line?

   (a) $C = 1402.5 - 12.75L$

   (b) $C = 1602.5 - 12.75L$

   (c) $C = 1850 - 15L$

   (d) $C = 1272.5 - 9.75L$

   (e) $C = 1072.5 - 9.75L$

   Solution: Tom's effective wage: $W^N = 15(1 - .15) - 3 = \$9.75$ $C = (wT + V) - wL = (9.75 \cdot 110 + 200) - 9.75L = 1272.5 - 9.75L$

7. A worker has preferences given by $U(C, L) = 2C^{1/2}L^{1/2}$. If the worker is indifferent between bundle A, given by (\$900, 100 hours), and bundle B, given by (\$625, X), what is X?

   (a) 169 hours

   (b) 150 hours

   (c) 121 hours

   (d) 160 hours

   (e) 144 hours

   Solution: $U(900, 100) = 2(900)^{1/2}100^{1/2} = 600$. $U(625, X) = 2(625)^1/2X^{1/2} = 600 \Rightarrow 50X^{1/2} = 600 \Rightarrow X^{1/2} = 12 \Rightarrow X = 144$

8. Refer to Figure 1 below.

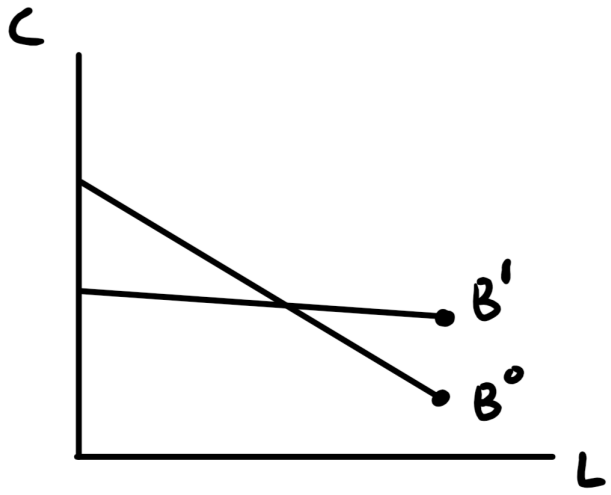

Figure 1: Harold's Budget Set

Which of the following would cause Harold's budget constraint to change from B^0 to B^1?

(a) An increase in both her wage rate and non-labor income.

(b) A decrease in both her wage rate and non-labor income.

(c) An increase in her wage rate and a decrease in her non-labor income.

(d) A decrease in her wage rate and an increase in her non-labor income.

(e) None of the above.

Solution: Harold's endowment point would shift up due to an increase in non-labor income. Her budget line's slope would decrease due to a decrease in her wage rate.

9. How many of the following statements regarding predictions under the Neoclassical Model of Labor Supply are FALSE?

- A decrease in non-labor income is predicted to unambiguously increase the number of hours worked for a worker currently working more than zero hours.
- An increase in the wage rate is predicted to unambiguously decrease the number of hours worked for a worker currently working more than zero hours.
- An increase in non-labor income is predicted to unambiguously increase labor force participation among workers currently out of the labor force.
- An increase in the wage rate is predicted to unambiguously increase labor force participation among workers currently out of the labor force.

(a) 2

(b) 1

(c) 0

(d) 3

(e) 4

Solution:

- Statement 1: True
- Statement 2: False. An increase in the wage rate may increase hours worked if the substitution effect is larger than the income effect.
- Statement 3: False. An increase in non-labor income is predicted to decrease labor force participation because it raises a worker's reservation wage.
- Statement 4: True

10. The neoclassical model of labor supply predicts that the Earned Income Tax Credit should unambiguously

(a) decrease labor force participation.

(b) increase work hours among workers currently working.

(c) increase labor force participation

(d) decrease work hours among workers currently working.

Solution: By increasing a worker's net wage, the EITC is predicted to increase labor force participation. However, the effect of the EITC on work hours for those already working is ambiguous.

Short Answer

1. For each of the following, determine which type of unemployment is present.

   (a) Jonathan decided to leave his job as chocolatier three months ago in order to pursue a career as a pastry chef. He is actively looking for work, but it is taking time for him to search for job openings, fill out applications, and hear back from interested firms. **[1 pt]**

   Solution: Frictional unemployment

   (b) Jill worked as a licorice maker for 25 years, but was laid off a year ago because firms in the industry transitioned to automated processes. She has looked for work since then, but has not found employment because her skills as a licorice maker are not readily transferable to other sectors in the economy. **[1 pt]**

   Solution: Structural unemployment

   (c) Tina is currently looking for work as a Barista. She only started looking for work a few weeks ago, but it seems that most coffee shops are still recovering from an economic downturn and are hesitant to hire. **[1 pt]**

   Solution: Cyclical unemployment

   (d) The city council of Ski Mountain Resort observes that unemployment in the region increases during the summer months. **[1 pt]**

   Solution: Seasonal unemployment

2. Charlie has 5,000 hours per year to allocate between work and leisure. If he works, he can earn a gross hourly wage, w^G, and he faces the following marginal tax rates on his gross earnings:

Table 1: Marginal Tax Rates

Marginal Tax Rate	Gross Earnings
10%	\$15,000
20%	\$15,001 - \$40,000
25%	\$40,001 - \$90,000
30%	\$90,001+

Finally, Charlie earns \$5,000 a year in non-labor income. This income is not taxed. Figure 2 shows Charlie's budget line for the year. Note that points B and C represent "kink" points in his budget line where his marginal tax rate changes.

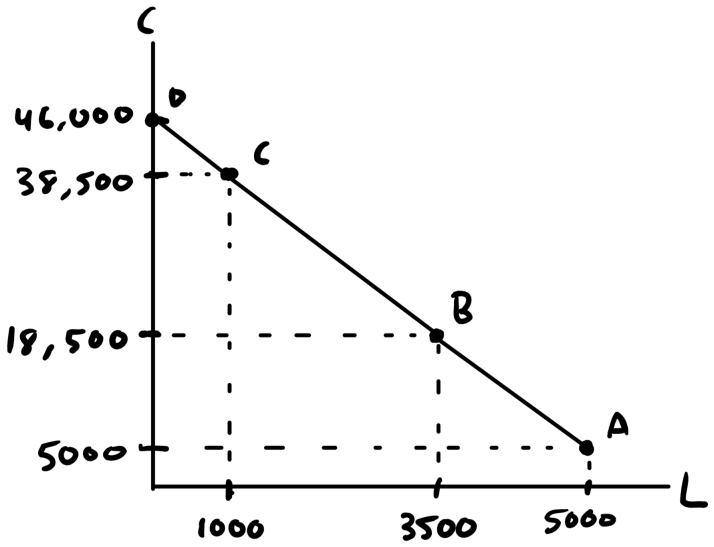

Figure 2: Charlie's Budget Line

(a) What is Charlie's **net** hourly wage between points B and C on his budget line? **[4 pts]**

Solution: w^N is the (absolute) slope of the budget line. Between B and C, $w^N = |(38,500 - 18,500)/(1000 - 3,500)| = \$8$.

(b) What is Charlie's **gross** hourly wage, w^G? **[4 pts]**

Solution: $w^N = w^G(1-\tau) \Rightarrow w^G = w^N/(1-\tau) = \$8/(1-.20) = \$10$.

3. Dennis' daily budget line is denoted B^1 in Figure 3 below. Suppose his marginal rate of substitution is given by $MRS_{L,C} = \frac{2C}{3L}$.

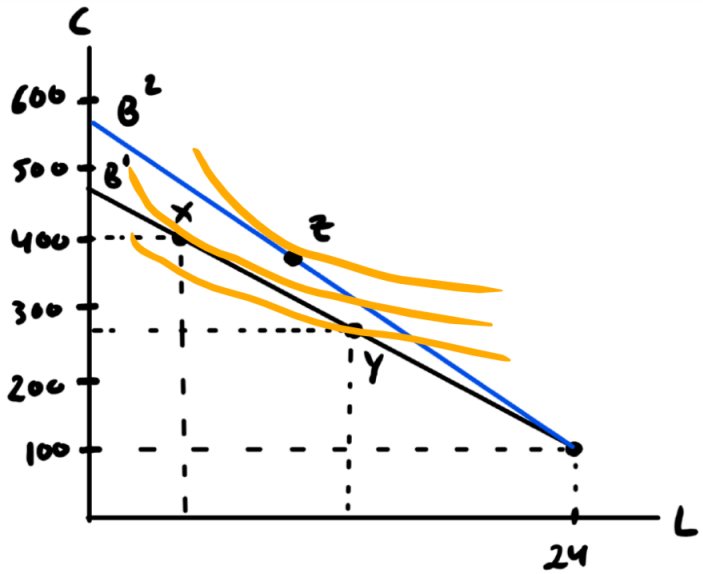

Figure 3: Dennis' Budget Line

(a) What is Dennis' reservation wage? **[2 pts]**

Solution: $w^{res} = MRS$ at the endowment point, where $C = V = 100$ and $L = T = 24$. $w^{res} = 2(100)/3(24) = 200/72 = \$2.78$.

(b) Suppose bundle X gives Dennis' optimal choice of consumption and leisure. Explain how Dennis could rearrange his bundle to increase his utility if he is currently at point Y. What is the relationship between the $MRS_{L,C}$ and Dennis' wage (w) at point Y? **[4 pts]**

Solution: Bundle X is the optimal bundle, so $MRS = w$ at point X. At point Y, Dennis could increase his utility by consuming more dollars and taking less leisure time. That is, the next hour of leisure would yield less utility per dollar spent than the next dollar of consumption spent at point Y: $(MU_L/w) < MU_C \Rightarrow (MU_L/MU_C) < w \Rightarrow MRS_{L,C} < w$.

Points: (2) $MRS < w$, (2) how to rearrange bundle (increase C, decrease L)

(c) Sketch Dennis' indifference curves going through points X and Y. You don't need to use his actual preferences, just general convex indifference curves. **[2 pts]**

(1) each. Make sure the one going through point X is tangent to the budget line and that the indifference curves don't cross. The slope of the indifference curve going through Y should be smaller than the slope of B^1 at point Y.

(d) Suppose Dennis' budget line changes to B^2. If Dennis' new optimal bundle of consumption and leisure is given by point Z, what does that tell you about the relationship between the income and substitution effects? **[4 pts]**

Solution: Dennis' wage increased (since his budget line became steeper). At this higher wage, Dennis will increase his leisure time, i.e., he decreases how many hours he works. Thus, it must be that the income effect dominates the substitution effect.

4. Art Sloan produces Flip Cups according to the following production function:

$$q = f(K, E) = 2K^{1/2}E^{1/2}$$

All markets are perfectly competitive, and Sloan currently has 5 units of capital. The marginal product of labor is given by $MP_E = \frac{K^{1/2}}{E^{1/2}}$. His Flip Cups sell for $p = \$20$, the market wage rate is $w = \$10$, and the capital rental rate is $r = \$5$.

(a) Determine Sloan's optimal short-run level of labor employment. **[3 pts]**

Solution: Optimal hiring rule: $VMP_E = w \Rightarrow p \times MP_E = w$. $K = K_0 = 5$.
$20 \times \frac{5^{1/2}}{E^{1/2}} = 10 \Rightarrow 10E^{1/2} = 20(5^{1/2}) \Rightarrow E^{1/2} = 2(5^{1/2}) \Rightarrow E^* = 4 \times 5 = 20$.

Points: (1) $VMP_E = w$, (1) work, (1) $E^* = 20$

(b) Now, assume that Sloan is able to vary his capital stock (i.e., we've moved to the long-run). He notices that at his current input bundle, $MP_E = 0.5$, $MP_K = 2$, and prices are still $w = \$10$, $r = \$5$. Explain how he can alter his inputs to increase his profits. **[3 pts]**

Solution: $MP_E/w = 0.05$ and $MP_K/r = 0.4$. Capital produces more additional output per dollar spent, so Sloan should reallocate resources towards capital in order to increase his profits ($\uparrow K, \downarrow L$).

Points: (1) Reallocate towards capital (2) Explanation