Midterm 1

answers

Instructions: The exam consists of 9 questions. Questions 1-4 are multiple choice; simply circle your answers, you do not need to show work. Questions 5-9 will be graded principally on your explanation and thought process in arriving at your answer, so please document your answer as thoroughly as possible. The questions add up to 95 points, so you will get 5 points for free. Good luck!

Problem 1 (5 points) Someone with constant marginal utility of wealth is:

a. Risk-averse

b. Risk-neutral

c. Risk-loving

d. Not enough information to tell

Problem 2 (5 points) Suppose we know the following about a firm's average total cost function:

Q	average total cost
10	6
11	7
12	8

Which of the following must be true?

a. The firm's production exhibits economies of scale

b. The firm has fixed cost equal to $60

c. The firm has fixed cost equal to $20

d. The marginal cost of the 11th unit is $17

e. The marginal cost of the 11th unit is $1

Problem 3 (5 points) A firm has production function $Q = \sqrt{K} * \sqrt{L}$. Suppose in the short run that K is fixed at 9. The cost of a unit of capital is $10 while the cost of a unit of labor is $15. Which of the following is true?

a. The average fixed cost of the 6th unit produced is $10

b. The total cost of producing $Q = 6$ units is $90

c. The average variable cost of the 6th unit produced is $10

d. The average total cost of the 6th unit produced is $15

Problem 4 (5 points) Alice is trying to decide between two jobs. Job A pays $1,000/month with certainty, while job B pays $1,500/month with probabilty p and $500/month with probability $1 - p$. Her utility over her monthly income w is given by the function $u(w) = 4 * \sqrt{w}$. Which of the following are true statements?

a. She will get a higher expected utility in job A, regardless of what p is.

b. She will get a higher expected utility in job B, regardless or what p is.

c. If $p = .55$, she will prefer job A

d. If $p = .5$, she is indifferent between the two jobs.

e. None of the above are true.

Problem 5 (15 points) A friend offers you a chance to purchase a share in his brewery for $10,000. The brewery's success is uncertain. After 1 year, your share will be worth w, where w is random according to the following distribution:

Probability	w
.2	$20,000
.3	$15,000
.2	$12,000
.2	$10,000
.1	$0

Alternatively, you can keep your money under your mattress, in which case $w = \$10,000$ with probability 1.

a. Calculate the expected value of w one year from now if you invest in the brewery.

The expected value of w if you invest in the brewery is $12,900.

b. Suppose your utility function over your wealth is $u(w) = \sqrt{w}$. Calculate your expected utility if you invest in the brewery.

Your expected utility from investing in the brewery is $.2 * \sqrt{20000} + .3 * \sqrt{15000} + .2 * \sqrt{12000} + .2 * \sqrt{10000} + .1 * \sqrt{0} = 106.94$

c. Calculate your certainty equivalent from investing in the brewery.

Your certainty equivalent is X, where $\sqrt{X} = 106.94$, or $X = 11,435.2$.

d. If you are an expected utility maximizer, will you invest in the brewery, or keep your money under your mattress?

The expected utility from storing your money under your mattress is $\sqrt{10,000} = 100$. This is less than the expected utility from investing in the brewery from part b. Therefore, you will invest in the brewery.

e. Suppose that you have just learned a bank has opened in town, which will pay you a return of R for keeping your money there for one year? How big does R have to be before you prefer this option to investing in the brewery?

If the bank paid you more than $1,435.20 in interest, you would prefer to keep your money in the bank (an answer in terms of an interest rate is fine too).

Problem 6 (15 points) Jack has utility function $u(A, B) = .01 * A * B^2$ over apples (A) and bananas (B). He has a budget of $30 to spend on these two goods. One apple costs $1, while one banana costs $.50.

a. Draw a clearly-labeled picture of Jack's budget line.

See figure at end of exam.

b. For each of the following three points, say whether it is on the budget line, below the budget line, or above the budget line.

<div align="center">

point X: $A = 7$, $B = 46$

point Y: $A = 15$, $B = 23$

point Z: $A = 20$, $B = 45$

</div>

Point X is on the budget line, point Y is below the budget line, and point Z is above the budget line.

c. In a new picture, draw a picture of the indifference curve that gives Jack a utility of 135.

See figure a the end of the exam.

d. The bundle $A = 15$, $B = 30$ gives Jack a utility of 135. It is also on his budget line. Calculate Jack's marginal utility of apples and marginal utility of bananas at this bundle.

$MU_A = MU_B = 9$ (I used calculus to get these answers. You may also compute marginal utility adding one to each good while holding the other constant and measuring the increase in utility. In this case, your answer will be approximate. This is fine.

e. Is Jack maximizing his utility at the bundle in part d?

No. The slope of his indifference curve through the point $(15, 30)$ is -1, while the slope of his budget line is either 2 or .5, depending on whether you put apples on the X-axis or the Y-axis. A picture helps to make this clear.

Problem 7 (15 points) Marilyn spends her entire monthly income on champagne (C) and perfume (F). The price of a bottle of champagne is \$30 and the price of an ounce of perfume is \$10. If she consumes 12 bottles of champagne and 24 ounces of perfume, her marginal rate of substitution is $MRS = 1$. Is her choice optimal? Explain with a diagram.

The slope of her indifference curve through the point $(C, F) = (12, 24)$ is -1. The slope of her budget line is either -3 or $-\frac{1}{3}$ depending on whether you put champagne on the X-axis or the Y-axis. Therefore, her choice is not optimal. See end of key for a picture.

Problem 8 (15 points) ABC construction is employing 10 acres of land and 50 tons of cement to produce 1,000 parking spaces. Land costs \$4,000 per acre, and cement costs \$12 per ton. At the current input quantities, the marginal product of land is 50, while the marginal product of cement is 4.

a. How much does it cost ABC to employ 10 acres of land and 50 tons of cement? Draw the isocost line associated with this cost level below. Be sure to label its intercepts.

It costs ABC \$40,600 to use this combination of inputs. See end of key for a picture.
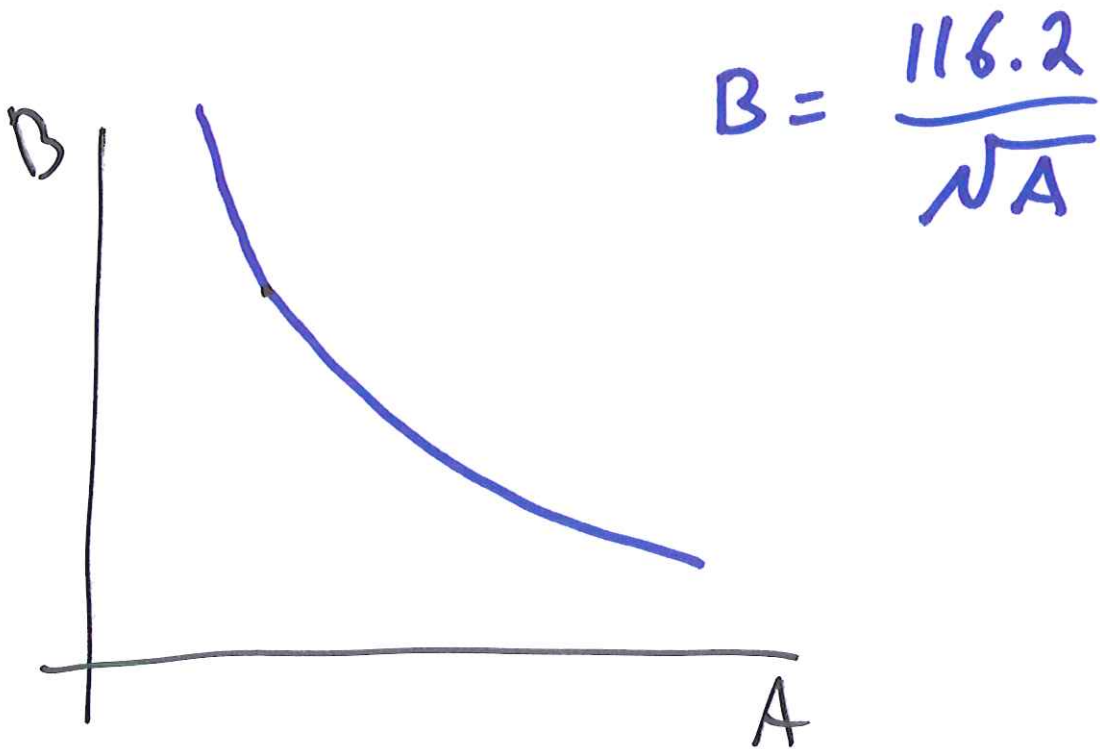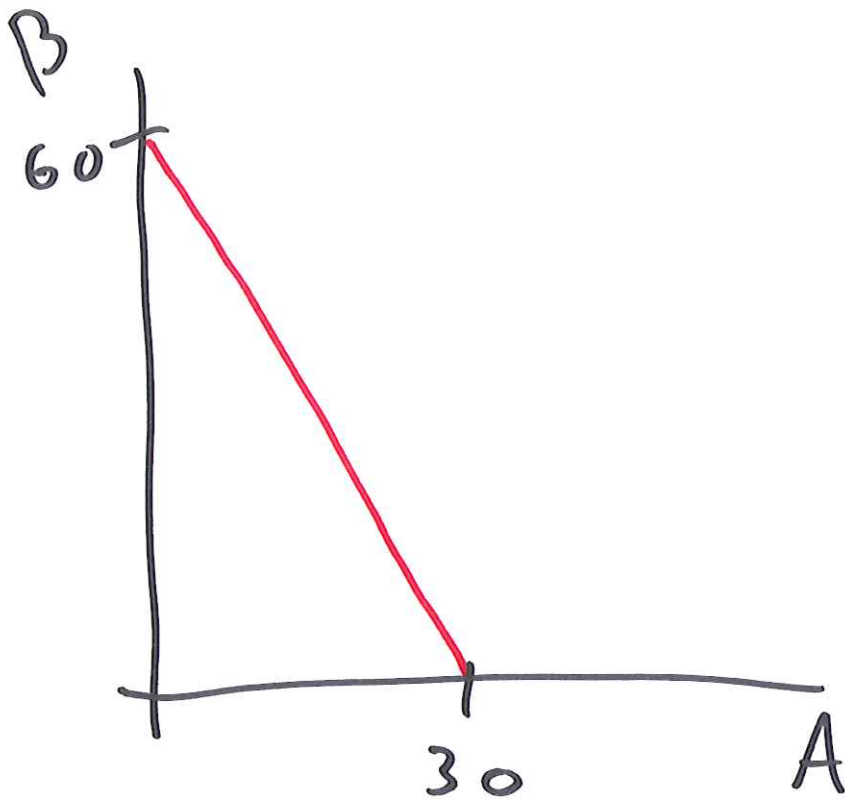
b. Is ABC producing the 1,000 parking spaces at the cheapest possible cost? If so, state how you know, and if not, show in a diagram how ABC could produce the same quantity at a lower cost. Be as specific as you can!

It is not producing at the cheapest possible cost. The slope of the isoquant through the point (10 land, 50 cement) is 12.5, with land on the x-axis. The slope of the isocost line is 8.3. See figure at end of key. ABC is producing at a point like the one identified in the figure. The marginal product per dollar of land is much lower than the marginal product per dollar of concrete. ABC should use more concrete and less land (i.e. build a parking garage).
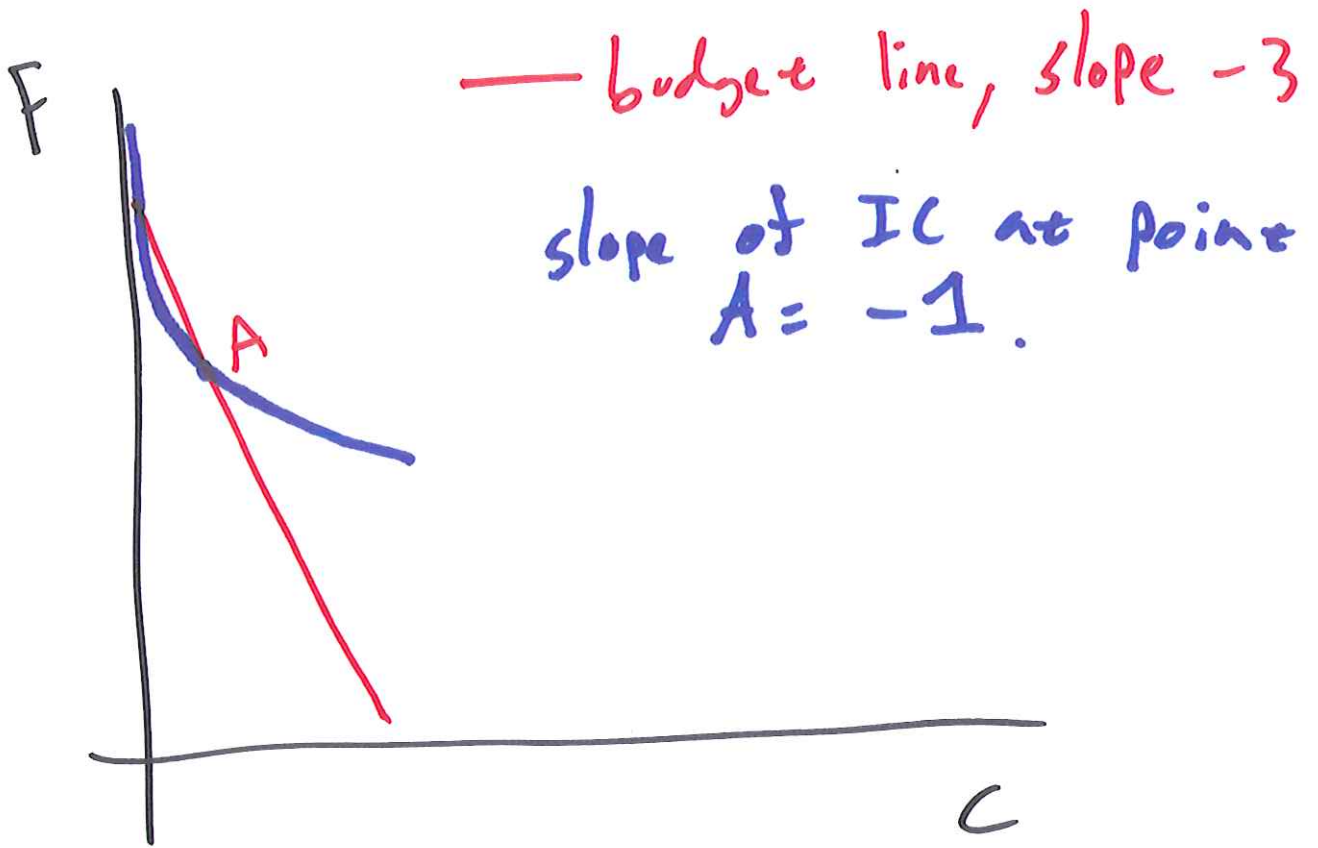
Problem 9 (15 points) Lloyd has the following indifference map. His income is 60. Fish costs 10 per box and Chips cost 5 per box. The diagram below is not necessarily drawn to scale.
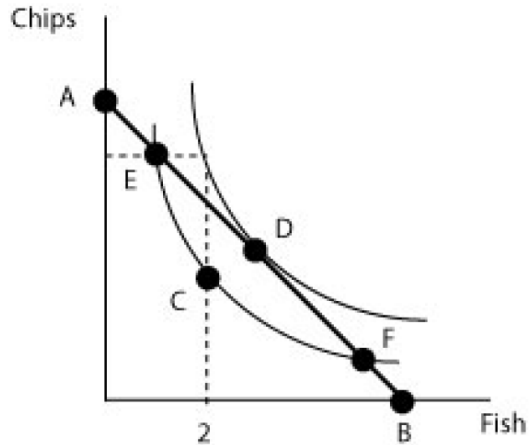
a.   Bundle A contains F boxes of fish and C boxes of chips. What are F and C?

$F = 0$, $C = 12$.

b.   Bundle D contains F boxes of fish and 6 boxes of chips. What is F?

$F = 3$.

c. If Lloyd is consuming at bundle F, is his MRS greater than or less than the price ratio?

The MRS of Fish for Chips is less than the price ratio $\frac{P_c}{P_f}$.

d.   If Lloyd is consuming at bundle F, should he buy more fish or less fish?
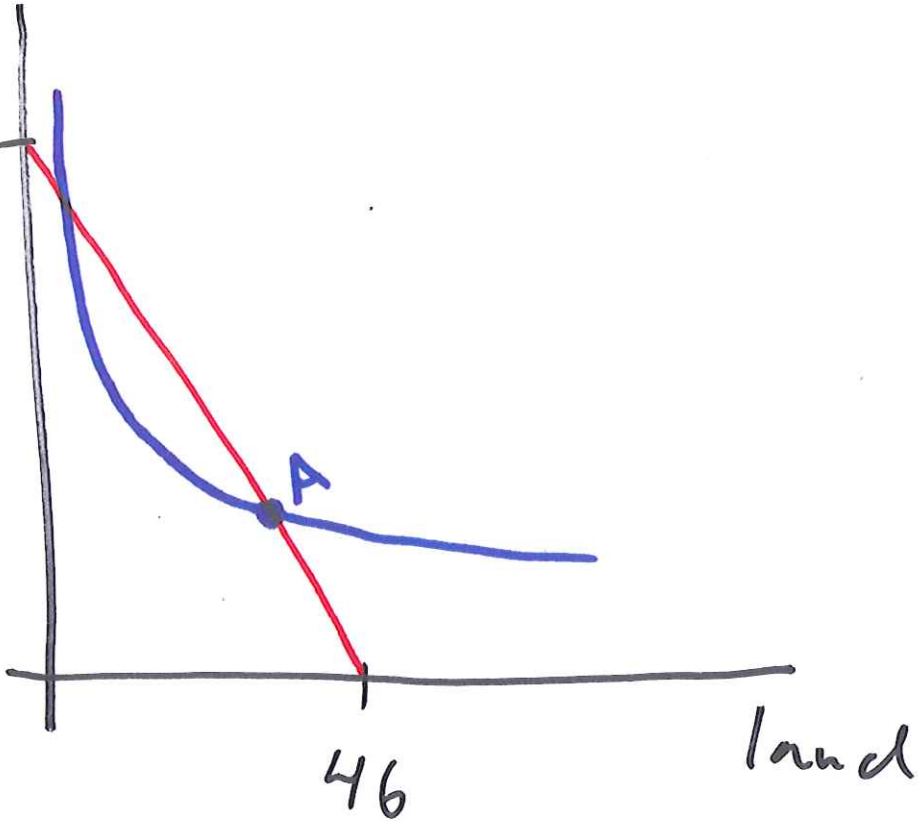
Lloyd should buy more chips and less fish.

B

60

30
A

$$B = \frac{116.2}{\sqrt{A}}$$

B

A

Problem 6

F

— budget line, slope −3

slope of IC at point A = −1.

A

C

Problem 7

cement

383.3

A

46   land

A= 10 land, 50 cement

Problem   8