

## Homework 4

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Please read all the instructions below carefully before you start working on the assignment.

- Please typeset your submissions in  $\text{\LaTeX}$  and submit your assignment as a PDF document. Use the template provided for your answers. Please include your name with you submission.
- This assignment is due at 11:59 pm on Monday, March 2nd.
- Please submit your assignment on Gradescope. Make sure to assign all questions to the corresponding page(s) of your assignment, or else it will not be graded.

## Problem 1: Budget Constraints

Eric has an income of 24 dollars and he can buy either vegemite, which costs 4 dollars, or boomerangs, which cost 8 dollars.

### Question 1.1

What is Eric's budget constraint? Make sure to use  $\text{\LaTeX}$ .

### Question 1.2

1. Can Eric afford to buy 1 boomerang and 2 vegemite?
2. What about 1 boomerang and 4 vegemite?
3. What about 2 boomerangs and 4 vegemite?
4. Which consumption bundle would Eric choose, and why?

### Question 1.3

Vegemite has now decreased to 3 dollars, while boomerangs remain at 8 dollars. If the quantity of vegemite was on the x-axis and the quantity of boomerangs was on the y-axis, what will happen to the slope and intercepts?

### Question 1.4

What will happen to the slope and intercepts if Eric's income increases to 32 dollars, while the price of vegemite and boomerangs stay the same at 4 and 8 dollars respectively?

## Problem 2: Marginal Utility

Consider the utility function:

$$u(x_1, x_2) = x_1 + x_2$$

### Question 2.1

What is the marginal utility function with respect to  $x_1$ ? What is the marginal utility function with respect to  $x_2$ ?

### Question 2.2

Given your results in (a), what is significant about this utility function?

## Problem 3: Perfect Complements

Consider the utility function:

$$u(x_1, x_2) = \min(x_1, x_2)$$

In other words, the function simply outputs the minimum between  $x_1$  and  $x_2$ . Note that this function is not directly differentiable, so its marginal utility functions are not straightforward. Nonetheless, we will examine consumer utility-optimization behavior in this problem.

*Note:* For the drawing portions of this question, please include this as part of your  $\LaTeX$  submission. To learn more about how to include images in  $\LaTeX$ , check out this [link](#). If you complete the graphs without scanning or taking a photograph (i.e. digitally), **you will receive 1 bonus point**. Check out [draw.io](#) to draw simple diagrams; if you have an iPad, using a drawing/notetaking app is OK as well.

### Question 3.1

Draw out the indifference curves for this utility function.

### Question 3.2

Assume that  $x_1$  and  $x_2$  have the same price, and you have the ability to purchase one more unit of  $x_1$  or  $x_2$ . If you currently consume 5 units  $x_1$  and 3 units of  $x_2$ , which good would you purchase? Why?

### Question 3.3

Why is this function known as the perfect complements function? ([hint](#))

### Question 3.4

Add a budget constraint to your indifference curve(s) from part a). Assume that  $x_1$  and  $x_2$  have the same price.

### Question 3.5

At which point on the utility curve will individuals tend to choose as their optimal consumption bundle?