# *Problem Set 1*

Econ 3010 Fall 2017

Problem 1: Drawing Budget Constraints
Sally has $100. She likes consuming apples (A) and bananas (B). The price of apples is $10 and the price of bananas is $5.

a) Graph Sally's budget constraint.

b) Now suppose Sally is given 3 free bananas which cannot be sold. Graph Sally's new budget constraint.

c) Instead of being given 3 free bananas, Sally is informed that the price of apples is now$20. Graph Sally's new budget constraint.

d) Sally has exactly 1 hour to eat her apples and bananas. The price of apples is still$10 and the price of bananas is still $5. However, each apple takes 3 minutes to eat and each banana takes 6 minutes to eat. Sally receives no free bananas and only one piece of fruit can be consumed at a time. Graph Sally's budget constraint. Graph Sally's time constraint. Shade the set of all feasible bundles that Sally can consume.

Problem 2: More Budget Constraints Draw
the budget constraint for:

a) $p_x = 10$, $p_y = 10$, Income = 10

b) $p_x = 3$, $p_y = 21$, Income = 42

c) $p_x = 10z$, $p_y = z$, Income = $100z$ where $z > 0$

d) $p_x = 2p_y$, Income = $10p_x$

e) Income = 100, buying 10 units of x and 5 units of y costs 100. Buying 20 units of y and no units of x costs 100.

Problem 3: The Real World
Give examples of real world commodities that would likely have the properties described below.

a) A commodity where more is not better.

b) A commodity that is worthless when consumed without a specific other commodity.

c) A commodity x where any bundle (including other goods) with a positive value of x is strictly preferred to any bundle where $x = 0$

**Problem 4: Pizza and Beer**
Bob likes pizza and beer as long as each is consumed in moderation. He prefers more beer to less beer as long as he has consumed fewer than six beers. After six beers he prefers less beer to more. Similarly he prefers more pizza to less as long as he consumes fewer than 4 slices. Beyond 4 slices he prefers less to more.

With pizza on the horizontal axis and beer on the vertical sketch Bob's indifference map showing all important features.

**Problem 5: Math Practice**
Maximize the following functions taking into account any constraints that are imposed.

a) $f(x) = -x^2$

b) $f(x) = -2x^2 + 10$

c) $f(x) = (-ax^2 + b)^3$ where $a, b > 0$

d) $f(x, y) = -x^2 - y^2$

e) $f(x, y) = -(x + y)^2$

f) $f(x) = g(-x^2)$ where $g(z)$ is a strictly increasing function

**Problem 6: Elasticities**
For each of the following, you will be given a function. Given that function you will be asked to calculate one or more elasticities.

a) $z = f(x, y) = x^2y^3$. Calculate $\varepsilon_{xz}$ and $\varepsilon_{yz}$.

b) $z = f(x, y) = ln(x) + 2y$. Calculate $\varepsilon_{xz}$ and $\varepsilon_{yz}$.

c) $z = f(x) = A + Bx$ where $A$, $B > 0$. Calculate $\varepsilon_{xz}$.

**Problem 7: Let's Draw!**
Draw a set of indifferences curves for the following utility functions.

a) $U(x, y) = x + y$

b) $U(x, y) = x - y$

c) $U(x, y) = x$

d) (x, y) = x + y2 + 5

e) $U(x, y) = ln(x + y)$

f) $U(x, y) = (x - y)^{10001}$

g) $U(x, y) = y^{10000}$

**Problem 8: Utility Comparison**

State whether each of the following statements in true or false. Explain your reasoning.

a) $U_1(x, y) = x + y$ and $U_2(x, y) = x^2 + 2xy + y^2$ both represent the same underlying preferences.

b) $U_1(x, y) = x^a y^b$ and $U_2(x, y) = a * ln(x) + b * ln(y) + 1$ both represent the same underlying preferences.