Writing Assignment 1 - MATH 381

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Consider the salsa-and-guacamole scenario from this weeks's lecture. Suppose we sell salsa for \$1 per unit, and guacamole for \$ z per unit. Depending on the value of z, we would maximize revenue by making all salsa, all guacamole, or some of each. Describe the range of z values corresponding to each type of solution, and give plenty of justification.

In this problem we are given the known price of \$1 per unit of salsa and a unknown price of \$$z$ per unit of guacamole (will shorten to guac for now on). We are interested in maximizing our revenue by selling these two goods. How much of each good we decide to sell depends on our z.

Let us define our other variables and objective function,

$$x_1 = \text{quantity of units of salsa producible} \geq 0$$

$$x_2 = \text{quantity of units of guac producible} \geq 0$$

$$r = \text{revenue generated}$$

$$\max_{x_1, x_2} r = 1 * x_1 + z * x_2$$

Depending on z we decide to either produce either only salsa, only guac, or some of both. In an unconstrained revenue problem like this, which decision to make depending on the range of z is extremely simple. *If $z < \$1$ we produce only salsa. If $z > \$1$ we produce only guac. If $z = \$1$ the prices of our goods are equal, so we are indifferent of how many of each to sell.*

However, if we incorporate the constraints on tomatoes and garlic to make salsa and guac, which I do not recall (not uploaded on class website), the range of z that determines which of the three decisions to make should change depending on the optimal amount of x_1 and x_2 producible given our resources in order to maximize revenue.

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[*]I can't believe it is already 2019.