EECS 16A Designing Information Devices and Systems I
Summer 2023 Discussion 1B

1. Solving Systems of Equations

While we'd love every system of linear equations to have a unique solution, in reality we can either have (a) one unique solution, (b) an infinite number of solutions, or (c) no solution at all. We are going to walk through some examples to see what sorts of equations create these types of solutions.

(a) Let's consider the system (where each $a, b \in \mathbb{R}$ can be any real number):

$$\begin{aligned} ax + y &= 3 \\ -x + 2y &= b \end{aligned}$$

For each of the selected values for a and b, sketch or plot out the lines $y(x)$ each of these equations form.

Can you conclude which values result in a unique solution? Infinite solutions? No solutions?

- i. $a = 1 \quad , \ b = 0$
- ii. $a = 0 \quad , \ b = 2$
- iii. $a = -1/2 \ , \ b = 6$
- iv. $a = -1/2 \ , \ b = 4$

(b) Now, assume we are using the tomography imaging technique described in lecture to image a 2x2 grid, as shown below.

2x2 Tomography Example

x_1	x_2
x_3	x_4

i. We record the following measurements:

$$\begin{aligned} x_1 + x_2 &= 2 \\ x_1 + x_3 &= 2 \\ x_2 + x_4 &= 2 \\ x_3 + x_4 &= 3 \end{aligned}$$

Solve this system using any method. Is this a valid set of measurements? Why or why not?

ii. We are led to believe our measurements might be faulty, so we record the following new measurements:

$$\begin{aligned} x_1 + x_2 &= 2 \\ x_1 + x_3 &= 3 \\ x_2 + x_4 &= 2 \\ x_3 + x_4 &= 3 \end{aligned}$$

Now, solve this system using any method. Is this a valid set of measurements? Why or why not?