MA103: Mathematical Modeling & Intro to Calculus
Robust Optimization 2

Lesson Objectives: Cadets will

1. Articulate the worst-case among multiple options in the context of a linear programming modeling problem
2. Explore robust optimization graphically
3. Interpret the results of a robust optimization in the context of a modeling problem
4. Analyze and articulate ethical considerations of performing prescriptive analytics using the ethics checklist

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Review: Consider the a compnay attempting to minimize an objective function associated with Cost, C:

$$\text{Minimize } C = ax + 2y, \quad \text{where } a = 5$$

$$3x + y \geq 15 \quad (1)$$
$$x + 2y \geq 12 \quad (2)$$
$$x \leq 9 \quad (3)$$
$$x \geq 0 \quad (4)$$
$$y \geq 1 \quad (5)$$
$$y \leq 10 \quad (6)$$

Graph the linear program and solve for the optimal point.

What are the binding constraints?

Determine the range of values of the coefficient a for which the minimum point remains the optimal solution.

From the perspective of Robust Optimization, what end of this range should we consider and why?

Challenge Problem: You are given the following linear programming model in algebraic form.

$$\begin{aligned} \min_{x_1,x_2} \quad & Z = 40x_1 + 50x_2 \\ \text{s.t.} \quad & 2x_1 + 3x_2 \geq 30 \\ & x_1 + x_2 \geq 12 \\ & 2x_1 + x_2 \geq 20 \\ & x_1, x_2 \geq 0 \end{aligned} \tag{1}$$

1. Work backwards to create your own word problem from the algebraic form.

2. Create and solve a robust optimization problem with a range of values for at least one parameter in the objective function and all the parameters in one of the constraints.