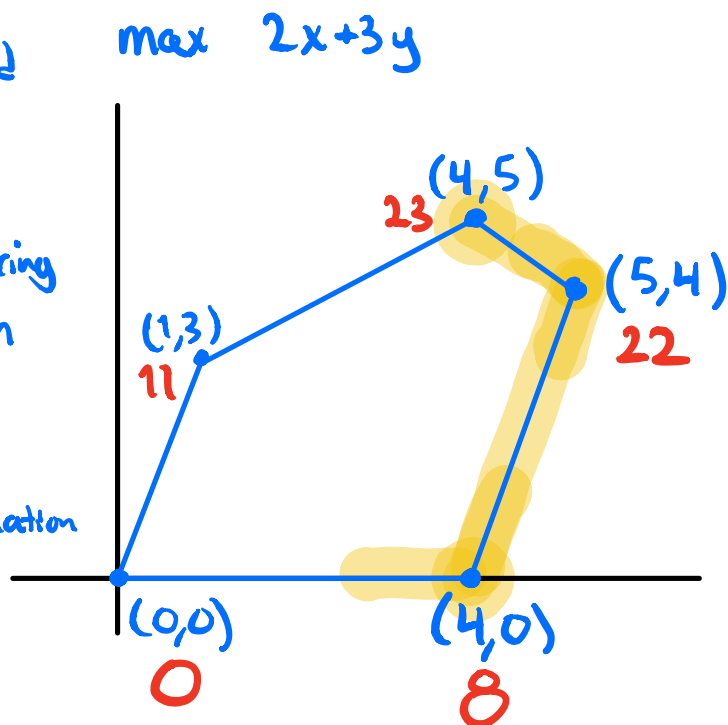


# LP in Higher Dimensions

## The Simplex Method

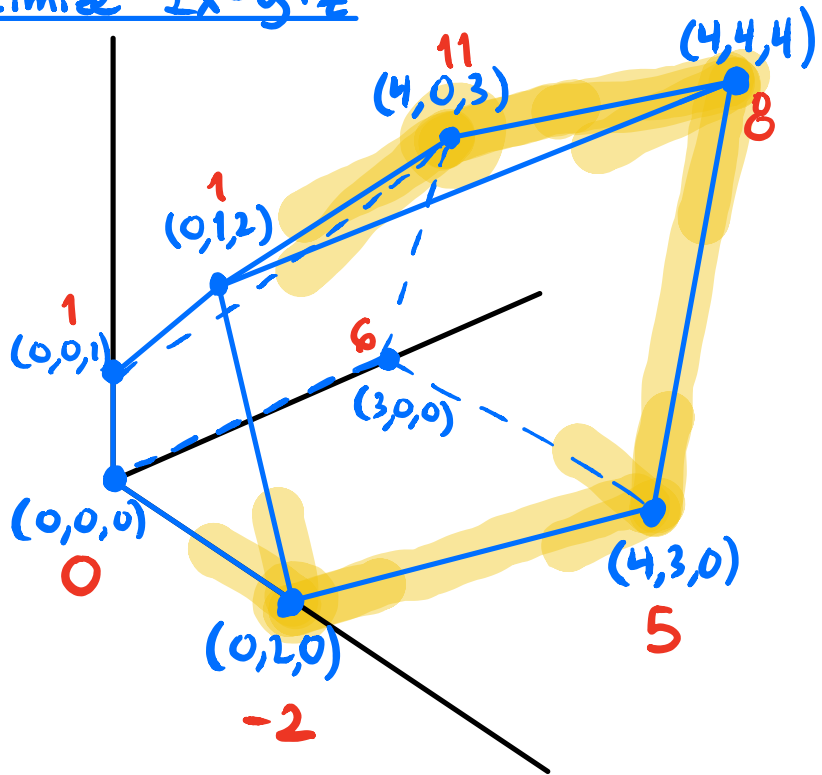
The simplex method is an iterative algorithm that moves from corner to corner until it reaches the optimal solution.

- The simplex method starts at any corner
- identifies neighboring corners (shares an edge)
- moves to corner with highest evaluation
- repeat



maximize  $2x - y + z$

- The simplex method starts at any corner
- identifies neighboring corners (shares an edge)
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- repeat



## An Online Simplex Calculator

$$3x - 25 + y + 2z \leq 0$$

$$z \geq x + y - 12$$

$$4(x + y) - 30 \geq 0$$

$$2x \leq 3z$$

$$\left. \begin{array}{l} x \geq 0 \\ y \geq 0 \\ z \geq 0 \end{array} \right\}$$

standard  
assumptions

$$\max \quad 7x + 5y + 6z$$

$$3x_1 - 25 + x_2 + 2x_3 \leq 0$$

$$x_3 \geq x_1 + x_2 - 12$$

$$4(x_1 + x_2) - 30 \geq 0$$

$$2x_1 \leq 3x_3$$

$$x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$$

$$\max \quad 7x_1 + 5x_2 + 6x_3$$

$$3x_1 + x_2 + 2x_3 \leq 25$$

$$x_1 + x_2 - x_3 \leq 12$$

$$4x_1 + 4x_2 \geq 30$$

$$2x_1 - 3x_3 \leq 0$$

$$x = 0, y = 49/3, z = 13/3$$

optimal value  $323/3$

## Another LP Word Problem

Your company is creating a new recipe for a protein bar.

Each batch calls for between 400 and 600 grams of flour of which at least 100 grams must be almond flour. The total grams of protein per batch should exceed 160 and fat should not exceed 75. How much of each flour should be used to minimize cost?

Flour (100g)	Protein(g)	Fat (g)	Cost (\$)
Almond	21	50	1.70
Chickpea	22	7	1.20
Sunflower seed	48	2	3.57

Variables:  $A$  #100g of almond flour  
 $C$  #100g of chickpea  
 $S$  #100g of sunflower

$$A + C + S \leq 6$$

$$A + C + S \geq 4$$

$$A \geq 1$$

$$21A + 22C + 48S \geq 160$$

$$50A + 7C + 2S \leq 75$$

$$A \geq 0, C \geq 0, S \geq 0$$

$$\text{minimize: } 1.7A + 1.2C + 3.57S$$