

# Algorithms, Fall 2021 at CIS – Homework 1

David Woodruff

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## Problem 1

Suppose you have 2 items: gadgets and widgets. To make a gadget requires 30 minutes of buying material and 20 minutes to put the material together. To make a widget requires 15 minutes of buying material and 30 minutes to put the material together. The profit on a gadget is  $40\text{RMB}$  and the profit on a widget is  $50\text{RMB}$ . The business operates for at most 8 hours per day. Write a linear program to determine how many gadgets and widgets should be made to maximize profit, and determine what the maximum profit is.

## Problem 2

Exercise 1: What if both players have somewhat different weaknesses? What if the payoffs are:

$$\begin{array}{cc} (-1/2, 1/2) & (3/4, -3/4) \\ (1, -1) & (-3/2, 3/2) \end{array}$$

Show that minimax-optimal strategies are  $\mathbf{p} = (2/3, 1/3)$ ,  $\mathbf{q} = (3/5, 2/5)$  and value of game is 0.

## Problem 3

Exercise 3: For the game with payoffs:

$$\begin{array}{cc} (-1/2, 1/2) & (-1, 1) \\ (1, -1) & (2/3, -2/3) \end{array}$$

Show that minimax-optimal strategies are  $\mathbf{p} = (0, 1)$ ,  $\mathbf{q} = (0, 1)$  and value of game is  $\frac{2}{3}$ .