G-TEAMS: Mountain View High School

David Romero
Department of Mathematics
Mountain View High School

Matt Lafferty
Department of Mathematics
University of Arizona

Operations Research Project

"You have just been hired by Renaissance Technologies, a hedge fund founded by mathematician James Simon. They have given you the authority to purchase a total of 100 shares of stock in Google and Apple...."

Students were given one of four scenarios: a **hedge fund manager** trying to determine an optimal investment strategy, a **baker** at Beyond Bread trying to determine how many loaves of Focaccia and Ciabatta to bake, an **assistant coach** with the Oakland Raiders trying to determine how many carries to give Michael Bush and Darren McFadden, or a **television executive** trying to optimize ad revenue.

g = Shares of Google
a = Shares of Apple

Maximize $625g + 357a$

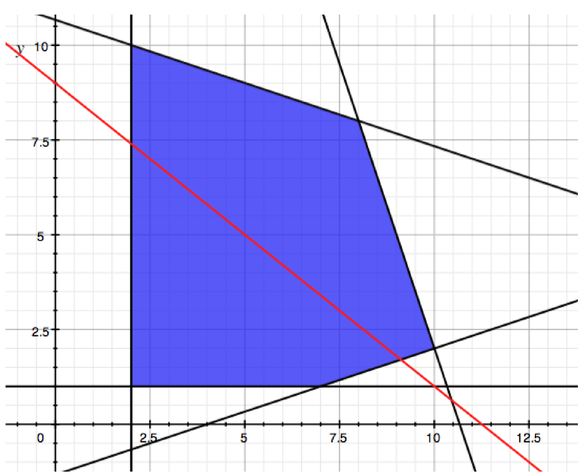
Constraints:

$$\begin{aligned} -10g - 4a &\geq -610 \\ -10g + 2a &\geq -300 \\ 7g - 4a &\geq -300 \\ g + a &\leq 100 \\ g &\geq 0 \\ a &\geq 0 \end{aligned}$$

Using nothing more than their knowledge of,

- Linear equations
- Linear inequalities

students were able to determine the optimal solutions. The method employed is a simplified version of the **simplex algorithm**, a powerful tool used by countless companies in a wide range of industries to optimize their resources.



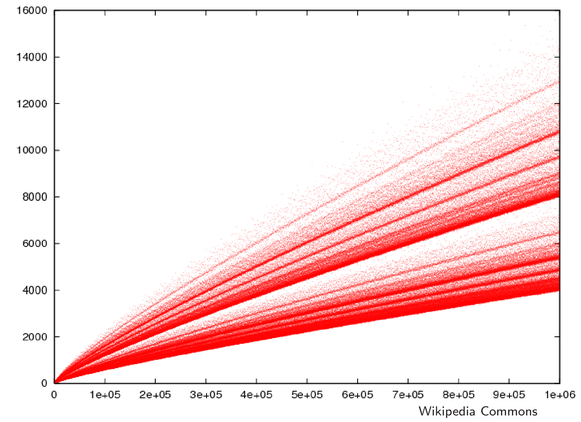
Research in the classroom

"Computation is to mathematics as a spelling bee is to writing a novel."

Factorization and Number Theory

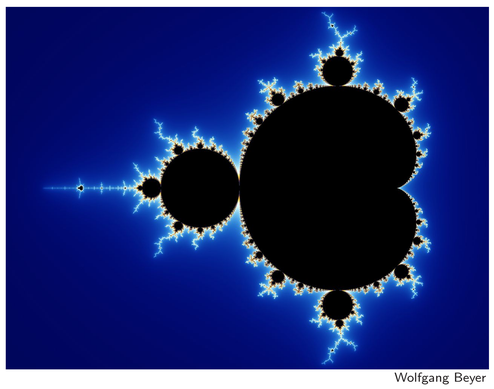
Students were introduced to number theory, some of its famous problems and applications:

- Fermat's Last Theorem
- The Twin Prime Conjecture
- Goldbach's Conjecture
- Public Key Cryptography



Wikipedia Commons

Absolute Value and Chaos Theory

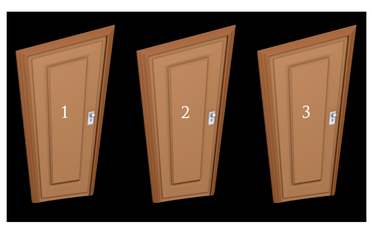

Wolfgang Beyer

Students learned how the complex absolute is used to create the **Mandelbrot set**

$$z_{i+1} \mapsto z_i^2 + c$$

Does $|z_i| \to \infty$ as $i \to \infty$?

Theoretical vs. Experimental Probability : The Monty Hall Problem



You have a choice of three doors. Behind one is a pile of money, behind the other two, a goat. After choosing, the host opens one of the remaining doors to reveal a goat. You are then given the opportunity to switch doors. What should you do?