

CS 312, Winter 2006

## **Project #7: Resource Allocation by Linear Programming**

Early Date: April 14, 2006

Due: April 17, 2006

### **Overview:**

In this project, you will solve a resource allocation problem by way of Linear Programming.

### **Objectives:**

- To understand how to formulate a problem as a linear programming problem.
- To understand how to translate the problem into slack or normal form.
- To solve the problem using the simplex algorithm.

### **Details:**

You are the operations director for a processing plant at a large mine. Your job is to devise a program, or plan, for the plant that maximizes profits while staying within the resource budget. The plant produces four major resources: copper, gold, silver and platinum.

In a given week, the mine produces 2,000 tons of ore that must be processed into some combination of the four major resources. A ton of ore contains 10 ounces of copper, 2 ounces of gold, 3 ounces of silver and 1 ounce of platinum. You may only extract one resource from each unit of ore processed.

Processing the ore requires power, water, labor and use of one of the three processing lines. Producing each of the resources requires different amounts of processing resources. One ounce of copper requires 30 kW hours, 1,000 gallons of water, 50 hours of labor and 4 hours of processing time on a processing line. One ounce of gold requires 15 kW hours, 6,000 gallons of water, 20 hours of labor and 6 hours of processing time on a processing line. One ounce of silver requires 19 kW hours, 4,100 gallons of water, 21 hours of labor and 19 hours of processing time on a processing line. One ounce of platinum requires 12 kW hours, 9,100 gallons of water, 10 hours of labor and 30 hours of processing time on a processing line.

There is only a limited amount of power, water, labor and processing line time available. In a given week, you may use 1,000 kW hours of power, 1,000,000 gallons of water, 640 hours of labor and you can run the processing lines 24 hours a day for 7 days a week for a total of 504 hours.

Finally, each ounce of finished resource has an associated profit. An ounce of copper is worth \$10.20, an ounce of gold is worth \$422.30, an ounce of silver is worth \$6.91, and an ounce of platinum is worth \$853.00.

## To Do:

For this final project,

- Formulate this resource allocation problem as a linear program.
- Write a simplex solver that solves this linear programming problem. Note that your simplex solver need not solve any other linear programming problem. That is, you need not worry about input formats, full generality etc. Just write a simplex solver for this problem. Turn in a simple report (via email) that says how much copper, silver, gold and platinum you will produce.
- Include your well-commented source code as an attachment to your email.