Name: _____

Problem Set 4
Computational Methods (ERS 420)

Purpose

- Improve understanding of basic linear algebra mehtods
- Use a scripting language to efficiently implement these methods
- Apply these methods to a mass-balance modeling problem

Problems

1. Using the well know proportions of different granites (Amber Granite (A), Blue Granite (B), and Cyan Granite (C)) in glacial till from three different source areas, you hope to assess the source areas for two tills in northern Maine.

Percentage of granites in tills

source	% A	% B	% C
1	10	20	10
2	15	50	5
3	60	5	30

Because you are a poor graduate student, you are unable to collect a representative sample by directly sampling the till. Fortunately, your study area lies in the territorial range of the upland rock beaver (URB) , an industrious mammal that forms long ridges of rock in the Maine woods be moving the rocks from till deposits to these piles. You hire, at incredibly low hourly rate, two undergraduates with a deep an intimate knowledge of granite. Their vast training allows them to rapidly distinguish between granites of different color. These workers count the numbers of Amber, Blue and Cyan granite boulders in 10 m long segments of rock piles created by the URB.

Rocks by type in two URB ridges.

sample	A	B	C	Other
1	25	70	15	100
2	51	64	26	576

   (a) Set this as a matrix equation relating the proportion of granite types to the amount of granites in each sample . Clearly write out the equation you are using.

   (b) Solve the equation for sample 1 by hand, using Gaussian Elimination. What are the source areas of this sample?

   (c) Verify your answer by multiplying (by hand) the matrix you constructed with the answer.

   (d) Using a scripting language, cast the steps to get the matrix into upper triangular form into a single matrix operation. Show the matrix operation, including all terms, in your answer. What are the source areas for sample 2.

   (e) Solve the matrix equations using the built in tools in numpy (solve in a single step, don't write your own script).