

2.2 More on Gaussian Elimination (Part Two)

Suggested exercises: 11-15 odd

Back addition gives us a unique reduced echelon form for our system of linear equations. It also makes it very easy to find the solution in terms of our variables. These techniques extend to a situation where we might have the same coefficients, but different constant terms. We will see how to solve these without having to repeat ourselves too much.

2 keys:

- Multisystems
- Application

I Multisystems

Definition Several systems of linear equations that differ only in their constant terms are called **multisystems**. The coefficients of the equations in each linear system remain the same.

Instead of having to repeat our Gaussian elimination for each system of linear equations, we can solve all of them at the same time. We simply add a column for the constant terms in each system of our multisystem, just as we added a single column to form the augmented coefficient matrix.

Example.

Now when we use back addition to find the reduced echelon form of our matrix, we solve all of the systems of linear equations at the same time. Note that this only works when each system has the same coefficient matrix.

Example.

II Application

We have used systems of linear equations to solve different types of problems involving planning and production. Sometimes we don't know exactly what our parameters are, but we know a few possibilities instead. *Contingency planning* gives us a way of solving our problems, given a few possible sets of parameters. An example will help demonstrate this idea.

Example. Wheat, corn, and rye flours are blended to make different types of bread. The loaves are made up from the flours as shown in the following table:

	Multigrain	Cornmeal	Sourdough
Wheat	50%	10%	20%
Corn	30%	50%	20%
Rye	20%	40%	60%

The breads sell very well, and everything that can be baked will be sold. Therefore, management want to completely exhaust the supplies during production. However, because of uncertainties in shipping, they are unsure of the exact supplies that will be on hand at the beginning of the production period. They believe, with reasonable certainty, that the stocks will be one of the 3 possibilities in the following table, given in 1000-lb. units:

	I	II	III
Wheat	2	4	6
Corn	3	3	6
Rye	5	3	8

Determine the quantities of the products that should be made for each of the stock possibilities so that they will be ready when the production period starts.