

Throughout the semester, we've encountered many topics without any sort of algorithmic way to solve them. Take integrals, for example. Each integral must be analyzed carefully to find a technique that will allow us to do the computation. The techniques in linear algebra are very different from that, however. They are very systematic. Gaussian and Gauss-Jordan Elimination are very algorithmic processes. Computers are very good at doing the techniques of linear algebra.

The first thing you always do in Gaussian and Gauss-Jordan Elimination is get the (1,1)-entry to be 1. Often, this is done by switching rows if the first entry in some row is a 1, or you can multiply row one by the reciprocal of the first entry if it is not 0. After you get this first entry to be a 1, you want to use this 1 to get all of the entries below it to be 0. Suppose you want to make the first entry in row 2 be a 0, and the first entry in row 2 is c . You can take $-cR_1 + R_2$ to replace row 2. You repeat this process until column one starts with a 1 and everything below it is a 0.

Next, you want to make the (2,2)-entry into a 1. Again, you can do this by switching rows if one of the rows below row 2 has a 1 in column 2 or by multiplying row 2 by the reciprocal of the 2nd entry of row 2. Now that you have a 1 in row 2 column 2, you want to use this 1 to get all entries below it to be 0. Again, you do the same process as before, but instead with row 2 instead of row 1. If row 3, for instance starts with a 0 in column 1 and has a c in column 2, you can take $-cR_2 + R_3$ replacing row 3.

You repeat this general procedure until you get to row-echelon form.

If you are doing Gauss-Jordan elimination, you work your way back up the matrix and basically do the Gaussian Elimination process in reverse. You have a 1 in row 3 column 3 (and 0's everywhere else in row 3). So you use the 1 in row 3 to turn the entries above row 3 column 3 into 0's. Again, if the 3rd entry in row 2, for example is c , you can take $-cR_3 + R_2$ replacing row 2.

You repeat this process until you have reduced row-echelon form.

If you want to see this process in action, take a look at the Quiz 17 solutions posted on my website. You can see this basic process played out there. See how I first try to get a 1 in the appropriate place, and then I use that 1 to get entries below it to be 0. Then I try to get the (2,2)-entry to be 1, and I use that 1 to get the entries below it to be 0. etc.