CS1003 – The Gaussian Elimination Algorithm

The Gaussian Elimination Algorithm is concerned with transforming a matrix into reduced row echelon form. If the matrix represents a linear system, then the solution to the system can be easily obtained from the reduced row echelon form of the matrix. Here's how we implement the algorithm, step by step:

Label the rows in the matrix: **row 1** as **R1**, **row 2** as **R2** etc.

STEP 1:
Interchange the top row with another (if necessary) so as to have a **non-zero entry** as **far left as possible** in the first row.

STEP 2:
Multiply the top row by a suitable **constant** to get a **leading entry of 1**.

STEP 3:
Add multiples of the top row to each row below so that **all entries below the leading 1 are zero**.

STEP 4:
Ignore the top row and move on to the second row.

STEP 5:
If necessary, **interchange** the second row with another row **below** it so as to get a **non-zero entry** as **far to the left as possible** in the second row.

STEP 6:
If necessary, **multiply** the second row by a **constant** to get a **leading entry of 1**.

STEP 7:
Add multiples of the second row to each row above and below so that **all entries above and below the leading 1 are zero**.

STEP 8:
Move onto the third row and **repeat steps 5, 6 and 7** (but **this time looking at the third row, rather than the second row**). Keep going until you have dealt with all rows in the matrix.

STEP 9:
Stop when the matrix is in **reduced row echelon form**. Remember if there is a row that consists of all 0's then these rows should come at the bottom of the matrix. If your matrix represents a linear system of equations then you can read off your solution from this final matrix.