

# Testing Strategy

Step 1) Test for every possible error first.

If the code runs as expected.



Step 2) Test for the easiest case,  
(upper triangular input.).

If the code runs as expected.



Step 3) Test a avg / worst case, ie  
(matrix with all inputs nonzero,  
+ large matrix)

If the code runs as expected.



Good chance it works  
as intended.

Test 1)

$$\left[ \begin{array}{ccc|c} 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 2 \\ 0 & 0 & 1 & 3 \end{array} \right] \rightarrow \begin{array}{l} x_3 = 3 \\ x_2 \rightarrow 2 - 3 = -1 \\ x_1 \rightarrow 1 - (-1) - 3 = -1 \end{array}$$

Test 2)  $\left[ 1 \mid 0 \right] \rightarrow x_1 = 0$

Test 3)  $\left[ \begin{array}{ccc|c} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 2 \end{array} \right]$

$$\rightarrow \left[ \begin{array}{ccc|c} 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 \end{array} \right] \rightarrow \text{No unique solution}$$

Test 4)  $\left[ \begin{array}{ccc|c} 1 & 1 & 1 & 4 \\ 2 & 2 & 1 & 6 \\ 1 & 1 & 2 & 6 \end{array} \right]$

$$\rightarrow \left[ \begin{array}{ccc|c} 1 & 1 & 1 & 4 \\ 0 & 0 & -1 & -2 \\ 0 & 0 & 1 & 2 \end{array} \right] \rightarrow \text{No unique solution exists}$$

Test 5)  $\left[ \begin{array}{ccc} 2 & 3 & 3 \\ 1 & 2 & 3 \end{array} \right] \rightarrow \text{Error not a square matrix}$

Test 6)  $A = \left[ \begin{array}{ccc|c} 1 & -1 & 1 & 1 \\ 1 & 1 & 1 & 3 \\ 1 & 2 & 4 & 2 \end{array} \right]$

$$\rightarrow \left[ \begin{array}{ccc|c} 1 & -1 & 1 & 1 \\ 0 & 2 & 0 & 2 \\ 0 & 3 & 3 & 1 \end{array} \right]$$

$$\rightarrow x_3 = -\frac{2}{3}$$

$$x_2 = 1$$

$$x_1 = 1 + \frac{2}{3} + 1 = \frac{8}{3}$$

$$\rightarrow \left[ \begin{array}{ccc|c} 1 & -1 & 1 & 1 \\ 0 & 2 & 0 & 2 \\ 0 & 0 & 3 & -2 \end{array} \right]$$

## Test verifications

### Test 1

```
>> guass_elim([1,1,1;0,1,1;0,0,1], 1:3);
```

A =

```
1 1 1 1
0 1 1 2
0 0 1 3
```

A =

```
1 1 1 1
0 1 1 2
0 0 1 3
```

result =

```
-1
-1
3
```

### Test 4

A =

```
1 1 1 4
0 0 -1 -2
0 0 1 2
```

result =

"No unique solution exists"

ans =

"No unique solution exists"

### Test 2

```
>> guass_elim([1], [0]);
```

result =

0

### Test 3

```
>> guass_elim([1,1;1,1], [1,2]);
```

A =

```
1 1 1
0 0 1
```

result =

"No unique solution exists"

### Test 5

```
>> guass_elim([2,3,3;1,2,3], [1,2])
```

Error using **guass\_elim** (line 17)

Error: A is not a square matrix!

## Test 6

```
>> guass_elim([1,-1,1:1,1,1:1,2,4], [1,3,2])
```

A =

```
1  -1  1  1
0   2  0  2
0   3  3  1
```

A =

```
1  -1  1  1
0   2  0  2
0   0  3 -2
```

result =

```
2.6667
1.0000
-0.6667
```

ans =

```
2.6667
1.0000
-0.6667
```

## Extra test 7

```
>> guass_elim([1,1:1,2], [1:10])
```

A =

```
5  7  3  1  7  0  1  5  10  9
6  3  4  4  5  4  6  6  7  4
9  5  4  6  2  9  0  9  4  1
5  6  8  5  6  6  8  0  9  4
2  1  8  0  1  5  9  7  5  3
4  6  4  2  7  9  10  5  6  4
4  7  7  9  6  1  10  1  7  9
10 4  10 0  0  9  5  10 4  4
6  9  8  9  0  1  2  6  2  4
7  8  7  0  1  5  1  4  6  3
```

A =

```
5.0000  7.0000  3.0000  1.0000  7.0000  0  1.0000  5.0000  10.0000  9.0000  1.0000
0 -5.4000  0.4000  2.8000 -3.4000  4.0000  4.8000  0 -5.0000 -6.8000  8.8000
0 -7.6000 -1.4000  4.2000 -10.6000  9.0000 -1.8000 -1.0000 -14.0000 -15.2000  1.2000
0 -1.0000  5.0000  4.0000 -1.0000  6.0000  7.0000 -5.0000 -1.0000 -5.0000  3.0000
0 -1.8000  6.8000 -0.4000 -1.8000  5.0000  8.6000  5.0000  1.0000 -0.6000  4.6000
0  0.4000  1.6000  1.2000  1.8000  9.0000  9.2000  1.0000 -2.0000 -3.2000  5.2000
0  1.4000  4.6000  8.2000  0.4000  1.0000  9.2000 -3.0000 -1.0000  1.8000  6.2000
0 -10.0000  4.0000 -2.0000 -14.0000  9.0000  3.0000  0 -16.0000 -14.0000  6.0000
0  0.6000  4.4000  7.8000 -8.4000  1.0000  0.8000  0 -10.0000 -6.8000  7.8000
0 -1.8000  2.8000 -1.4000 -8.8000  5.0000 -0.4000 -3.0000 -8.0000 -9.6000  8.6000
```

ans =

```
0.5086
1.4268
-0.9873
-0.2235
-2.1706
0.0296
1.1971
-0.1883
0.4940
0.1837
```

result =

```
0.5086
1.4268
-0.9873
-0.2235
-2.1706
0.0296
1.1971
-0.1883
0.4940
0.1837
```

I modified the code to produce a random 10 by 10 matrix & compare the result of my function with the result of  $\text{inv}(A) * x$ .

→ Since they equal, strong suggestion that main algorithm works.