Gauss-Jordan Forward Followed by backward Sub

```
>> M=[1 0 5 -2 9;1 -2 9 -2 -5;-2 2 -14 -2 20;-1 -2 -1 0 -15];
>> M

M =

     1     0     5    -2     9
     1    -2     9    -2    -5
    -2     2   -14    -2    20
    -1    -2    -1     0   -15

>> %E21(-1) E31(2) E41(1)
>> M(2,:)=M(2,:)+-1*M(1,:);
>> M(3,:)=M(3,:)+2*M(1,:);
>> M(4,:)=M(4,:)+1*M(1,:)

M =

     1     0     5    -2     9
     0    -2     4     0   -14
     0     2    -4    -6    38
     0    -2     4    -2    -6
```

```
>> %E32(1) E34(-1)
>> %E32(1) E42(-1)
>> M(3,:)=M(3,:)+1*M(2,:);
>> M(4,:)=M(4,:)+-1*M(2,:)

M =

     1     0     5    -2     9
     0    -2     4     0   -14
     0     0     0    -6    24
     0     0     0    -2     8

>> %E43(-1/3)
>> M(4,:)=M(4,:)+-1/3*M(3,:)

M =

     1     0     5    -2     9
     0    -2     4     0   -14
     0     0     0    -6    24
     0     0     0     0     0
```

```
>> %Backwards Elimination
>> %E3(-1/6)
```

```
>> M(3,:)=(-1/6)*M(3,:)

M =

     1     0     5    -2     9
     0    -2     4     0   -14
     0     0     0     1    -4
     0     0     0     0     0

>> %E13(2)
>> M(1,:)=M(1,:)+ 2*M(3,:)

M =

     1     0     5     0     1
     0    -2     4     0   -14
     0     0     0     1    -4
     0     0     0     0     0

>> %E2(-1/2)
>> M(2,:)=-1/2*M(2,:)

M =

     1     0     5     0     1
     0     1    -2     0     7
     0     0     0     1    -4
     0     0     0     0     0
```

continuation of a.) in upper right-hand side

b.)

rref (M)

```
>> rref(M)

ans =

     1     0     5     0     1
     0     1    -2     0     7
     0     0     0     1    -4
     0     0     0     0     0
```

c.)

Rank [M] = 3

Rank [A] = 3

matlab

```
>> rank(A)

ans =

     3

>> rank(M)

ans =

     3

>> rank(A)

ans =

     3
```

d.) The system is consistent and as a result of rank[A] <n, the system is not unique and has infinitely many solutions.

consistent or non consistent / unique or not unique

a.)

```
>> M =[3 -2 1 26 -21;3 -1 1 24 -14;0 1 -2 -16 3;-3 -2 -3 -32 -11]

M =

     3    -2     1    26   -21
     3    -1     1    24   -14
     0     1    -2   -16     3
    -3    -2    -3   -32   -11

>> rref(M)

ans =

     1     0     0     5    -3
     0     1     0    -2     7
     0     0     1     7     2
     0     0     0     0     0
```

The system is consistent and due to the fact rank[A]<n, the system is not unique and due to the last row being all zero, has infinitely many solutions. This is under the assumption rank[A] will have the same definition as question 2 and n being the count of columns in a coefficient matrix.

If we consider the variables a,b,c,d with the corresponding columns we can say the following about a:

a= -3

b.)

```
>> M= [-2 -8 1 2 -11 -9;-2 -8 0 1 -12 -6;3 12 3 -1 26 -1;-5 -20 2 -5 -9 -57;-5 -20 3 3 -22 -32;2 8 -2 -2 8 14]

M =

    -2    -8     1     2   -11    -9
    -2    -8     0     1   -12    -6
     3    12     3    -1    26    -1
    -5   -20     2    -5    -9   -57
    -5   -20     3     3   -22   -32
     2     8    -2    -2     8    14

>> rref(M)

ans =

     1     4     0     0     5     0
     0     0     1     0     3     0
     0     0     0     1    -2     0
     0     0     0     0     0     1
     0     0     0     0     0     0
     0     0     0     0     0     0
```

The system is inconsistent and has no solutions.

c.)

```
>> M = [-3 2 -4 3 3 -47;-1 2 1 -2 -1 14;-1 -2 2 -1 2 -24;5 0 -1 -1 5 -17;1 1 4 3 3 -29

M =

    -3     2    -4     3     3   -47
    -1     2     1    -2    -1    14
    -1    -2     2    -1     2   -24
     5     0    -1    -1     5   -17
     1     1     4     3     3   -29

>> rref(M)

ans =

     1     0     0     0     0     5
     0     1     0     0     0     2
     0     0     1     0     0     0
     0     0     0     1     0    -3
     0     0     0     0     1    -9
```

The system in consistent. There is exactly one solution for every variable, meaning that they system is unique (Rank[A]=n). The answers to the variables are shown below:

a=5

b=2

c=0

d=-3

e=-9

Distributive Clause w/ Random Matrix

```
>> A=randi([-5 5],2,3)

A =

     3    -5    -3
     4    -1     3

>> B=randi([-5 5],2,3)

B =

    -1    -3    -4
     5    -3    -4

>> c=rand()

c =

    0.8693
```

```
>> %c(A+B)=cA+cB
>> c*(A+B)

ans =

    1.7386   -6.9543   -6.0850
    7.8236   -3.4772   -0.8693

>> c*A+c*B

ans =

    1.7386   -6.9543   -6.0850
    7.8236   -3.4772   -0.8693
```

The above concretely shows that the distributive law for scalar multiplication holds true

b.)

```
D=c(A+B)
E=cA+cB
Dij=(c(A+B))ij
Eij=cAij+cBij



(c(A+B))ij=cAij+cBij
-->by definiition of +

=cAij+cBij
-->distribution of + over matrices
|
=(c(A+B))ij
-->by definiion of +

for all i,j so c(A+B)=cA+cB
Dij=Eij
```