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```
% Aditya Gopalan
% APPM 2360 Matlab Homework 5
% Due: Thursday, October 17, 2019
% Problem 1 - Main Script

clc
clear all
close all

A = [1 0 0 0; 1 -1 0 0; 0 1 -2 0; 1 -1 3 3]
B = [1 -1 -1 0 0 0; 0 1 0 1 -1 0; 0 0 1 -1 0 -1; 1 0 0 0 1 1]
```

```
A =

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


B =

     1    -1    -1     0     0     0
     0     1     0     1    -1     0
     0     0     1    -1     0    -1
     1     0     0     0     1     1
```

(a)

This matrix is a lower tiangular matrix. The maximum rank of matrix testA would be 4 because this matrix has 4 pivot columns

(b)

```
J = rref(A)
% Matrix A has 4 pivot colums
% This means the rank(A) is still 4 since it matches the number of
 pivot
% columns


J =

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

(c)

```
R = det(A)
% Matrix A has a determinant of 6. This makes sense because if the
 rank
% of the matrix equals the number of rows, then the determinant is
 greater
% than zero. If the rank was less than the number of rows, then the
% determinant would be 0.


R =

     6
```

(d)

A is invertible because the determinant is greater than 0 and the inverse is equal to 1/determinant

```
H = A^-1
K = rref(H)


H =

    1.0000         0         0         0
    1.0000   -1.0000         0         0
    0.5000   -0.5000   -0.5000         0
   -0.5000    0.1667    0.5000    0.3333


K =

     1     0     0     0
```

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

(e)

```
b = [1 1 1 1]';
x = A\b
y = rref(x)
% there are 4 solutions: 1, 0, -0.5, 0.5
% The solution to the augmented matrix is 1.00


x =

    1.0000
         0
   -0.5000
    0.5000


y =

     1
     0
     0
     0
```

(f)

```
bab = [0 0 0 0]';
h = A\bab
% zero solutions


h =

     0
     0
     0
     0
```

(g)

```
A2 = [1 0 0 0; 1 0 1 3; 0 1 -2 0; 1 -1 3 3]
TT = rref(A2)
% Matrix A2 has 3 pivot columns. The last row does not have a pivot.
```

```
A2 =

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


TT =

     1     0     0     0
     0     1     0     6
     0     0     1     3
     0     0     0     0
```

(h)

```
bb = [1 1 1 1]'
xx = A2\bb
%two infinite solutions


bb =

     1
     1
     1
     1

Warning: Matrix is singular to working precision.

xx =

   NaN
   NaN
  -Inf
   Inf
```

(i)

```
bbb = [1 0 0 0]'
xx = A2\bbb
% no solutions


bbb =

     1
     0
     0
     0
```

```
Warning: Matrix is singular to working precision.

xx =

   NaN
   NaN
   NaN
   NaN
```

(j)

```
BB = rref(B)
% four pivot columns
% B cannot have unique solutions because the determinant does not
 exist due
% to the fact that the rank of the matrix is less than the amount of
 rows


BB =

     1     0     0     0     0     0
     0     1     0     1     0     1
     0     0     1    -1     0    -1
     0     0     0     0     1     1
```

(k)

```
Hi = B'
HH = rref(Hi)
% matrix B transpose (Hi) has one pivot column
% B transpose cannot have any unique solution because it is not a
 square
% matrix.


Hi =

     1     0     0     1
    -1     1     0     0
    -1     0     1     0
     0     1    -1     0
     0    -1     0     1
     0     0    -1     1


HH =

     1     0     0     0
     0     1     0     0
```

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

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