Contents


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% ------------------------------------------------------------------
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```

Problem 1

```
A = [1 -2 1 1 2;
    -2 5 -3 1 0;
     1 -1 3 4 4;
     1 2 3 13 3];
% Creating a sole pivot in column 1
A(2, :) = 2*A(1, :) + A(2, :)
A(3, :) = -1*A(1, :) + A(3, :)
A(4, :) = -1*A(1, :) + A(4, :)
% Creating a sole pivot in column 2
A(1, :) = 2 *A(2, :) + A(1, :)
A(3, :) = -1*A(2, :) + A(3, :)
A(4, :) = -4*A(2, :) + A(4, :)
% Cleaning up the rest
A(3, :) = 1/3 * A(3, :)
A(2, :) = A(3, :) + A(2, :)
A(1, :) = A(3, :) + A(1, :)
A(4, :) = -6 * A(3, :) + A(4, :)
A(4, :) = -1/11 * A(4, :)
A(3, :) = 2/3 * A(4, :) + A(3, :)
A(2, :) = -10/3 * A(4, :) + A(2, :)
A(1, :) = -28/3 * A(4, :) + A(1, :)
% Redeclare the matrix, but use rref this time instead
A = [1 -2 1 1 2;
    -2 5 -3 1 0;
     1 -1 3 4 4;
     1 2 3 13 3]

rref(A)

disp("There are no solutions because if there were 0 would equal")
disp("1, but that is clearly false.")
```

```
A =

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

```
     1     2     3    13     3


A =

     1    -2     1     1     2
     0     1    -1     3     4
     0     1     2     3     2
     1     2     3    13     3


A =

     1    -2     1     1     2
     0     1    -1     3     4
     0     1     2     3     2
     0     4     2    12     1


A =

     1     0    -1     7    10
     0     1    -1     3     4
     0     1     2     3     2
     0     4     2    12     1


A =

     1     0    -1     7    10
     0     1    -1     3     4
     0     0     3     0    -2
     0     4     2    12     1


A =

     1     0    -1     7    10
     0     1    -1     3     4
     0     0     3     0    -2
     0     0     6     0   -15


A =

    1.0000         0   -1.0000    7.0000   10.0000
         0    1.0000   -1.0000    3.0000    4.0000
         0         0    1.0000         0   -0.6667
         0         0    6.0000         0  -15.0000


A =

    1.0000         0   -1.0000    7.0000   10.0000
         0    1.0000         0    3.0000    3.3333
         0         0    1.0000         0   -0.6667
         0         0    6.0000         0  -15.0000
```

```
A =

    1.0000         0         0    7.0000    9.3333
         0    1.0000         0    3.0000    3.3333
         0         0    1.0000         0   -0.6667
         0         0    6.0000         0  -15.0000


A =

    1.0000         0         0    7.0000    9.3333
         0    1.0000         0    3.0000    3.3333
         0         0    1.0000         0   -0.6667
         0         0         0         0  -11.0000


A =

    1.0000         0         0    7.0000    9.3333
         0    1.0000         0    3.0000    3.3333
         0         0    1.0000         0   -0.6667
         0         0         0         0    1.0000


A =

    1.0000         0         0    7.0000    9.3333
         0    1.0000         0    3.0000    3.3333
         0         0    1.0000         0         0
         0         0         0         0    1.0000


A =

    1.0000         0         0    7.0000    9.3333
         0    1.0000         0    3.0000         0
         0         0    1.0000         0         0
         0         0         0         0    1.0000


A =

     1     0     0     7     0
     0     1     0     3     0
     0     0     1     0     0
     0     0     0     0     1


A =

     1    -2     1     1     2
    -2     5    -3     1     0
     1    -1     3     4     4
     1     2     3    13     3


ans =
```

```
     1     0     0     7     0
     0     1     0     3     0
     0     0     1     0     0
     0     0     0     0     1

There are no solutions because if there were 0 would equal
1, but that is clearly false.
```

Problem 2

```
syms a b
A = [132 500 a; 328 400 b]
rref(A)
%ask about weights
disp("The weights are (5b/1112 - a/278) and (41*a/13900 - 33*b/27800")

w = [1 2.5625];
disp("This w works because then it will have no solutions. To cancel")
disp("out 328 from 132, you need to multiply it by -2.5625, if you")
disp("cancel out both 328 and 2.5625, 0 will have to equal b, and so")
disp("not EVERY vector will work for a and b, an explicit")
disp("vector a b that will not span T is 1 2 where a = 1 and b = 2")
disp("again, applying row operations will have us get no solutions.")

A =[132 1 1; 500 2.5626 2]
rref(A)
```

```
A =

[132, 500, a]
[328, 400, b]


ans =

[1, 0,          (5*b)/1112 - a/278]
[0, 1, (41*a)/13900 - (33*b)/27800]

The weights are (5b/1112 - a/278) and (41*a/13900 - 33*b/27800
This w works because then it will have no solutions. To cancel
out 328 from 132, you need to multiply it by -2.5625, if you
cancel out both 328 and 2.5625, 0 will have to equal b, and so
not EVERY vector will work for a and b, an explicit
vector a b that will not span T is 1 2 where a = 1 and b = 2
again, applying row operations will have us get no solutions.

A =

  132.0000    1.0000    1.0000
  500.0000    2.5626    2.0000


ans =
```

```
    1.0000         0   -0.0035
         0    1.0000    1.4592
```

Problem 3

```
A = [1 4 -4 3; 5 -2 5 3; 6 5 1 -7; 4 -4 5 0]
rref(A)
disp("A set of vectors is linearly independent if it only has the trivial solution")
disp("This set has a pivot in all rows of the matrix, meaning that ")
disp("it has no free variables, meaning that it is linearly independent")
```

```
A =

     1     4    -4     3
     5    -2     5     3
     6     5     1    -7
     4    -4     5     0


ans =

     1     0     0     0
     0     1     0     0
     0     0     1     0
     0     0     0     1

A set of vectors is linearly independent if it only has the trivial solution
```

```
This set has a pivot in all rows of the matrix, meaning that
it has no free variables, meaning that it is linearly independent
```

Problem 4

```
A = [-1 5 3 -25; 3 -9 3 93; 4 -10 18 130]
rref(A)
disp("There is only one solution, therefore there is only one way to")
disp("write the linear combination.")
```

```
A =

    -1     5     3   -25
     3    -9     3    93
     4   -10    18   130


ans =

     1     0     0    40
     0     1     0     3
     0     0     1     0

There is only one solution, therefore there is only one way to
write the linear combination.
```

Problem 5

```
A = [-1 5 -4 -7; 1 5 22 13; -3 5 -15 -22; 1 5 -8 3]
rref(A)
disp("Yes")
A = [-7 5 -4 -1; 13 5 22 1; -22 5 -15 -3; 3 5 -8 1]
rref(A)
disp("Yes")
A = [-7 -1 -4 5; 13 1 22 5; -22 -3 -15 5; 3 1 -8 5]
rref(A)
disp("No")
A = [-7 -1 5 -4; 13 1 5 22; -22 -3 5 -15; 3 1 5 -8]
rref(A)
disp("Yes")
disp("We know that the set is linearly dependant because the set of")
disp("vectors always has a free variable")
disp("A result from class states that a")
disp("set of vectors is linearly dependant if one can be represented as")
disp("a linear combination of the others, in our case, many of the vectors")
disp("can be shown as a linear combination of the others, so it is. ")
disp("If we only tested if v3 can be a linear combination of the ")
disp("rest of the vectors we cannot conclude whether the system is")
disp("linearly dependant or independant because we only tested if one")
disp("vector is a linear combination of the set, we must test them all. ")
disp("This does not contradict the theorem in class because the theorem")
disp("clearly states that ONE of the vectors must be able to be represented")
disp("as a linear combination of the rest, this means it can be v1, v2, or")
disp("v4, not just v3")
```

```
A =

    -1     5    -4    -7
     1     5    22    13
    -3     5   -15   -22
     1     5    -8     3


ans =

    1.0000         0         0    5.6667
         0    1.0000         0         0
         0         0    1.0000    0.3333
         0         0         0         0

Yes

A =

    -7     5    -4    -1
    13     5    22     1
   -22     5   -15    -3
     3     5    -8     1


ans =

    1.0000         0         0    0.1765
         0    1.0000         0         0
         0         0    1.0000   -0.0588
         0         0         0         0

Yes

A =

    -7    -1    -4     5
    13     1    22     5
   -22    -3   -15     5
     3     1    -8     5


ans =

     1     0     3     0
     0     1   -17     0
     0     0     0     1
     0     0     0     0

No

A =

    -7    -1     5    -4
    13     1     5    22
   -22    -3     5   -15
     3     1     5    -8
```

```
ans =

     1     0     0     3
     0     1     0   -17
     0     0     1     0
     0     0     0     0

Yes
We know that the set is linearly dependant because the set of
vectors always has a free variable
A result from class states that a
set of vectors is linearly dependant if one can be represented as
a linear combination of the others, in our case, many of the vectors
can be shown as a linear combination of the others, so it is.
If we only tested if v3 can be a linear combination of the
rest of the vectors we cannot conclude whether the system is
linearly dependant or independant because we only tested if one
vector is a linear combination of the set, we must test them all.
This does not contradict the theorem in class because the theorem
clearly states that ONE of the vectors must be able to be represented
as a linear combination of the rest, this means it can be v1, v2, or
v4, not just v3
```

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