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```
%%Math 240 Matlab Project 1
% Spring 2020
%
% Section [0342]
%
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%
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```

Problem 1

(a)

```
clear
clc
close all
A =[1 1 2 5 ; -2 -7 -2 -14 ; 3 -2 5 32]
%[ 1     1     2     5
% -2    -7    -2   -14
%  3    -2     5    32 ]
```

```
A =

     1     1     2     5
    -2    -7    -2   -14
     3    -2     5    32
```

(b)

```
A(2,:)=A(2,:)+2*A(1,:)
%[ 1     1     2     5
%  0    -5     2    -4
%  3    -2     5    32]
```

```
A =

     1     1     2     5
```

```
     0    -5     2    -4
     3    -2     5    32
```

(c)

```
A(3,:)= A(3,:)+(-3)*A(1,:)
% [1     1     2     5
%  0    -5     2    -4
%  0    -5    -1    17]
format short
A(2,:)=-1/5*A(2,:)
% [1.0000    1.0000    2.0000    5.0000
%       0    1.0000   -0.4000    0.8000
%       0   -5.0000   -1.0000   17.0000]
A(3,:)=A(3,:)+5*A(2,:)
%     [1.0000    1.0000    2.0000    5.0000
%           0    1.0000   -0.4000    0.8000
%           0         0   -3.0000   21.0000]
A(3,:)=-1/3*A(3,:);
%     [1.0000    1.0000    2.0000    5.0000
%           0    1.0000   -0.4000    0.8000
%           0         0    1.0000   -7.0000]
A(2,:)=A(2,:)+(2/5)*A(3,:)
%    [1     1     2     5
%     0     1     0    -2
%     0     0     1    -7]
A(1,:)=A(1,:)+(-2)*A(3,:)
%    [1     1     0    19
%     0     1     0    -2
%     0     0     1    -7]
A(1,:)=A(1,:)+(-1)*A(2,:)
%    [ 1     0     0    21
%      0     1     0    -2
%      0     0     1    -7]


A =

     1     1     2     5
     0    -5     2    -4
     0    -5    -1    17


A =

    1.0000    1.0000    2.0000    5.0000
         0    1.0000   -0.4000    0.8000
         0   -5.0000   -1.0000   17.0000


A =

    1.0000    1.0000    2.0000    5.0000
```

```
         0    1.0000   -0.4000    0.8000
         0         0   -3.0000   21.0000


A =

     1     1     2     5
     0     1     0    -2
     0     0     1    -7


A =

     1     1     0    19
     0     1     0    -2
     0     0     1    -7


A =

     1     0     0    21
     0     1     0    -2
     0     0     1    -7
```

(d)

```
x1=21
x2=-2
x3=-7
%The solution of the system is x1=21, x2=-2 and x3=-7


x1 =

    21


x2 =

    -2


x3 =

    -7
```

Problem 2

```
% (a)
B=[1 -2 0 4 -1 4 ; -3 3 12 -17 5 -9 ; 2 -4 0 11 4 17 ; 1 -20 72 -32 -1
 4]
%[ 1    -2     0     4    -1     4
```

```
%     -3     3    12   -17     5    -9
%      2    -4     0    11     4    17
%      1   -20    72   -32    -1     4 ]
```

B =

```
     1    -2     0     4    -1     4
    -3     3    12   -17     5    -9
     2    -4     0    11     4    17
     1   -20    72   -32    -1     4
```

(b and c)

```
B(2,:)=B(2,:)+3*B(1,:)
%[ 1    -2     0     4    -1     4
%      0    -3    12    -5     2     3
%      2    -4     0    11     4    17
%      1   -20    72   -32    -1     4 ]
 B(3,:)=B(3,:)+(-2)*B(1,:)
% [ 1    -2     0     4    -1     4
%   0    -3    12    -5     2     3
%   0     0     0     3     6     9
%   1   -20    72   -32    -1     4 ]
B(4,:)=B(4,:)+(-1)*B(1,:)
% [ 1    -2     0     4    -1     4
%   0    -3    12    -5     2     3
%   0     0     0     3     6     9
%   0   -18    72   -36     0     0 ]
B(2,:)=-1/3*B(2,:)
% [ 1.0000   -2.0000         0    4.0000   -1.0000    4.0000
%        0    1.0000   -4.0000    1.6667   -0.6667   -1.0000
%        0         0         0    3.0000    6.0000    9.0000
%        0  -18.0000   72.0000  -36.0000         0         0 ]
B(4,:)=B(4,:)+18*B(2,:)
% [ 1.0000   -2.0000         0    4.0000   -1.0000    4.0000
%        0    1.0000   -4.0000    1.6667   -0.6667   -1.0000
%        0         0         0    3.0000    6.0000    9.0000
%        0         0         0   -6.0000  -12.0000  -18.0000]
B(3,:)=1/3*B(3,:)
%  [ 1.0000   -2.0000         0    4.0000   -1.0000    4.0000
%         0    1.0000   -4.0000    1.6667   -0.6667   -1.0000
%         0         0         0    1.0000    2.0000    3.0000
%         0         0         0   -6.0000  -12.0000  -18.0000]
B(4,:)=B(4,:)+6*B(3,:)
%  [1.0000   -2.0000         0    4.0000   -1.0000    4.0000
%        0    1.0000   -4.0000    1.6667   -0.6667   -1.0000
%        0         0         0    1.0000    2.0000    3.0000
%        0         0         0   -0.0000         0         0]
B(2,:)=B(2,:)+(-5/3)*B(3,:)
% [1.0000   -2.0000         0    4.0000   -1.0000    4.0000
%       0    1.0000   -4.0000   -0.0000   -4.0000   -6.0000
%       0         0         0    1.0000    2.0000    3.0000
```

```
%       0         0         0   -0.0000         0         0]
B(1,:)=B(1,:)+(-4)*B(3,:)
%  [1.0000   -2.0000         0         0   -9.0000   -8.0000
%        0    1.0000   -4.0000   -0.0000   -4.0000   -6.0000
%        0         0         0    1.0000    2.0000    3.0000
%        0         0         0   -0.0000         0         0]
B(1,:)=B(1,:)+2*B(2,:)
% [ 1.0000         0   -8.0000   -0.0000  -17.0000  -20.0000
%        0    1.0000   -4.0000   -0.0000   -4.0000   -6.0000
%        0         0         0    1.0000    2.0000    3.0000
%        0         0         0   -0.0000         0         0]
```

B =

```
     1    -2     0     4    -1     4
     0    -3    12    -5     2     3
     2    -4     0    11     4    17
     1   -20    72   -32    -1     4
```

B =

```
     1    -2     0     4    -1     4
     0    -3    12    -5     2     3
     0     0     0     3     6     9
     1   -20    72   -32    -1     4
```

B =

```
     1    -2     0     4    -1     4
     0    -3    12    -5     2     3
     0     0     0     3     6     9
     0   -18    72   -36     0     0
```

B =

```
    1.0000   -2.0000         0    4.0000   -1.0000    4.0000
         0    1.0000   -4.0000    1.6667   -0.6667   -1.0000
         0         0         0    3.0000    6.0000    9.0000
         0  -18.0000   72.0000  -36.0000         0         0
```

B =

```
    1.0000   -2.0000         0    4.0000   -1.0000    4.0000
         0    1.0000   -4.0000    1.6667   -0.6667   -1.0000
         0         0         0    3.0000    6.0000    9.0000
         0         0         0   -6.0000  -12.0000  -18.0000
```

B =

```
    1.0000   -2.0000         0    4.0000   -1.0000    4.0000
         0    1.0000   -4.0000    1.6667   -0.6667   -1.0000
         0         0         0    1.0000    2.0000    3.0000
         0         0         0   -6.0000  -12.0000  -18.0000


B =

    1.0000   -2.0000         0    4.0000   -1.0000    4.0000
         0    1.0000   -4.0000    1.6667   -0.6667   -1.0000
         0         0         0    1.0000    2.0000    3.0000
         0         0         0   -0.0000         0         0


B =

    1.0000   -2.0000         0    4.0000   -1.0000    4.0000
         0    1.0000   -4.0000   -0.0000   -4.0000   -6.0000
         0         0         0    1.0000    2.0000    3.0000
         0         0         0   -0.0000         0         0


B =

    1.0000   -2.0000         0         0   -9.0000   -8.0000
         0    1.0000   -4.0000   -0.0000   -4.0000   -6.0000
         0         0         0    1.0000    2.0000    3.0000
         0         0         0   -0.0000         0         0


B =

    1.0000         0   -8.0000   -0.0000  -17.0000  -20.0000
         0    1.0000   -4.0000   -0.0000   -4.0000   -6.0000
         0         0         0    1.0000    2.0000    3.0000
         0         0         0   -0.0000         0         0
```

(d)

```
B=[1 -2 0 4 -1 4 ; -3 3 12 -17 5 -9 ; 2 -4 0 11 4 17 ; 1 -20 72 -32 -1
 4]
%    [ 1    -2     0     4    -1     4
%     -3     3    12   -17     5    -9
%      2    -4     0    11     4    17
%      1   -20    72   -32    -1     4]
rref(B)
%    [ 1     0    -8     0   -17   -20
%      0     1    -4     0    -4    -6
%      0     0     0     1     2     3
%      0     0     0     0     0     0]
```

```
B =

     1    -2     0     4    -1     4
    -3     3    12   -17     5    -9
     2    -4     0    11     4    17
     1   -20    72   -32    -1     4


ans =

     1     0    -8     0   -17   -20
     0     1    -4     0    -4    -6
     0     0     0     1     2     3
     0     0     0     0     0     0
```

(e) x1=-20+8(x3)+17(x5), x2=-6+4(x3)+4(x5), x3=free variable, x4=3-2(x5) x5=free variable Let x3=s and x5=t (-20+8s+17t,-6+4s+4t,s,3-2t,t)

Problem 3

```
% (a)
format short
A=[8 3 -3 3 ; 5 -3 -7 2 ; 5 6 -5 -6]
%    [8     3    -3     3
%     5    -3    -7     2
%     5     6    -5    -6]
rref(A)
%    [ 1.0000         0         0    1.1856
%           0    1.0000         0   -1.1203
%           0         0    1.0000    1.0412]


A =

     8     3    -3     3
     5    -3    -7     2
     5     6    -5    -6


ans =

    1.0000         0         0    1.1856
         0    1.0000         0   -1.1203
         0         0    1.0000    1.0412
```

(b)

```
format short
x1=1.1856
x2=-1.1203
x3=1.0412
% Soultion in decial form is: x1=1.1856,x2=-1.1203 and x3=1.0412
```

```
x1 =

    1.1856


x2 =

   -1.1203


x3 =

    1.0412
```

(c)

```
format rat
A=[8 3 -3 3 ; 5 -3 -7 2 ; 5 6 -5 -6]
%    [8     3    -3     3
%     5    -3    -7     2
%     5     6    -5    -6]
rref(A)
%    [  1              0              0            115/97
%       0              1              0           -326/291
%       0              0              1            101/97]


A =

       8              3             -3              3
       5             -3             -7              2
       5              6             -5             -6


ans =

       1              0              0            115/97
       0              1              0           -326/291
       0              0              1            101/97
```

(d)

```
format rat
x1=115/97
x2=-326/291
x3=101/97
% Solution in fraction form is: x1=115/97,x2=-326/291 and x3=101/97


x1 =

     115/97
```

```
x2 =

    -326/291


x3 =

     101/97
```

Problem 4

```
format short
% (a)[ 36     51    13     80  [x1     [33
%      52     34    74      0   x2  =   45
%       0     7    1.1    3.4   x3       3
%    1.26    .29    .8    .18]  x4]     .8]
%
```

(b)

```
format short
A =[36 51 13 80 33 ; 52 34 74 0 45 ; 0 7 1.1 3.4 3 ;
 1.26 .19 .8 .18 .8 ]
%    [36.0000   51.0000   13.0000   80.0000   33.0000
%     52.0000   34.0000   74.0000         0   45.0000
%           0    7.0000    1.1000    3.4000    3.0000
%      1.2600    0.1900    0.8000    0.1800    0.8000]


A =

   36.0000   51.0000   13.0000   80.0000   33.0000
   52.0000   34.0000   74.0000         0   45.0000
         0    7.0000    1.1000    3.4000    3.0000
    1.2600    0.1900    0.8000    0.1800    0.8000
```

(c)

```
rref(A)
%    [ 1.0000         0         0         0    0.6414
%           0    1.0000         0         0    0.5441
%           0         0    1.0000         0   -0.0926
%           0         0         0    1.0000   -0.2079]


ans =

    1.0000         0         0         0    0.6414
         0    1.0000         0         0    0.5441
         0         0    1.0000         0   -0.0926
```

```
         0         0         0    1.0000   -0.2079
```

(d)

```
x1=0.6414
x2=0.5441
x3=-0.0926
x4=-0.2079
% The soulation: x1=0.6414 x2=0.5441 x3=-0.0926 x4=-0.2079
% this soultion would not be feasible because the mixture contained a
% negative number for whey and the isolated soy protein. While the
% the two ingerdites are fairly small they can not be ignored. The
 mixutre
% of .64 units of nonfat milk and .54 units of soy flour provide 50.6g
 of
% protein, 51.6g of carbohydrate, 3.8 g of fat, and .9 g of calcium.
 Some
% of these nutrientd are nowhere near to the seeked amount.


x1 =

    0.6414


x2 =

    0.5441


x3 =

   -0.0926


x4 =

   -0.2079
```

Problem 5

```
% (a)
A =[25.1 26.1 24.1 ; 20.9 15.9 17.9 ; 27.7 23.7 24.7 ]
%    [25.1000   26.1000   24.1000
%     20.9000   15.9000   17.9000
%     27.7000   23.7000   24.7000]
rref(A)
%     [1.0000         0    0.5738
%           0    1.0000    0.3716
%           0         0         0]
c1=0.5738
c2=0.3716
```

```
%c1=0.5738 c2=0.3716 c3=free variable


A =

   25.1000   26.1000   24.1000
   20.9000   15.9000   17.9000
   27.7000   23.7000   24.7000


ans =

    1.0000         0    0.5738
         0    1.0000    0.3716
         0         0         0


c1 =

    0.5738


c2 =

    0.3716


%(b) Yes, the given vectors are in the span of the other because
C1 = [25.1 ; 20.9 ; 27.7 ]
%   [25.1000
%   20.9000
%   27.7000]
C2 = [26.1 ; 15.9 ; 23.7 ]
%  [26.1000
%   15.9000
%   23.7000]

C1(1,:)=(0.5738)*C1(1,:)
C1(2,:)=(0.5738)*C1(2,:)
C1(3,:)=(0.5738)*C1(3,:)
%  [14.4024
%   11.9924
%   15.8943]
C2(1,:)=(0.3716)*C2(1,:)
C2(2,:)=(0.3716)*C2(2,:)
C2(3,:)=(0.3716)*C2(3,:)
%  [9.6988
%   5.9084
%   8.8069]
%C1+C2=C3
%  [24.1
%   17.9
%   24.7]
```

```
C1 =

   25.1000
   20.9000
   27.7000


C2 =

   26.1000
   15.9000
   23.7000


C1 =

   14.4024
   20.9000
   27.7000


C1 =

   14.4024
   11.9924
   27.7000


C1 =

   14.4024
   11.9924
   15.8943


C2 =

    9.6988
   15.9000
   23.7000


C2 =

    9.6988
    5.9084
   23.7000


C2 =

    9.6988
    5.9084
    8.8069
```

(c)

```
A =[25.1 26.1 24.1 0 ; 20.9 15.9 17.9 0 ; 27.7 23.7 24.7 0 ]
%[ 25.1000   26.1000   24.1000         0
%  20.9000   15.9000   17.9000         0
%  27.7000   23.7000   24.7000         0]
rref(A)
%   [1.0000         0    0.5738         0
%         0    1.0000    0.3716         0
%         0         0         0         0]
%c1+0.5738=0
%c1=-0.5738k
%c2+0.3716=0
%c2=-0.3716k
%c3=k(free variable)
%(-0.5738k,-0.3716k,k)=non trival=
%Linearly Dependet
```

```
A =

   25.1000   26.1000   24.1000         0
   20.9000   15.9000   17.9000         0
   27.7000   23.7000   24.7000         0


ans =

    1.0000         0    0.5738         0
         0    1.0000    0.3716         0
         0         0         0         0
```

Problem 6

```
% (a)
syms a
syms b
A =[8 -5 a ; 4 1 b]
%[ 8, -5, a]
%[ 4,  1, b]
```

```
A =

[ 8, -5, a]
[ 4,  1, b]
```

(b)

```
rref(A)
```

```
%   [ 1, 0, a/28 + (5*b)/28]
%   [ 0, 1,   (2*b)/7 - a/7]


ans =

[ 1, 0, a/28 + (5*b)/28]
[ 0, 1,   (2*b)/7 - a/7]
```

(c)

```
w1=a/28 + (5*b)/28
w2=(2*b)/7 - a/7
% The weights of w1 is: w1=a/28 + (5*b)/28 . (In terms of a and b)
% The weights of w2 is: w2=(2*b)/7 - a/7 . (In terms of a and b)


w1 =

a/28 + (5*b)/28


w2 =

(2*b)/7 - a/7
```

Problem 7

```
% (a)
 A =[7 6 7 9 -7 ; 1 -2 5 11 0 ; 4 -2 8 20 4 ; 2 -3 1 11 -5]
% [ 6     7     9    -7
%   1    -2     5    11     0
%   4    -2     8    20     4
%   2    -3     1    11    -5]
rref(A)
%    [ 1     0     0     2     0
%      0     1     0    -2     0
%      0     0     1     1     0
%      0     0     0     0     1]


A =

     7     6     7     9    -7
     1    -2     5    11     0
     4    -2     8    20     4
     2    -3     1    11    -5


ans =

     1     0     0     2     0
```

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

(b)I can tell from the rref that the vector are linearly dependent becuase the last row states 0=1 which is not true so it is non-trival making the it linearly dependet

(c)

```
A =[7 6 7 9 -7 0 ; 1 -2 5 11 0 0 ; 4 -2 8 20 4 0 ; 2 -3 1 11 -5 0 ]
%[ 7     6     7     9    -7     0
%  1    -2     5    11     0     0
%  4    -2     8    20     4     0
%  2    -3     1    11    -5     0]
rref(A)
%[ 1     0     0     2     0     0
%  0     1     0    -2     0     0
%  0     0     1     1     0     0
%  0     0     0     0     1     0]
% x4=free so x5=0, x3=-x4, x2=2x4, x1=-2x4
% Then if x4=1 then. x3= -1. x2=2, x1=-2 and x5 remains 0
% This combination yields 0


A =

     7     6     7     9    -7     0
     1    -2     5    11     0     0
     4    -2     8    20     4     0
     2    -3     1    11    -5     0


ans =

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

(d) Since p>n there must be a free variable so there is a non-trival solution. Such a solution provides a non-trivial relation of linenear dependent

(e) yes, it does span in R4 becuase all rows contains piviot position

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