Lab 4

Table of Contents

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Problem 1

```
% 1a

x = [4 3 8]
y = [2; 1; -4]
a1 = x * y

% 1b

x = [9 1 0]
y = [-5; 6; 2]
b1 = x * y

% 1c

A = [3 1; 2 -7]
x = [2; 1]
c1 = A * x

% 1d

B = [4 -6; 0 2]
d1 = A * B
```

```
x =

     4     3     8


y =

     2
     1
    -4
```

```
a1 =

   -21


x =

     9     1     0


y =

    -5
     6
     2


b1 =

   -39


A =

     3     1
     2    -7


x =

     2
     1


c1 =

     7
    -3


B =

     4    -6
     0     2


d1 =

    12   -16
     8   -26
```

Problem 2

Problem 1b was not well posed because in order to do matrix multiplication the number of rows in the first matrix needs to equal the number of columns of the it's multiplied with.

Problem 3

```
A = [4 2; -1 5]
b = [3; 4]
a3 = A \ b
```

```
A =

     4     2
    -1     5


b =

     3
     4


a3 =

    0.3182
    0.8636
```

Problem 4

```
% 4a

A = [2 -1; 6 -5]
b = [8; 32]
a4 = A \ b

% 4b

A = [0 1 1; 3 -1 1; 1 1 -3]
b = [6; -7; -13]
b4 = A \ b

% 4c

A = [2 1 -3; 6 3 -8; 2 -1 5]
b = [0; 0; -4]
c4 = A \ b


A =
```

```
     2    -1
     6    -5


b =

     8
    32


a4 =

     2
    -4


A =

     0     1     1
     3    -1     1
     1     1    -3


b =

     6
    -7
   -13


b4 =

   -3.0000
    2.0000
    4.0000


A =

     2     1    -3
     6     3    -8
     2    -1     5


b =

     0
     0
    -4


c4 =
```

```
    -1
     2
     0
```

Problem 5

```
A = [1 1; 25 5]
b = [40; 640]
x = A \ b
a5 = A * x
%22 Quarters; 18 Nickels


A =

     1     1
    25     5


b =

    40
   640


x =

   22.0000
   18.0000


a5 =

    40
   640
```

Problem 6

```
A = [1 1 1; 25 10 5; 0 2 -1]
b = [44; 750; 0]
x = A \ b
a6 = A * x
% It is not possible for all of these conditions to be satisfied with
 an integer
% number of coins, thus Suhasini must be lying.


A =

     1     1     1
    25    10     5
```

```
     0     2    -1


b =

    44
   750
     0


x =

   24.9091
    6.3636
   12.7273


a6 =

    44
   750
     0
```

Problem 7

```
A = zeros(13,13)
b = zeros(13,1)
x = 1/sqrt(2)
A(1,[2 6]) = [1 -1]
A(2,3) = 1
b(2,1) = 10
A(3,[1 4 5]) = [x -1 -x]
A(4,[1 3 5]) = [x 1 x]
A(5,[4 8]) = [1 -1]
A(6,7) = 1
A(7,[5 6 9 10]) = [x 1 -x 1]
A(8,[5 7 9]) = [x 1 x]
b(8,1) = 15
A(9,[10 13]) = [1 -1]
A(10,11) = 1
b(10,1) = 20
A(11,[8 9 12]) = [1 x -x]
A(12,[9 11 12]) = [x 1 x]
A(13,[12 13]) = [1 x]

a7 = A \ b


A =

     0     0     0     0     0     0     0     0     0     0     0
 0     0
```

```
     0     0     0     0     0     0     0     0     0     0     0
 0     0
     0     0     0     0     0     0     0     0     0     0     0
 0     0
     0     0     0     0     0     0     0     0     0     0     0
 0     0
     0     0     0     0     0     0     0     0     0     0     0
 0     0
     0     0     0     0     0     0     0     0     0     0     0
 0     0
     0     0     0     0     0     0     0     0     0     0     0
 0     0
     0     0     0     0     0     0     0     0     0     0     0
 0     0
     0     0     0     0     0     0     0     0     0     0     0
 0     0
     0     0     0     0     0     0     0     0     0     0     0
 0     0
     0     0     0     0     0     0     0     0     0     0     0
 0     0
     0     0     0     0     0     0     0     0     0     0     0
 0     0
     0     0     0     0     0     0     0     0     0     0     0
 0     0
```

```
b =

     0
     0
     0
     0
     0
     0
     0
     0
     0
     0
     0
     0
     0
     0
```

```
x =

    0.7071
```

```
A =

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

```
     0     0     0     0     0     0     0     0     0     0     0
0     0
     0     0     0     0     0     0     0     0     0     0     0
0     0
     0     0     0     0     0     0     0     0     0     0     0
0     0
     0     0     0     0     0     0     0     0     0     0     0
0     0
     0     0     0     0     0     0     0     0     0     0     0
0     0
     0     0     0     0     0     0     0     0     0     0     0
0     0
     0     0     0     0     0     0     0     0     0     0     0
0     0
     0     0     0     0     0     0     0     0     0     0     0
0     0
     0     0     0     0     0     0     0     0     0     0     0
0     0
     0     0     0     0     0     0     0     0     0     0     0
0     0
     0     0     0     0     0     0     0     0     0     0     0
0     0
```

A =

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

```
b =

     0
    10
     0
     0
     0
     0
     0
     0
     0
     0
     0
     0
     0


A =

  Columns 1 through 7

         0    1.0000         0         0         0   -1.0000         0
         0         0    1.0000         0         0         0         0
    0.7071         0         0   -1.0000   -0.7071         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0

  Columns 8 through 13

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0


A =
```

```
  Columns 1 through 7

         0    1.0000         0         0         0   -1.0000         0
         0         0    1.0000         0         0         0         0
    0.7071         0         0   -1.0000   -0.7071         0         0
    0.7071         0    1.0000         0    0.7071         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0

  Columns 8 through 13

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0


A =

  Columns 1 through 7

         0    1.0000         0         0         0   -1.0000         0
         0         0    1.0000         0         0         0         0
    0.7071         0         0   -1.0000   -0.7071         0         0
    0.7071         0    1.0000         0    0.7071         0         0
         0         0         0    1.0000         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0

  Columns 8 through 13

         0         0         0         0         0         0
```

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

```
A =

  Columns 1 through 7

         0    1.0000         0         0         0   -1.0000         0
         0         0    1.0000         0         0         0         0
    0.7071         0         0   -1.0000   -0.7071         0         0
    0.7071         0    1.0000         0    0.7071         0         0
         0         0         0    1.0000         0         0         0
         0         0         0         0         0         0    1.0000
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0

  Columns 8 through 13

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

```
A =

  Columns 1 through 7

         0    1.0000         0         0         0   -1.0000         0
```

```
         0         0    1.0000         0         0         0         0
    0.7071         0         0   -1.0000   -0.7071         0         0
    0.7071         0    1.0000         0    0.7071         0         0
         0         0         0    1.0000         0         0         0
         0         0         0         0         0         0    1.0000
         0         0         0         0    0.7071    1.0000         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0

  Columns 8 through 13

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
   -1.0000         0         0         0         0         0
         0         0         0         0         0         0
         0   -0.7071    1.0000         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0

A =

  Columns 1 through 7

         0    1.0000         0         0         0   -1.0000         0
         0         0    1.0000         0         0         0         0
    0.7071         0         0   -1.0000   -0.7071         0         0
    0.7071         0    1.0000         0    0.7071         0         0
         0         0         0    1.0000         0         0         0
         0         0         0         0         0         0    1.0000
         0         0         0         0    0.7071    1.0000         0
         0         0         0         0    0.7071         0    1.0000
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0

  Columns 8 through 13

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
```

```
   -1.0000         0         0         0         0         0
         0         0         0         0         0         0
         0   -0.7071    1.0000         0         0         0
         0    0.7071         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
```

```
b =

     0
    10
     0
     0
     0
     0
     0
    15
     0
     0
     0
     0
     0
```

```
A =

  Columns 1 through 7

         0    1.0000         0         0         0   -1.0000         0
         0         0    1.0000         0         0         0         0
    0.7071         0         0   -1.0000   -0.7071         0         0
    0.7071         0    1.0000         0    0.7071         0         0
         0         0         0    1.0000         0         0         0
         0         0         0         0         0         0    1.0000
         0         0         0         0    0.7071    1.0000         0
         0         0         0         0    0.7071         0    1.0000
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0

  Columns 8 through 13

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

```
         0   -0.7071    1.0000         0         0         0
         0    0.7071         0         0         0         0
         0         0    1.0000         0         0   -1.0000
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
```

```
A =

  Columns 1 through 7

         0    1.0000         0         0         0   -1.0000         0
         0         0    1.0000         0         0         0         0
    0.7071         0         0   -1.0000   -0.7071         0         0
    0.7071         0    1.0000         0    0.7071         0         0
         0         0         0    1.0000         0         0         0
         0         0         0         0         0         0    1.0000
         0         0         0         0    0.7071    1.0000         0
         0         0         0         0    0.7071         0    1.0000
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0

  Columns 8 through 13

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
   -1.0000         0         0         0         0         0
         0         0         0         0         0         0
         0   -0.7071    1.0000         0         0         0
         0    0.7071         0         0         0         0
         0         0    1.0000         0         0   -1.0000
         0         0         0    1.0000         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
```

```
b =

     0
    10
     0
     0
     0
     0
     0
    15
```

```
     0
    20
     0
     0
     0
```

```
A =

  Columns 1 through 7

         0    1.0000         0         0         0   -1.0000         0
         0         0    1.0000         0         0         0         0
    0.7071         0         0   -1.0000   -0.7071         0         0
    0.7071         0    1.0000         0    0.7071         0         0
         0         0         0    1.0000         0         0         0
         0         0         0         0         0         0    1.0000
         0         0         0         0    0.7071    1.0000         0
         0         0         0         0    0.7071         0    1.0000
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0

  Columns 8 through 13

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
   -1.0000         0         0         0         0         0
         0         0         0         0         0         0
         0   -0.7071    1.0000         0         0         0
         0    0.7071         0         0         0         0
         0         0    1.0000         0         0   -1.0000
         0         0         0    1.0000         0         0
    1.0000    0.7071         0         0   -0.7071         0
         0         0         0         0         0         0
         0         0         0         0         0         0
```

```
A =

  Columns 1 through 7

         0    1.0000         0         0         0   -1.0000         0
         0         0    1.0000         0         0         0         0
    0.7071         0         0   -1.0000   -0.7071         0         0
    0.7071         0    1.0000         0    0.7071         0         0
         0         0         0    1.0000         0         0         0
         0         0         0         0         0         0    1.0000
         0         0         0         0    0.7071    1.0000         0
         0         0         0         0    0.7071         0    1.0000
```

```
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0

  Columns 8 through 13

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
   -1.0000         0         0         0         0         0
         0         0         0         0         0         0
         0   -0.7071    1.0000         0         0         0
         0    0.7071         0         0         0         0
         0         0    1.0000         0         0   -1.0000
         0         0         0    1.0000         0         0
    1.0000    0.7071         0         0   -0.7071         0
         0    0.7071         0    1.0000    0.7071         0
         0         0         0         0         0         0


A =

  Columns 1 through 7

         0    1.0000         0         0         0   -1.0000         0
         0         0    1.0000         0         0         0         0
    0.7071         0         0   -1.0000   -0.7071         0         0
    0.7071         0    1.0000         0    0.7071         0         0
         0         0         0    1.0000         0         0         0
         0         0         0         0         0         0    1.0000
         0         0         0         0    0.7071    1.0000         0
         0         0         0         0    0.7071         0    1.0000
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0
         0         0         0         0         0         0         0

  Columns 8 through 13

         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
         0         0         0         0         0         0
   -1.0000         0         0         0         0         0
         0         0         0         0         0         0
         0   -0.7071    1.0000         0         0         0
         0    0.7071         0         0         0         0
         0         0    1.0000         0         0   -1.0000
         0         0         0    1.0000         0         0
    1.0000    0.7071         0         0   -0.7071         0
```

```
         0    0.7071         0    1.0000    0.7071         0
         0         0         0         0    1.0000    0.7071
```

```
a7 =

  -28.2843
  -55.0000
   10.0000
  -30.0000
   14.1421
  -55.0000
         0
  -30.0000
    7.0711
   50.0000
   20.0000
  -35.3553
   50.0000
```

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