MATLAB PROJECT 2

Please include this page in your Group file, as a front page. Type in the group number and the names of all members WHO PARTICIPATED in this project.

GROUP # \_\_\_\_9\_\_\_\_\_\_\_

FIRST & LAST NAMES (UFID numbers are NOT required):

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**By signing your names above, each of you had confirmed that you did the work and agree with the work submitted**.

diary on

format compact

% Exercise 1

type ele1

function E1 = ele1(n,r,i,j)

E1 = eye(n);

E1(j,:) = E1(j,:) + E1(i,:)\*r;

end

type ele2

function E2 = ele2(n,i,j)

E2 = eye(n);

A = E2(j,:);

E2(j,:) = E2(i,:);

E2(i,:) = A;

end

type ele3

function E3 = ele3(n,j,k)

E3 = eye(n);

E3(j,:) = E3(j,:) \* k;

end

type closetozeroroundoff

function B=closetozeroroundoff(A)

[m,n]=size(A);

for i=1:m

for j=1:n

if abs(A(i,j))<10^(-7)

A(i,j) = 0;

end

end

end

B=A;

end

format compact

format rat

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

A =

2 1 3

1 0 2

2 3 -1

E2 = ele2(3,1,2)

E2 =

0 1 0

1 0 0

0 0 1

A1= A\*E2

A1 =

1 2 3

0 1 2

3 2 -1

A1 = E2 \*A

A1 =

1 0 2

2 1 3

2 3 -1

E1 = ele1(3,-2,1,2)

E1 =

1 0 0

-2 1 0

0 0 1

A2=E1\*A1

A2 =

1 0 2

0 1 -1

2 3 -1

E1=ele1(3,-2,1,3)

E1 =

1 0 0

0 1 0

-2 0 1

A3 = E1\*A2

A3 =

1 0 2

0 1 -1

0 3 -5

E1 = ele1(3, -3,2,3)

E1 =

1 0 0

0 1 0

0 -3 1

A4 = E1 \*A3

A4 =

1 0 2

0 1 -1

0 0 -2

E3 = ele3(3,3,-1/2)

E3 =

1 0 0

0 1 0

0 0 -1/2

A5= E3 \*A4

A5 =

1 0 2

0 1 -1

0 0 1

E1 = ele1(3,1,3,2)

E1 =

1 0 0

0 1 1

0 0 1

A6 = E1 \* A5

A6 =

1 0 2

0 1 0

0 0 1

E1 = ele1(3, -2 , 3, 1)

E1 =

1 0 -2

0 1 0

0 0 1

A7 = E1 \* A6

A7 =

1 0 0

0 1 0

0 0 1

% Exercise 2

type inverses

function D=inverses(A)

[n,~] = size(A);

if (n == rank(A))

D = rref([A eye(n)]);

D = D(:,n+1:end);

else

D=[];

end

end

A = [4 0 -7 -7; -6 1 11 9; 7 -5 10 19; -1 2 3 -1]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

-1 2 3 -1

D = inverses(A)

D =

-19 -14 0 7

-549 -401 -2 196

267 195 1 -95

-278 -203 -1 99

A = [1 -3 2 -4 ;-3 9 -1 5; 2 -6 4 -3; -4 12 2 7]

A =

1 -3 2 -4

-3 9 -1 5

2 -6 4 -3

-4 12 2 7

D = inverses(A)

D =

[]

A = magic(5)

A =

17 24 1 8 15

23 5 7 14 16

4 6 13 20 22

10 12 19 21 3

11 18 25 2 9

D = inverses(A)

D =

-0.0049 0.0512 -0.0354 0.0012 0.0034

0.0431 -0.0373 -0.0046 0.0127 0.0015

-0.0303 0.0031 0.0031 0.0031 0.0364

0.0047 -0.0065 0.0108 0.0435 -0.0370

0.0028 0.0050 0.0415 -0.0450 0.0111

inv(A)

ans =

-0.0049 0.0512 -0.0354 0.0012 0.0034

0.0431 -0.0373 -0.0046 0.0127 0.0015

-0.0303 0.0031 0.0031 0.0031 0.0364

0.0047 -0.0065 0.0108 0.0435 -0.0370

0.0028 0.0050 0.0415 -0.0450 0.0111

A = magic(4)

A =

16 2 3 13

5 11 10 8

9 7 6 12

4 14 15 1

D= inverses(A)

D =

[]

inv(A)

[Warning: Matrix is close to singular or badly scaled. Results may be inaccurate. RCOND = 1.306145e-17.]

ans =

1.0e+14 \*

0.9382 2.8147 -2.8147 -0.9382

2.8147 8.4442 -8.4442 -2.8147

-2.8147 -8.4442 8.4442 2.8147

-0.9382 -2.8147 2.8147 0.9382

closetozeroroundoff(ans)

ans =

1.0e+14 \*

0.9382 2.8147 -2.8147 -0.9382

2.8147 8.4442 -8.4442 -2.8147

-2.8147 -8.4442 8.4442 2.8147

-0.9382 -2.8147 2.8147 0.9382

%The result obtained from inv() is inaccurate becuase the matrix is not invertable but the function attempted to calculate the inverse anyway

diary off

%Exercise 3

function [ C,N ] = solvesys( A )

%SOLVESYS Summary of this function goes here

%   Detailed explanation goes here

format long

[n,m]=size(A)

b = fix(10\*rand(n, 1))

if det (A)==0

    disp('“The system is either inconsistent or the solution is not unique”.')

    C=[]

    N=[]

else

    x= A\b

end

C=[x(1),x(2),x(3)]

N=[norm(x(1)-x(2));norm(x(2)-x(3));norm(x(3)-x(1))]

end

A=magic(6)

>> solvesys(A)

n =

6

m =

6

b =

2

5

9

9

1

9

> In solvesys (line 15)

Warning: Matrix is close to singular or badly scaled. Results may be inaccurate. RCOND =

4.800964e-18.

x =

1.0e+15 \*

2.627099782632790

2.627099782632790

-1.313549891316395

-2.627099782632789

-2.627099782632790

1.313549891316393

C =

1.0e+15 \*

2.627099782632790 2.627099782632790 -1.313549891316395

N =

1.0e+15 \*

0.000000000000001

3.940649673949185

3.940649673949185

ans =

1.0e+15 \*

2.627099782632790 2.627099782632790 -1.313549891316395

>>

(b)

>> A=eye(5)

A =

1 0 0 0 0

0 1 0 0 0

0 0 1 0 0

0 0 0 1 0

0 0 0 0 1

>> solvesys(A)

n =

5

m =

5

b =

9

4

8

1

4

x =

9

4

8

1

4

C =

9 4 8

N =

5

4

1

ans =

9 4 8

>>

(c)

>> A=randi(20,4,4)

A =

19 1 16 4

16 17 15 15

20 19 8 1

14 14 14 6

>> solvesys(A)

n =

4

m =

4

b =

0

0

8

6

x =

-0.301390075328105

0.557816261551604

0.534285936165256

-0.844994952240429

C =

-0.301390075328105 0.557816261551604 0.534285936165256

N =

0.859206336879708

0.023530325386348

0.835676011493361

ans =

-0.301390075328105 0.557816261551604 0.534285936165256

>>

(d)

>> A=magic(3)

A =

8 1 6

3 5 7

4 9 2

>> solvesys(A)

n =

3

m =

3

b =

3

9

0

x =

-0.858333333333334

0.016666666666667

1.641666666666667

C =

-0.858333333333334 0.016666666666667 1.641666666666667

N =

0.875000000000000

1.625000000000000

2.500000000000000

ans =

-0.858333333333334 0.016666666666667 1.641666666666667

>>

>> (e)

A=hilb(6)

A =

Columns 1 through 4

1.000000000000000 0.500000000000000 0.333333333333333 0.250000000000000

0.500000000000000 0.333333333333333 0.250000000000000 0.200000000000000

0.333333333333333 0.250000000000000 0.200000000000000 0.166666666666667

0.250000000000000 0.200000000000000 0.166666666666667 0.142857142857143

0.200000000000000 0.166666666666667 0.142857142857143 0.125000000000000

0.166666666666667 0.142857142857143 0.125000000000000 0.111111111111111

Columns 5 through 6

0.200000000000000 0.166666666666667

0.166666666666667 0.142857142857143

0.142857142857143 0.125000000000000

0.125000000000000 0.111111111111111

0.111111111111111 0.100000000000000

0.100000000000000 0.090909090909091

>> solvesys(A)

n =

6

m =

6

b =

4

3

7

7

1

4

x =

1.0e+07 \*

-0.003467400000468

0.101808000013973

-0.699468000097141

1.836828000257382

-2.040570000287924

0.807760800114609

C =

1.0e+06 \*

-0.034674000004682 1.018080000139728 -6.994680000971414

N =

1.0e+06 \*

1.052754000144410

8.012760001111142

6.960006000966732

ans =

1.0e+06 \*

-0.034674000004682 1.018080000139728 -6.994680000971414

>>

Note: Type the Hilbert matrices using rational format, for example,

format rat, A = hilb(6)

>> format rat,A=hilb(6)

A =

Columns 1 through 5

1 1/2 1/3 1/4 1/5

1/2 1/3 1/4 1/5 1/6

1/3 1/4 1/5 1/6 1/7

1/4 1/5 1/6 1/7 1/8

1/5 1/6 1/7 1/8 1/9

1/6 1/7 1/8 1/9 1/10

Column 6

1/6

1/7

1/8

1/9

1/10

1/11

>>

diary on

format compact

% Exercise# 4

% arevol function

type arevol

function D = arevol(B)

% B is a matrix

% B is given by user input

[m,n] = size(B);

if (m == 2) && (n == 3)

% Calculate vector 1 from matrix B

% (Column 2 - Column 1)

v1 = ( B(:,2) - B(:,1) );

% Calculate vector 2 from matrix B

% (Column 3 - Column 2)

v2 = ( B(:,3) - B(:,2) );

% The result of the three vectors into an A-matrix

A=[v1 v2];

% Output the area from vectors in D

D=abs(det(A));

D=closetozeroroundoff(D);

if (D == 0)

disp('The point lie on the same line and no parallelogram can be built');

else

disp('The area of parallelogram is ');

end

elseif (m == 3) && (n == 4)

% Calculate vector 1 from matrix B

% (Column 2 - Column 1)

v1 = ( B(:,2) - B(:,1) );

% Calculate vector 2 from matrix B

% (Column 3 - Column 2)

v2 = ( B(:,3) - B(:,2) );

% Calculate vector 3 from matrix B

% (Column 4 - Column 3)

v3 = ( B(:,4) - B(:,3) );

% The result of the four vectors into an A-matrix

A=[v1 v2 v3];

% Output the volume in D

D=abs(det(A));

D=closetozeroroundoff(D);

if (D == 0)

disp('The point lie on the same line and no parallelepiped can be built');

else

disp('The volume of parallelepiped is ');

end

end

% close to zero roundoff fucntion

type closetozeroroundoff

function B = closetozeroroundoff(A)

[m,n] = size(A);

for i = 1:m

for j = 1:n

if abs (A(j,i)) < 10^(-7)

A (i,j) = 0;

end

end

end

B = A;

end

% Run the function with D = arevol(B)

% a. B = randi([-10,10], 2, 3)

B = randi([-10,10], 2, 3)

B =

7 7 9

-5 -5 -3

D = arevol(B)

The point lie on the same line and no parallelogram can be built

D =

0

% b. B = randi([-10,10], 3, 4)

B = randi([-10,10], 3, 4)

B =

-6 -1 2 -4

-5 -3 1 5

2 7 9 5

D = arevol(B)

The volume of parallelepiped is

D =

60.0000

% c. X = randi([-10,10], 2, 1), B = [X,-X, 2\*X]

X = randi([-10,10], 2, 1)

X =

-3

1

B = [X,-X, 2\*X]

B =

-3 3 -6

1 -1 2

D = arevol(B)

The point lie on the same line and no parallelogram can be built

D =

0

% d. X = randi([-10,10], 3, 1), Y = randi([-10,10], 3, 1), B = [X, Y, X+Y, X\_Y]

X = randi([-10,10], 3, 1)

X =

-9

-9

1

Y = randi([-10,10], 3, 1)

Y =

6

9

-8

B = [X, Y, X+Y, X-Y]

B =

-9 6 -3 -15

-9 9 0 -18

1 -8 -7 9

D = arevol(B)

The point lie on the same line and no parallelepiped can be built

D =

0

diary off

% Exercise 5

diary on

format compact

R1 = [1 0; 0 -1]

R1 =

1 0

0 -1

R2 = [-1 0; 0 1]

R2 =

-1 0

0 1

VS = [1 0; 2 1]

VS =

1 0

2 1

type transf

function C = transf(A,E)

%

E=A\*E

x=E(1,:); y=E(2,:);

plot(x,y)

v=[-5 5 -5 5];

axis(v)

grid

C=E;

grid

end

%E=A\*E - multiplies E by A and assings result to E

%x=E(1,:); y=E(2,:); - creates coordinates

%plot(x,y) - plots the given coordinates

%v=[-5 5 -5 5]; - specifies axis limits

%axis(v) - assigns axis limits

%grid - creates grid for the graph

%C=E; - assigns E to C

%grid - creates grid for the graph

E = [0 1 1 0 0; 0 0 1 1 0]

E =

0 1 1 0 0

0 0 1 1 0

A = eye(2);

hold

[\_Warning: MATLAB has disabled some advanced

graphics rendering features by switching to

software OpenGL. For more information, click

<a href="matlab:opengl('problems')">here</a>.]\_

Current plot held

grid

C = transf(A,E)

E =

0 1 1 0 0

0 0 1 1 0

C =

0 1 1 0 0

0 0 1 1 0

E = C;

A = VS

A =

1 0

2 1

C = transf(A,E)

E =

0 1 1 0 0

0 2 3 1 0

C =

0 1 1 0 0

0 2 3 1 0

E = C;

A = R1

A =

1 0

0 -1

C = transf(A,E)

E =

0 1 1 0 0

0 -2 -3 -1 0

C =

0 1 1 0 0

0 -2 -3 -1 0

E = C;

A = R2

A =

-1 0

0 1

C = transf(A,E)

E =

0 -1 -1 0 0

0 -2 -3 -1 0

C =

0 -1 -1 0 0

0 -2 -3 -1 0

E = C;

A = R1

A =

1 0

0 -1

C = transf(A,E)

E =

0 -1 -1 0 0

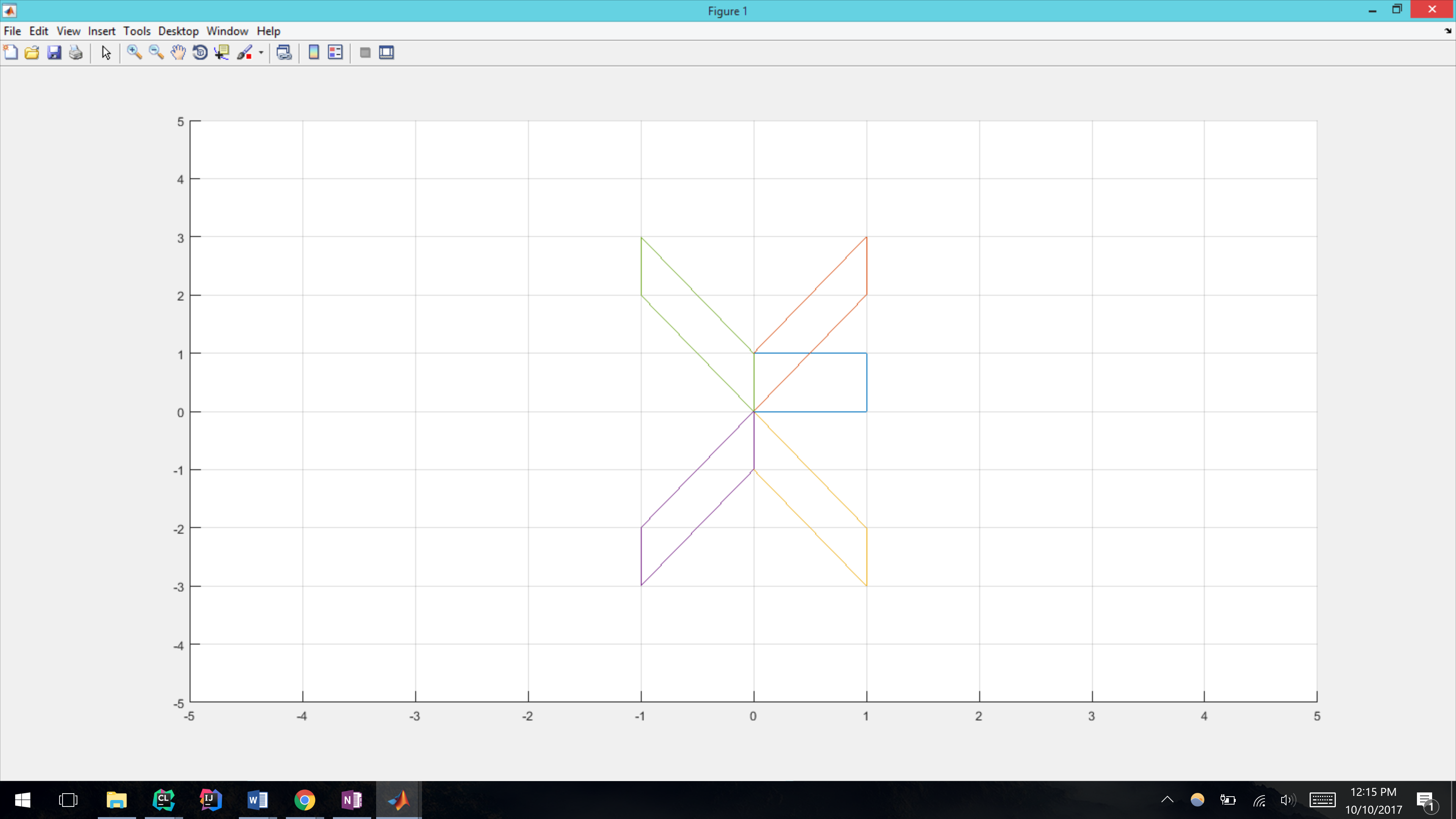
0 2 3 1 0

C =

0 -1 -1 0 0

0 2 3 1 0

diary off



%Exercise 6

function [ C ] = cofactor( a )

%COFACTOR generates cofactors from input matrix a.

% This function generates (n-1)x(n-1) matricies. Each A\_ij is obtained

% from a by deleting row i and column j. The output matrix is an nxn

% matrix whose entries are the cofactors calculated by the formula:

% C\_ij = (-1)^(i+j)detA\_ij

n = size(a);

C = zeros(n);

for i = 1:(n)

for j = 1:(n)

A = a;

A(i, :) = [];

A(:, j) = [];

C(i, j) = ((-1)^(i+j)) \* det(A);

end

end

for i = 1:n

for j = 1:n

end

end

end

function [ D ] = determine( a, C )

%DETERMINE Calculates the derteminant of matrix a.

% Calculates the determinant of matrix a by cofactor expansion of each

% row and column using set of cofactors C.

n = size(a, 1);

D1 = zeros(n, 1);

for row = 1:n

d = 0;

for col = 1:n

d = d + (C(row, col) \* a(row, col));

end

D1(row, 1) = d;

end

D2 = zeros(n, 1);

for col = 1:n

d = 0;

for row = 1:n

d = d + (C(row, col) \* a(row, col));

end

D2(col, 1) = d;

end

D = D1(1,1);

for i = 1:n

if abs(d - D1(n,1)) > (10^(-7)) || abs(d - D2(n,1)) > (10^(-7))

D = [];

disp('There is a problem with my code!');

return

end

end

end

function [ B ] = inverse( a, C, D )

%UNTITLED2 Calculates the inverse of a.

% Calculates the inverse of a by using the formula: (1/d)\*transpose(C).

% If the rank(a) does not equal the size of a, then the matrix is not

% invertible and the function will return an empty matrix. Rank is

% preferable for determining is the matrix is invertible to the

% determinant as matricies with a nonzero determinant may only have a

% left or right side inverse.

n = size(a, 1);

B = zeros(n);

if rank(a) ~= n

B = []

return

end

B = (1/D)\*(C');

end

format rat

a = diag([1,2,3,4]);

C = cofactor(a)

C =

24 0 0 0

0 12 0 0

0 0 8 0

0 0 0 6

D = determine(a, C)

D =

24

det(a)

ans =

24

%The results are the same.

B = inverse(a,C,D)

B =

1 0 0 0

0 1/2 0 0

0 0 1/3 0

0 0 0 1/4

inv(a)

ans =

1 0 0 0

0 1/2 0 0

0 0 1/3 0

0 0 0 1/4

%The results are the same.

a = ones(5);

C = cofactor(a)

C =

0 0 0 0 0

0 0 0 0 0

0 0 0 0 0

0 0 0 0 0

0 0 0 0 0

D = determine(a, C)

D =

0

det(a)

ans =

0

%The results are the same.

B = inverse(a,C,D)

B =

[]

B =

[]

inv(a)

[Warning: Matrix is singular to working precision.]

ans =

1/0 1/0 1/0 1/0 1/0

1/0 1/0 1/0 1/0 1/0

1/0 1/0 1/0 1/0 1/0

1/0 1/0 1/0 1/0 1/0

1/0 1/0 1/0 1/0 1/0

%The results are the same.

a = magic(5);

C = cofactor(a)

C =

-25025 218725 -153400 23725 13975

259350 -189150 15600 -33150 25350

-179400 -23400 15600 54600 210600

5850 64350 15600 220350 -228150

17225 7475 184600 -187525 56225

D = determine(a, C)

D =

5070000

det(a)

ans =

5070000

%The results are the same.

B = inverse(a,C,D)

B =

-77/15600 133/2600 -23/650 3/2600 53/15600

89/2063 -97/2600 -3/650 33/2600 23/15600

-59/1950 1/325 1/325 1/325 71/1950

73/15600 -17/2600 7/650 113/2600 -577/15600

43/15600 1/200 27/650 -9/200 98/8837

inv(a)

ans =

-77/15600 133/2600 -23/650 3/2600 53/15600

89/2063 -97/2600 -3/650 33/2600 23/15600

-59/1950 1/325 1/325 1/325 71/1950

73/15600 -17/2600 7/650 113/2600 -577/15600

43/15600 1/200 27/650 -9/200 98/8837

%The results are the same.

a = magic(4);

C = cofactor(a)

C =

-136 -408 408 136

-408 -1224 1224 408

408 1224 -1224 -408

136 408 -408 -136

D = determine(a, C)

D =

1/314146179365

det(a)

ans =

-1/689889648801

%The results are not the same. This must be because the matrix is special. It may not be invertible.

B = inverse(a,C,D)

B =

[]

B =

[]

inv(a)

[Warning: Matrix is close to singular or badly scaled. Results may be inaccurate. RCOND = 1.306145e-17.]

ans =

\* \* \* \*

\* \* \* \*

\* \* \* \*

\* \* \* \*

%The results are the same. The matrix is not invertible.

a = hilb(4)

a =

1 1/2 1/3 1/4

1/2 1/3 1/4 1/5

1/3 1/4 1/5 1/6

1/4 1/5 1/6 1/7

C = cofactor(a)

C =

1/378000 -1/50400 1/25200 -1/43200

-1/50400 1/5040 -1/2240 1/3600

1/25200 -1/2240 3/2800 -1/1440

-1/43200 1/3600 -1/1440 1/2160

D = determine(a, C)

D =

1/6048000

det(a)

ans =

1/6048000

%The results are the same.

B = inverse(a,C,D)

B =

16 -120 240 -140

-120 1200 -2700 1680

240 -2700 6480 -4200

-140 1680 -4200 2800

inv(a)

ans =

16 -120 240 -140

-120 1200 -2700 1680

240 -2700 6480 -4200

-140 1680 -4200 2800

%The results are the same.