**MAT 343 MATLAB LAB 3 NAME: \_Hieu Pham\_\_\_\_**

%Exercise 1

A = floor(10\*rand(4,3))

A =

9 8 8

2 7 4

6 4 6

4 0 7

E1 = eye(4);

E1([1,3],:)=E1([3,1],:)

E1 =

0 0 1 0

0 1 0 0

1 0 0 0

0 0 0 1

E2 = eye(4);

E2(2,2)=5

E2 =

1 0 0 0

0 5 0 0

0 0 1 0

0 0 0 1

E3 = eye(4);

E3(4,1)=7

E3 =

1 0 0 0

0 1 0 0

0 0 1 0

7 0 0 1

**MAT 343 MATLAB LAB 3 NAME: \_Hieu Pham\_\_\_\_**

E1\*A

ans =

6 4 6

2 7 4

9 8 8

4 0 7

E2\*A

ans =

9 8 8

10 35 20

6 4 6

4 0 7

E3\*A

ans =

9 8 8

2 7 4

6 4 6

67 56 63

%For E1\*A, the rows were swapped/exchanged.

%For E2\*A, the second row was multiplied by 5.

%For E3\*A, Row 4 was the original row 4 plus 7\*row1

%Exercise 2

%Part A

A = [1,-2,3;2,-6,5;-1,-4,0];

E1 = eye(3);

E1(2,1) = -2

E1 =

1 0 0

-2 1 0

0 0 1

**MAT 343 MATLAB LAB 3 NAME: \_Hieu Pham\_\_\_\_**

E1\*A

ans =

1 -2 3

0 -2 -1

-1 -4 0

E2 = eye(3);

E2(3,1) = 1

E2 =

1 0 0

0 1 0

1 0 1

E2\*E1\*A

ans =

1 -2 3

0 -2 -1

0 -6 3

E3 = eye(3);

E3(3,2) = -3

E3 =

1 0 0

0 1 0

0 -3 1

U = E3\*E2\*E1\*A

U =

1 -2 3

0 -2 -1

0 0 6

**MAT 343 MATLAB LAB 3 NAME: \_Hieu Pham\_\_\_\_**

%U is the upper triangular matrix.

%Part B

L = inv(E1)\*inv(E2)\*inv(E3)

L =

1 0 0

2 1 0

-1 3 1

%L is the lower triangular matrix.

A=L\*U

A =

1 -2 3

2 -6 5

-1 -4 0

%L\*U produced matrix A.

%Exercise 3

%Part A

p = [3,1,2,5,4];

E = eye(length(p));

E = E(p,:)

E =

0 0 1 0 0

1 0 0 0 0

0 1 0 0 0

0 0 0 0 1

0 0 0 1 0

A = floor(10\*rand(5))

A =

9 9 8 6 4

7 4 0 2 9

1 8 1 1 4

4 0 2 0 4

**MAT 343 MATLAB LAB 3 NAME: \_Hieu Pham\_\_\_\_**

9 3 1 7 8

E\*A

ans =

1 8 1 1 4

9 9 8 6 4

7 4 0 2 9

9 3 1 7 8

4 0 2 0 4

A\*E

ans =

9 8 9 4 6

4 0 7 9 2

8 1 1 4 1

0 2 4 4 0

3 1 9 8 7

%For E\*A operation, the rows were swapped in the same order as E matrix.

%For A\*E operation, the columns were swapped in matrix A.

%Part B

inv(E)

ans =

0 1 0 0 0

0 0 1 0 0

1 0 0 0 0

0 0 0 0 1

0 0 0 1 0

E'

ans =

0 1 0 0 0

0 0 1 0 0

1 0 0 0 0

**MAT 343 MATLAB LAB 3 NAME: \_Hieu Pham\_\_\_\_**

0 0 0 0 1

0 0 0 1 0

%E and E' produced the same results.

%Exercise 4

%Part A

A = [2,2,4,6;1,2,1,4;-4,-3,-7,-8;2,1,3,3];

b = [6;8;-11;3];

[L,U,P] = lu(A)

L =

1.0000 0 0 0

-0.2500 1.0000 0 0

-0.5000 0.4000 1.0000 0

-0.5000 -0.4000 -1.0000 1.0000

U =

-4.0000 -3.0000 -7.0000 -8.0000

0 1.2500 -0.7500 2.0000

0 0 0.8000 1.2000

0 0 0 1.0000

P =

0 0 1 0

0 1 0 0

1 0 0 0

0 0 0 1

L\*U

ans =

-4 -3 -7 -8

1 2 1 4

2 2 4 6

2 1 3 3

**MAT 343 MATLAB LAB 3 NAME: \_Hieu Pham\_\_\_\_**

P\*A-L\*U (If PA = LU, their differences evaluate to 0)

ans =

0 0 0 0

0 0 0 0

0 0 0 0

0 0 0 0

%Part B

y = L\(P\*b);

x = U\y

x =

-1.0000

8.0000

1.0000

-2.0000

P\*b

ans =

-11

8

6

3

P\*A\*x

ans =

-11

8

6

3

%Part C

z = [-1;8;1;-2];

norm (x-z)

ans =

2.2204e-016

%Exercise 5

%Part A

A = rand(500);

x = ones(500,1);

b = A\*x;

tic; R = rref([A,b]); x\_rref = R(:,end); toc

elapsed\_time =

20.7520

%Part B

tic; [L,U,P] = lu(A); y = L\(P\*b); x\_lu = U\y; toc

elapsed\_time =

0.0370

%The LU decomposition produced faster result than Part A.

%Part C

norm(x\_rref - x)

ans =

1.5236e-011

norm(x\_lu - x)

ans =

1.9308e-011

%The solutions are different. The LU decomposition likely the most accurate.

diary off