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Lab 3

Thursdays 1:30 p.m.

Everett/Mahalov

>> **%question1**

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

A =

8 6 9

9 0 9

1 2 1

9 5 9

>> 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

>> E1\*A

ans =

1 2 1

9 0 9

8 6 9

9 5 9

>> E2\*A

ans =

8 6 9

45 0 45

1 2 1

9 5 9

>> E3\*A

ans =

8 6 9

9 0 9

1 2 1

65 47 72

>> **%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**

>>

>> **%Question2**

**>> %2A**

>> 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

>> 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

>> **%Verified that U is indeed an upper triangular matrix.**

**>> %2B**

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

L =

1 0 0

2 1 0

-1 3 1

>> **%L = lower triangular matrix**

>> A=L\*U

A =

1 -2 3

2 -6 5

-1 -4 0

>> **%A=L\*U gives us matrix A.**

**>> %question3**

**>> %3A**

>> 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 3 2

4 7 9 6 0

8 9 6 1 0

1 6 7 7 8

4 0 7 0 6

>> E\*A

ans =

8 9 6 1 0

9 9 8 3 2

4 7 9 6 0

4 0 7 0 6

1 6 7 7 8

>> A\*E

ans =

9 8 9 2 3

7 9 4 0 6

9 6 8 0 1

6 7 1 8 7

0 7 4 6 0

>> **%For E\*A, rows were exchanged/swapped in the same order as E matrix**

**>> %For A\*E, columns were swapped in the function A matrix**

**>> %3b**

>> 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

0 0 0 0 1

0 0 0 1 0

**>> %Both solutions are the same.**

**>> %Question4**

**>> %4a**

>> 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

>> P\*A-L\*U

ans =

0 0 0 0

0 0 0 0

0 0 0 0

0 0 0 0

>> **%4b**

>> 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 =

-11.0000

8.0000

6.0000

3.0000

>> **%4c**

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

>> norm (x-z)

ans =

4.9651e-16

>> **%B and C almost same in value**

**>> %Question5**

**>> %5A**

>> A = rand(500);

>> x = ones(500,1);

>> b = A\*x;

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

Elapsed time is 15.780171 seconds.

>> %5B

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

Elapsed time is 0.052844 seconds.

>> **%Compared to 5A, this produces a much faster result using the LU decomposition**

>> %5C

>> norm(x\_rref - x)

ans =

1.6334e-11

>> norm(x\_lu - x)

ans =

6.9174e-12

**>> %Solutions are not the same, LU decomposition most likely the most accurate.**