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EP 501 - Vittorio Baraldi

Homework 2

```
clear all
close all
clc
```

Ex.1

```
load C:\Users\Vittorio\EP501_matlab\linear_algebra\testproblem.mat
```

Part a) and b)

```
%implementing a simple forward elimination method for LU factorization
[L,U,bt]=simple_elimination_dolittle(A,b);
%preparing matrix for back substitution algorithm
Awork=[U bt];
%back-substitution
x=backsub(Awork);

%checking results with buil-in Matlab function
check1=A\b;

disp('Final solution for linear system of eqns using LU factorization
 method: ')
disp(x)
disp('Built-in MatLab function result:')
disp(check1)
```

```
Final solution for linear system of eqns using LU factorization
 method:
    1.0000
    2.0000
    3.0000
    4.0000
    5.0000
    6.0000
    7.0000
    8.0000

Built-in MatLab function result:
```

```
    1.0000
    2.0000
    3.0000
    4.0000
    5.0000
    6.0000
    7.0000
    8.0000
```

Part c)

```matlab
%solving a multiple right hand side system
xt1=forwsub([L b]);
x1=backsub([U xt1]);
xt2=forwsub([L b2]);
x2=backsub([U xt2]);
xt3=forwsub([L b3]);
x3=backsub([U xt3]);
%final solution matrix
result=[x1 x2 x3];

%checking results with buil-in Matlab function
check2=A\b2;
check3=A\b3;

disp('Final solution for multiple right-hand side using LU
 factorization method:')
disp(result)
disp('Checking results with built-in MatLab function:')
disp([check1 check2 check3])
```

```
Final solution for multiple right-hand side using LU factorization
 method:
    1.0000     2.0000    10.0000
    2.0000     4.0000    20.0000
    3.0000     6.0000    30.0000
    4.0000     8.0000    40.0000
    5.0000    10.0000    50.0000
    6.0000    12.0000    60.0000
    7.0000    14.0000    70.0000
    8.0000    16.0000    80.0000

Checking results with built-in MatLab function:
    1.0000     2.0000    10.0000
    2.0000     4.0000    20.0000
    3.0000     6.0000    30.0000
    4.0000     8.0000    40.0000
    5.0000    10.0000    50.0000
    6.0000    12.0000    60.0000
    7.0000    14.0000    70.0000
    8.0000    16.0000    80.0000
```

Part d)

```matlab
%Find inverse matrix inv(A) starting from the LU factorization

n=size(A,1);
for i=1:n
    %initializing the RHS
    bt=zeros(n,1);
    %setting the i-th element to 1, all others to 0
    bt(i)=1;
    %performing a forwards+back substitutions
    inv1=forwsub([L bt]);
    inv2=backsub([U inv1]);
    %inv2 is equal to the i-th column of the inverse matrix
    invmatrix(:,i)=inv2;
end

%checking result with buil-in MatLab function
check4=inv(A);

disp('Inverse matrix from LU factorization:')
disp(invmatrix)
disp('Inverse matrix from MatLab built-in function:')
disp(check4)
```

```
Inverse matrix from LU factorization:
  Columns 1 through 7

   -0.4480    0.3835    0.0281   -0.0881   -0.5795    1.0474   -0.5356
   -0.0540   -0.1948   -0.2456   -0.6264    0.1978   -0.2692    0.2222
    0.2062   -0.1064   -0.3766   -1.1154   -0.0220    0.5605    0.2837
   -0.3250    0.4251    0.0724   -0.1670   -0.3128    0.8816    0.4305
   -0.0697   -0.5582   -0.4000   -1.3059    0.0704    0.6537    0.8908
    0.3565    0.3345    0.1079   -0.1491    0.2014    0.0363   -0.2920
   -0.1222    0.1436    0.0008    0.7677   -0.2421   -0.0132   -0.1231
    0.1043   -0.2818   -0.2839   -0.2878    0.4281   -0.1212    0.1503

  Column 8

    0.2581
    0.2324
    0.3873
    0.2608
    0.6467
   -0.6463
   -0.7433
    0.0735

Inverse matrix from MatLab built-in function:
  Columns 1 through 7

   -0.4480    0.3835    0.0281   -0.0881   -0.5795    1.0474   -0.5356
   -0.0540   -0.1948   -0.2456   -0.6264    0.1978   -0.2692    0.2222
```

```
    0.2062    -0.1064    -0.3766    -1.1154    -0.0220     0.5605     0.2837
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