

test

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```
x = [50,100,150,200,250,300,350,400]
simulate = [0, 0, 0, 0, 0, 0, 0, 0]
counts = [0,0,0,0,0,0,0,0]

%%Question 1 is written in photo in the same direcotry
```

```
x =
    50    100    150    200    250    300    350    400
simulate =
    0    0    0    0    0    0    0    0
counts =
    0    0    0    0    0    0    0    0
```

Test forward substitution

```
for i = 1:8
    for j = 1:10
        test = rand(i*20);
        %while (forward(test)(3) == 0)
        % test = rand(i*20);
        %end

        tic
        [U, flag] = forward(test);
        endtime = toc

        counts(i)= counts(i) + endtime;
    end
```

end %

flag = 1	
endtime = 0.0042498	
flag = 1	
endtime = 0.0042329	
flag = 1	
endtime = 0.0043368	
flag = 1	
endtime = 0.0058758	
flag = 1	
endtime = 0.0048361	
flag = 1	
endtime = 0.0042009	
flag = 1	
endtime = 0.0041389	
flag = 1	
endtime = 0.0039899	
flag = 1	
endtime = 0.0040362	
flag = 1	
endtime = 0.0041132	
flag = 1	
endtime = 0.014833	
flag = 1	
endtime = 0.014871	
flag = 1	
endtime = 0.016727	
flag = 1	
endtime = 0.019560	
flag = 1	
endtime = 0.015555	
flag = 1	
endtime = 0.014888	
flag = 1	
endtime = 0.019803	
flag = 1	
endtime = 0.014593	
flag = 1	
endtime = 0.015477	
flag = 1	
endtime = 0.018319	
flag = 1	
endtime = 0.034587	
flag = 1	

```
endtime = 0.032622
flag = 1
endtime = 0.040407
flag = 1
endtime = 0.034827
flag = 1
endtime = 0.032379
flag = 1
endtime = 0.033831
flag = 1
endtime = 0.033748
flag = 1
endtime = 0.043568
flag = 1
endtime = 0.039036
flag = 1
endtime = 0.032889
flag = 1
endtime = 0.059444
flag = 1
endtime = 0.067199
flag = 1
endtime = 0.070407
flag = 1
endtime = 0.067760
flag = 1
endtime = 0.057627
flag = 1
endtime = 0.063768
flag = 1
endtime = 0.064667
flag = 1
endtime = 0.066244
flag = 1
endtime = 0.064352
flag = 1
endtime = 0.060937
flag = 1
endtime = 0.092533
flag = 1
endtime = 0.090458
flag = 1
endtime = 0.11238
flag = 1
endtime = 0.11149
flag = 1
```

```
endtime = 0.096846
flag = 1
endtime = 0.097383
flag = 1
endtime = 0.10189
flag = 1
endtime = 0.10571
flag = 1
endtime = 0.097954
flag = 1
endtime = 0.098705
flag = 1
endtime = 0.14948
flag = 1
endtime = 0.14766
flag = 1
endtime = 0.16020
flag = 1
endtime = 0.13466
flag = 1
endtime = 0.15080
flag = 1
endtime = 0.14715
flag = 1
endtime = 0.13720
flag = 1
endtime = 0.13601
flag = 1
endtime = 0.14087
flag = 1
endtime = 0.15029
flag = 1
endtime = 0.19438
flag = 1
endtime = 0.19140
flag = 1
endtime = 0.19618
flag = 1
endtime = 0.20625
flag = 1
endtime = 0.20566
flag = 1
endtime = 0.19215
flag = 1
endtime = 0.18397
flag = 1
```

```

endtime = 0.17988
flag = 1
endtime = 0.18091
flag = 1
endtime = 0.22108
flag = 1
endtime = 0.26778
flag = 1
endtime = 0.28603
flag = 1
endtime = 0.26009
flag = 1
endtime = 0.24413
flag = 1
endtime = 0.24940
flag = 1
endtime = 0.27213
flag = 1
endtime = 0.26749
flag = 1
endtime = 0.25152
flag = 1
endtime = 0.25011
flag = 1
endtime = 0.24553

```

Simulate forward decomposition the triple polynomial curve

```

%
[p, E] = polyfit(x, counts, 2)

simulated_x = linspace(50,500)
simulate = polyval(p, simulated_x)

plot(x, counts, 'x')
hold on
plot(simulated_x, simulate)
hold off

%

```

```

p =
    1.6449e-05    -1.5458e-04    1.2976e-02
E =

```

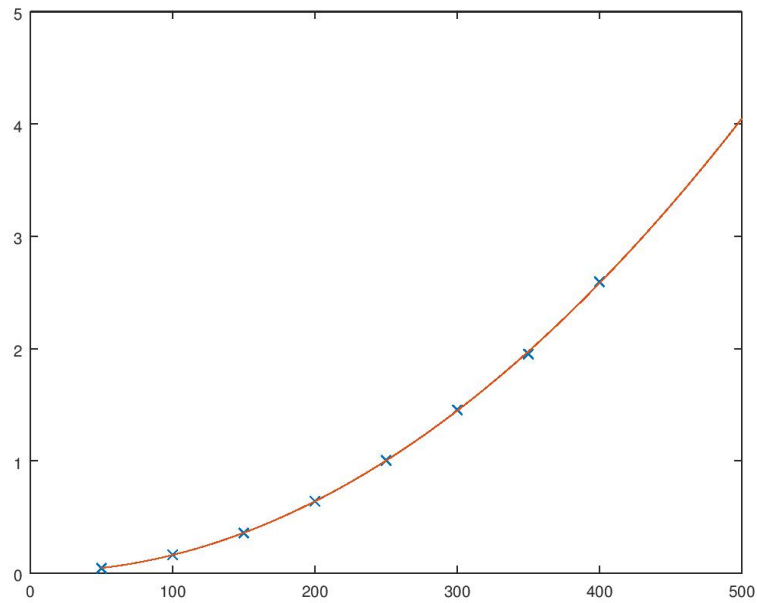
```

scalar structure containing the fields:
yf =
  Columns 1 through 6:
    0.046370    0.162010    0.359897    0.640029
    1.002408    1.447034
  Columns 7 and 8:
    1.973905    2.583023
X =
    2500         50         1
   10000        100         1
   22500        150         1
   40000        200         1
   62500        250         1
   90000        300         1
  122500        350         1
  160000        400         1
R =
   -2.3415e+05   -6.9187e+02   -2.1781e+00
    0.0000e+00   -1.7696e+02   -1.6559e+00
    0.0000e+00    0.0000e+00    7.1677e-01
C =
   9.5238e-10   -4.2857e-07    3.5714e-05
  -4.2857e-07    2.0238e-04   -1.8214e-02
   3.5714e-05   -1.8214e-02    1.9464e+00
df = 5
normr = 0.026356
simulated_x =
  Columns 1 through 8:
    50.000    54.545    59.091    63.636    68.182
    72.727    77.273    81.818
  Columns 9 through 16:
    86.364    90.909    95.455    100.000    104.545
    109.091    113.636    118.182
  Columns 17 through 24:
    122.727    127.273    131.818    136.364    140.909
    145.455    150.000    154.545
  Columns 25 through 32:
    159.091    163.636    168.182    172.727    177.273
    181.818    186.364    190.909
  Columns 33 through 40:
    195.455    200.000    204.545    209.091    213.636
    218.182    222.727    227.273
  Columns 41 through 48:
    231.818    236.364    240.909    245.455    250.000
    254.545    259.091    263.636
  Columns 49 through 56:

```

268.182	272.727	277.273	281.818	286.364
290.909	295.455	300.000		
Columns 57 through 64:				
304.545	309.091	313.636	318.182	322.727
327.273	331.818	336.364		
Columns 65 through 72:				
340.909	345.455	350.000	354.545	359.091
363.636	368.182	372.727		
Columns 73 through 80:				
377.273	381.818	386.364	390.909	395.455
400.000	404.545	409.091		
Columns 81 through 88:				
413.636	418.182	422.727	427.273	431.818
436.364	440.909	445.455		
Columns 89 through 96:				
450.000	454.545	459.091	463.636	468.182
472.727	477.273	481.818		
Columns 97 through 100:				
486.364	490.909	495.455	500.000	
simulate =				
Columns 1 through 7:				
0.046370	0.053484	0.061278	0.069752	0.078905
0.088738	0.099251			
Columns 8 through 14:				
0.110443	0.122315	0.134867	0.148099	0.162010
0.176601	0.191872			
Columns 15 through 21:				
0.207823	0.224453	0.241763	0.259752	0.278422
0.297771	0.317800			
Columns 22 through 28:				
0.338508	0.359897	0.381965	0.404712	0.428140
0.452247	0.477034			
Columns 29 through 35:				
0.502500	0.528647	0.555473	0.582979	0.611164
0.640029	0.669574			
Columns 36 through 42:				
0.699799	0.730703	0.762287	0.794551	0.827495
0.861118	0.895421			
Columns 43 through 49:				
0.930404	0.966066	1.002408	1.039430	1.077132
1.115513	1.154574			
Columns 50 through 56:				
1.194315	1.234735	1.275836	1.317615	1.360075
1.403214	1.447034			
Columns 57 through 63:				
1.491532	1.536711	1.582569	1.629107	1.676325

1.724222 1.772799
 Columns 64 through 70:
 1.822056 1.871993 1.922609 1.973905 2.025881
 2.078536 2.131871
 Columns 71 through 77:
 2.185886 2.240581 2.295955 2.352009 2.408743
 2.466157 2.524250
 Columns 78 through 84:
 2.583023 2.642475 2.702608 2.763420 2.824912
 2.887083 2.949935
 Columns 85 through 91:
 3.013466 3.077676 3.142567 3.208137 3.274387
 3.341316 3.408926
 Columns 92 through 98:
 3.477215 3.546183 3.615832 3.686160 3.757168
 3.828856 3.901223
 Columns 99 and 100:
 3.974270 4.047997



Test the LU decomposition


```

%
for i = 1:8
    for j = 1:10
        test = rand(i*20);
        % while (LU(test)(3) == 0)
        %     test = rand(i*20);
        %end

        tic
        [L, U, flag] = LU(test);
        endtime = toc

        counts(i)= counts(i) + endtime;
    end
end
%

```

```

flag = 1
warning: LU: some elements in list of return values are
        undefined
endtime = 2.2721e-04
flag = 1
warning: LU: some elements in list of return values are
        undefined
endtime = 8.8930e-05
flag = 1
warning: LU: some elements in list of return values are
        undefined
endtime = 8.2016e-05
flag = 1
warning: LU: some elements in list of return values are
        undefined
endtime = 8.1062e-05
flag = 1
warning: LU: some elements in list of return values are
        undefined
endtime = 8.0109e-05
flag = 1
warning: LU: some elements in list of return values are
        undefined
endtime = 7.7963e-05
flag = 1
warning: LU: some elements in list of return values are
        undefined

```

```

endtime =      7.7963e-05
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      7.8917e-05
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      7.8201e-05
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      9.0122e-05
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      1.3995e-04
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      1.2112e-04
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      1.1802e-04
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      9.1076e-05
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      8.7976e-05
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      7.7009e-05
flag = 1

```

```

warning: LU: some elements in list of return values are
undefined
endtime = 7.7963e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.8201e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.6056e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.5817e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
undefined

```

```

endtime =      7.5817e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime =      7.7963e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime =      7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime =      7.6056e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime =      7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime =      7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime =      7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime =      7.6056e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime =      7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime =      7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime =      7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime =      7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
undefined

```

```

warning: LU: some elements in list of return values are
undefined
endtime = 7.7963e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.7963e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.7963e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 1.1492e-04
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 8.0109e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.8917e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.7963e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 8.2970e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 8.0824e-05
flag = 1
warning: LU: some elements in list of return values are
undefined

```

```

endtime =      7.8917e-05
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      7.9155e-05
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      7.8201e-05
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      7.7963e-05
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      8.3923e-05
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      7.7963e-05
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      7.7963e-05
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      7.7009e-05
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      7.8917e-05
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      8.1062e-05
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      1.2517e-04
flag = 1
warning: LU: some elements in list of return values are
          undefined
endtime =      8.0109e-05
flag = 1

```

```

warning: LU: some elements in list of return values are
undefined
endtime = 7.9155e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.9155e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.7963e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.7963e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.8917e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.7963e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.8917e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.7963e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.9870e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.8917e-05
flag = 1
warning: LU: some elements in list of return values are
undefined
endtime = 7.7963e-05
flag = 1
warning: LU: some elements in list of return values are
undefined

```

```

endtime =      7.7963e-05
flag = 1
warning: LU: some elements in list of return values are
         undefined
endtime =      7.8917e-05
flag = 1
warning: LU: some elements in list of return values are
         undefined
endtime =      7.8917e-05
flag = 1
warning: LU: some elements in list of return values are
         undefined
endtime =      7.8917e-05
flag = 1
warning: LU: some elements in list of return values are
         undefined
endtime =      7.8917e-05

```

Simulate LU decomposition the triple polynomial curve

```

%
[p, E] = polyfit(x, counts, 3)

simulated_x = linspace(50,500)
simulate = polyval(p, simulated_x)

plot(x, counts, 'x')
hold on
plot(simulated_x, simulate)

%

```

```

p =
    3.0419e-09    1.4399e-05    2.3526e-04   -4.8064e-03
E =
    scalar structure containing the fields:
    yf =
        Columns 1 through 6:
        0.043335    0.165753    0.364729    0.642545
        1.001483    1.443823
        Columns 7 and 8:
        1.971848    2.587838
X =
    125000    2500    50    1

```


1000000	10000	100	1
3375000	22500	150	1
8000000	40000	200	1
15625000	62500	250	1
27000000	90000	300	1
42875000	122500	350	1
64000000	160000	400	1

R =

-8.3569e+07	-2.3101e+05	-6.5604e+02	-1.9385e+00
0.0000e+00	-3.8225e+04	-2.7338e+02	-1.6270e+00
0.0000e+00	0.0000e+00	-6.9789e+01	-1.1960e+00
0.0000e+00	0.0000e+00	0.0000e+00	4.0584e-01

C =

1.0774e-13	-7.2727e-11	1.3872e-08	-6.6667e-07
-7.2727e-11	5.0043e-08	-9.7922e-06	4.8571e-04
1.3872e-08	-9.7922e-06	1.9884e-03	-1.0405e-01
-6.6667e-07	4.8571e-04	-1.0405e-01	6.0714e+00

df = 4
normr = 0.024638
simulated_x =

Columns 1 through 8:

50.000	54.545	59.091	63.636	68.182
72.727	77.273	81.818		

Columns 9 through 16:

86.364	90.909	95.455	100.000	104.545
109.091	113.636	118.182		

Columns 17 through 24:

122.727	127.273	131.818	136.364	140.909
145.455	150.000	154.545		

Columns 25 through 32:

159.091	163.636	168.182	172.727	177.273
181.818	186.364	190.909		

Columns 33 through 40:

195.455	200.000	204.545	209.091	213.636
218.182	222.727	227.273		

Columns 41 through 48:

231.818	236.364	240.909	245.455	250.000
254.545	259.091	263.636		

Columns 49 through 56:

268.182	272.727	277.273	281.818	286.364
290.909	295.455	300.000		

Columns 57 through 64:

304.545	309.091	313.636	318.182	322.727
327.273	331.818	336.364		

Columns 65 through 72:

340.909	345.455	350.000	354.545	359.091
---------	---------	---------	---------	---------

```

        363.636    368.182    372.727
Columns 73 through 80:
        377.273    381.818    386.364    390.909    395.455
        400.000    404.545    409.091
Columns 81 through 88:
        413.636    418.182    422.727    427.273    431.818
        436.364    440.909    445.455
Columns 89 through 96:
        450.000    454.545    459.091    463.636    468.182
        472.727    477.273    481.818
Columns 97 through 100:
        486.364    490.909    495.455    500.000
simulate =
Columns 1 through 7:
        0.043335    0.051360    0.060001    0.069259    0.079136
        0.089634    0.100755
Columns 8 through 14:
        0.112499    0.124869    0.137867    0.151494    0.165753
        0.180644    0.196169
Columns 15 through 21:
        0.212330    0.229130    0.246569    0.264649    0.283372
        0.302740    0.322754
Columns 22 through 28:
        0.343417    0.364729    0.386693    0.409310    0.432582
        0.456511    0.481099
Columns 29 through 35:
        0.506346    0.532255    0.558828    0.586066    0.613972
        0.642545    0.671790
Columns 36 through 42:
        0.701706    0.732296    0.763562    0.795505    0.828128
        0.861430    0.895416
Columns 43 through 49:
        0.930085    0.965440    1.001483    1.038215    1.075638
        1.113754    1.152564
Columns 50 through 56:
        1.192071    1.232275    1.273179    1.314784    1.357092
        1.400104    1.443823
Columns 57 through 63:
        1.488251    1.533388    1.579237    1.625799    1.673076
        1.721069    1.769781
Columns 64 through 70:
        1.819214    1.869368    1.920245    1.971848    2.024178
        2.077237    2.131026
Columns 71 through 77:
        2.185547    2.240802    2.296792    2.353520    2.410987
        2.469194    2.528144

```

Columns 78 through 84:

2.587838	2.648278	2.709466	2.771402	2.834090
2.897530	2.961725			

Columns 85 through 91:

3.026676	3.092385	3.158853	3.226083	3.294076
3.362833	3.432357			

Columns 92 through 98:

3.502648	3.573710	3.645543	3.718150	3.791531
3.865690	3.940626			

Columns 99 and 100:

4.016343	4.092841
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