计算机作业——数值实验二(p56)：

1. 函数代码 zgf.m

```
function x=zgf(a,b,c,d)
%
% written by LiShixun(ID:2230514)
%  求解 Ax=d，其中 A 为三对角矩阵:
% A=[b1,c1,...                    ]
%     [a2,b2,c2...                ]
%     [    ,a3,b3,c3,...          ]
%     [       .   .   .           ]
%     [           .   .   .       ]
%     [         ...,an-1,bn-1,cn-1 ]
%     [               ...,an   ,bn    ]
% d=[d1,d2,...,dn]'
%
%  算法逻辑：根据通项公式迭代计算 L->y->U 三个矩阵，最后由 Ux=y 求解 x
%
n=length(b);% A 的阶数 n
% 1. 计算首项
l(1)=b(1);y(1)=d(1)./l(1);u(1)=c(1)./l(1);
% 2. 迭代
for i=2:n
    l(i)=b(i)-a(i-1).*u(i-1);
    y(i)=(d(i)-y(i-1).*a(i-1))./l(i);
    if(i~=n) % u 只计算至 n-1
        u(i)=c(i)./l(i);
    end
end
% 3. 求解 x:从底而上
x(n)=y(n);
for i=n-1:-1:1
    x(i)=y(i)-u(i)*x(i+1);
end
```

2. 测试代码 test.m

```
%% example2.2.3(page:46)
a=[-1,-2,-3];
b=[2,3,4,5];
c=[-1,-2,-3];
d=[6,1,-2,1];
x=zgf(a,b,c,d)

%% practise1(page:56)
n=101;
a=ones(n-1,1);
b=12*ones(n,1);
c=ones(n-1,1);
d=[11,10*ones(1,n-2),11];% 注意这里要用列矩阵
x=zgf(a,b,c,d)
```

3. 计算结果

```
x =

  Columns 1 through 17

    0.8581    0.7022    0.7153    0.7142    0.7143    0.7143    0.7143    0.7143    0.7143
0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143

  Columns 18 through 34

    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143
0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143

  Columns 35 through 51

    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143
0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143

  Columns 52 through 68

    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143
0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143

  Columns 69 through 85

    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143
0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143

  Columns 86 through 101

  0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143    0.7143
0.7143    0.7143    0.7143    0.7142    0.7153    0.7022    0.8581
```

附：验证手写作业的代码 check.m

```
clc,clear;
%% practice2.2
A1=[1,13,-2,-34;2,6,-7,-10;-10,-1,5,9;-3,-5,0,15];
b1=[13;-22;14;-36];
x1=A1\b1

%% practice2.3
A2=[15,7,0,10;6,18,15,9;0,10,28,7;5,0,6,35];b2=[8;6;4;2];
[L2,U2]=lu(A2);
y2=L2\b2;
x2=U2\b2

%% practice2.5
A3=[4,-1,0,0,0;-1,4,-1,0,0;0,-1,4,-1,0;0,0,-1,4,-1;0,0,0,-1,4];
b3=[5;8;16;24;36];
R3=chol(A3);
y3=R3'\b3
x3=R3\y3

%% practice2.6
a4=[1,1,1,1];c4=a4;
b4=12*ones(5,1);
d4=[11,10*ones(1,3),11];
x4=zgf(a4,b4,c4,d4)

%% practice2.8
a5=[6,2;3,5];
b5=[3,1;0,6];
c5=[4,0;0,4];
d5=[9,5;7,4];
A5=[a5,b5;c5,d5];
[L,U]=lu(A5)
```