```
clc;
clear;
```

Question 1

```
a = 2;
b = 1;
c = 1;

C = [a b; b c];

iters = 1;
C_k = chol_alg(C, iters);

disp(C_k);
```

Problem 2

```
eps = 1e-10;
B = [2 eps; eps 1];

% Compute one step of the QR algorithm with and without a shift
iters = 1;
B_k_1 = qr_alg(B, 0, iters);
B_k_2 = qr_alg(B, 1, iters);

% disp(B_k_1);
% disp(B_k_2);
```

Question 3

```
n = 99;
sub_diag  = ones(n, 1);
main_diag = 2*ones(n+1, 1);
A = diag(main_diag) + diag(sub_diag, -1) + diag(sub_diag, 1);

iters = 1000;
A_k = qr_alg(A, 0, iters);


% Compare the error between the eigenvalues returned by the QR iteration
% and MATLAB's eigs function
E_computed = diag(A_k);
E_actual   = eigs(A, n+1);

disp(abs(E_computed - E_actual));

function [A_prev] = chol_alg(A, iters)
    A_prev = A;
    for k = 1:iters
        A_prev = chol(A_prev); A_prev = A_prev*A_prev';
    end
end
```

```
function [A_prev] = qr_alg(A, mu, iters)
    A_prev = A;
    for k = 1:iters
        [Q_prev, R_prev] = qr(A_prev - mu*eye(size(A)));
        A_prev = R_prev*Q_prev + mu*eye(size(A));
    end
end
```

```
   2.500000000000000   0.500000000000000
   0.500000000000000   0.500000000000000

   0.002028075561455
   0.003111603508338
   0.002288953958013
   0.000027949547963
   0.001900416781986
   0.002105722675200
   0.001487381051598
   0.000903995085260
   0.000511282540006
   0.000274624490019
   0.000141311812393
   0.000070052322813
   0.000033599495316
   0.000015645452863
   0.000007091898202
   0.000003135983932
   0.000001354961029
   0.000000572730654
   0.000000237044719
   0.000000096124615
   0.000000038206343
   0.000000014887584
   0.000000005687550
   0.000000002130116
   0.000000000781934
   0.000000000281265
   0.000000000099097
   0.000000000034144
   0.000000000011531
   0.000000000003817
   0.000000000001219
   0.000000000000388
   0.000000000000123
   0.000000000000026
   0.000000000000024
   0.000000000000027
   0.000000000000024
   0.000000000000004
   0.000000000000017
   0.000000000000002
   0.000000000000011
   0.000000000000016
```

0.000000000000013
0.000000000000004
0.000000000000008
0.000000000000001
0.000000000000014
0.000000000000005
0.000000000000004
0.000000000000018
0.000000000000003
0.000000000000003
0.000000000000004
0.000000000000002
0.000000000000007
0.000000000000003
0.000000000000003
0.000000000000014
0.000000000000002
0.000000000000002
0.000000000000003
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