

```
%function of CG
%function CG = CG(A,b,tol)
%k = 0;
%x = zeros(25);
%x = x(:,1);
%r = b - A*x;
%rho = r'*r;
%delta = tol * norm(b);
%while rho^0.5 > delta
%    k = k+1;
%    if k == 1;
%        p = r;
%    else
%        tau = rho/rho_ ;
%        p = r + tau*p;
%    end
%    w = A*p;
%    mu = rho/(p'*w);
%    x = x + mu*p;
%    r = r - mu*w;
%    rho_ = rho;
%    rho = r'*r;
%end
%G = x
%end

%try to identify the 50-by-50 matrix first
%here i use a diagonal matrix, with the biggest diagonal entry is 10^8
%and the smallest one is 1.
%the conditional number of this matrix should be 10^4
a = linspace(10^8,1,25);
A = diag(a)
A = diag(a);
exact_x = ones(25);
exact_x = exact_x(:,1)*2
exact_x =
```

2

```
b = A*exact_x
```

```
b =
```

```
1.0e+08 *
```

```
2.0000
```

```
1.9167
```

```
1.8333
```

```
1.7500
```

```
1.6667
```

```
1.5833
```

```
1.5000
```

```
1.4167
```

```
1.3333
```

```
1.2500
```

```
tol_1 = 10^-4 %tol must be much smaller than 10^-4
```

```
tol_1 = 1.0000e-04
```

```
tol_2 = 10^-10
```

```
tol_2 = 1.0000e-10
```

```
CG(A,b,tol_1)
```

```
G =
```

```
2.0000
```

```
2.0000
```

```
2.0000
```

```
1.9999
```

```
2.0002
```

```
1.9998
```

```
2.0001
```

```
2.0001
```

```
1.9998
```

```
1.9999
```

```
%with high tol of 10^-4, the generated x is not close to the exact x
```

```
CG(A,b,tol_2)
```

```
G =
```

```
2.0000
```

```
2.0000
```

```
2.0000
```

```
2.0000
```

```
2.0000
```

```
2.0000
```

```
2.0000
```

```
2.0000
```

```
2.0000
```

```
2.0000
```

```
%with a low tol of 10^-10, the generated x is pretty close to the exact x
```