

```

A=[ 1    2    3    4;
    -1   2    5   -2;
     2    0    4   -3;
    10   -1   -3    0;
     1    1    1   -1];
[n,m]=size(A);
b=ones(n,1);

% Es. 1.i
% Risoluzione minimi quadrati con QR
xQR=minquad_house(A,b);

% Es. 1.ii
% Risoluzione minimi quadrati con eqn. normale
xCHOL=minquad_chol(A,b);

norm(xQR-xCHOL)

% Es 1.iii
k=0;
for delta=10.^(-3:-1:-9)

    k=k+1;
    A=[1 1; -2 -2; 0 delta];
    b=ones(3,1);
    xQR=minquad_house(A,b);
    xCHOL=minquad_chol(A,b);
    x_true=A\b;
    normx=norm(x_true);

    erQR(k)=norm(xQR-x_true)/normx;
    if isempty(xCHOL)
        erCHOL(k)=1e10;
    else
        erCHOL(k)=norm(xCHOL-x_true)/normx;
    end

end

loglog(10.^(-3:-1:-9), erQR,'-o')
hold on
loglog(10.^(-3:-1:-9), erCHOL,'r-*')
hold off
xlabel('delta')
ylabel('errore relativo')
legend('minquad con QR','minquad con eqn.norm')

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%          CUT HERE
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
function x=minquad_house(A,b)

[n,m]=size(A);
R=A;

for k=1:m
    x=R(k:n,k);
    alpha = - sign(x(1))*norm(x);
    e1=eye(n-k+1,1);
    v=x-alpha*e1;
    beta = 2/(v'*v);
    R(k:n,k:m)=R(k:n,k:m) - v*(beta*(v'*R(k:n,k:m)));
    b(k:n)=b(k:n) - v*(beta*(v'*b(k:n)));
end

```

```
% Sostituire con il risolutore per sistemi triangolari sup
x = R(1:m,1:m)\b(1:m);
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
% CUT HERE
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
function x = minquad_chol(A,b);
```

```
[L,flag]=chol(A'*A,'lower');
fprintf('num.cond L con Chol:  %d\n',cond(L))
```

```
if flag==0
```

```
% Alternativa che evita il prodotto
```

```
[n,m]=size(A);
```

```
[~,R]=QR_house(A); L=R(1:m,1:m)';
```

```
fprintf('num.cond L con QR:  %d\n',cond(L))
```

```
x=L'\( L\ (A'*b));  %sostituire "\" con i risolutori per matrici triang.
```

```
else
```

```
fprintf('Matrice non definita positiva\n')
```

```
x=[];
```

```
end
```