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%{
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Description: Input A, b, out x as the solution of Ax=b,
Check the sizes of the matrices.
Partial Pivoting.
Alert to singular system and ill-conditioned systems.

%}
clear all;
close
t=0;
%disp(['Please Input Matrix A,b']);  % I wrote it for input
%A=input ('Enter matrix A = ');
%b=input ('Enter matrix b = ');
A = [3 -1 3 1; 6 0 9 -2; -12 0 -10 5;72 -8 48 -19];
b = [6;13;17;93];
%Check the sizes of the matrices
[mA, nA]=size(A);
[mb, nb]=size(b);
B=[A,b];
if mA ~= nA || nA ~= mb || nb~=1 ;
    disp('Matrices size error')
end
if det(A) == 0;
    disp('Singular system')
end
if cond(A)> 1000;
    disp('ill-conditioned system');
end
for i= 1:1:mA-1 %loop to second last row
    z=B(:,i); % assign i column to z to preparation for max
    [p,q]=max(abs(z(i:mA))); %  find the absoute value max term and
 its position of terms that are below "digonal" in each column.
    if (q-1+i) ~= i
        B([i,q-1+i],:) = B([q-1+i,i],:); % exchange the "larest" row
 with the "top" row. ONLY for those "under" digonal.
        t=t+1; % t to record row exchange performed
    end
    for g=i+1:1:mA
        B(g,:)=B(g,:)-B(g,i)/B(i,i).*B(i,:);  % get rid of term
 A(g,i), A becomes a upper triangle matix.
    end
end
   %back substitution
z=B(:,mA+1);
x=zeros(mA,1);
x(mA)=z(mA)/B(mA,mA); % calculate xn first
for i=mA-1:-1:1
    s=0;
    for g=i+1:1:mA
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        s=s+B(i,g)*x(g); %s= sum of xn multiple coefficients that
 already solved.
    end
    x(i)=(z(i)-s)/B(i,i);
end
x
sprintf('Ax-b = ')
disp([A*x-b])
sprintf('row exchange performed %d time(s)', t)
```

```
x =

  -26.6250
  -94.6250
   10.3500
  -39.8000


ans =

Ax-b =

   1.0e-12 *

   -0.0213
         0
         0
   -0.1137


ans =

row exchange performed 2 time(s)
```

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