Problem - 2

Function:

```
function [A,b] = gauss_em(A,b)
format rat
n = size(A,1);
for i = 1:n-1
    for k = i+1:n
        for j = i+1:n
            A(k,j) = A(k,j) - A(i,j)*A(k,i)/A(i,i);
        end
        b(k) = b(k) - A(k,i)/A(i,i)*b(i);
        A(k,i) = 0;
    end
end
End

function x = back_sub(A,b)
n=size(A,1);
for i = n:-1:1
    for j = i+1:n
        b(i) = b(i) - A(i,j)*x(j);
    end
    x(i) = b(i)/A(i,i);
end
end
```

Main code:

```
A =[2 -2 -1;4 1 -2;-2 1 -1]; % input the matrix
b =[-2,1,-3]; % input the vector
b = b';
[A,b] = gauss_em(A,b);
x = back_sub(A,b)
A =[1 2 -1;0 3 1;2 -1 1]; % input the matrix
b =[2,4,2]; % input the vector
b = b';
[A,b] = gauss_em(A,b);
x = back_sub(A,b)
A =[2 1 -4;1 -1 1;-1 3 -2]; % input the matrix
b =[-7,-2,6]; % input the vector
b = b';
[A,b] = gauss_em(A,b);
x = back_sub(A,b)
```

Problem - 3

Function:

```
function H = hilbert_matrix(n)
format rat
for i = 1:n
    for j = 1:n
        H(i,j) = 1/(i+j-1);
    end
end
end
```

Main:

```
n = 10; % input n (n = 2, 5, 10)
H=hilbert_matrix(n);
b = ones(n,1);
b = b';
[A,b] = gauss_em(H,b);
x = back_sub(A,b)
```

Answer:

When n is 2:

X = [-2, 6]

When n is 5:

X = [5, -120, 630, -1120, 630]

When n is 10:

X = [-9.99726592295338 989.763036748453 -23754.9411217005 240193.927668624 -1261039.93432433 3783174.35578543 -6725725.40441471 7000318.10320356 -3937714.68846575 923668.813948343]

Problem - 5

```
function A = matrix_norm(A)
m = size(A,1);
n = size(A,2);
b = zeros(m,1);
for i = 1:m
    for j = 1:n
        b(i)=b(i)+abs(A(i,j));
    end
end
A = max(b);
End

function num = cond_num(A)
num = matrix_norm(A)*matrix_norm(inv(A));
end
```

Problem - 8

Function:

```
function  A = matrix(n)
for i = 1:n
    for j = 1:n
        A(i,j) = 5/(i+2*j-1);
    end
end
end
```

Main:

```
n = 10; % input n(n = 6, 10)
A = matrix(n);
b = A*ones(n,1);
format long
xc = A\b;
matrix_norm(ones(n,1)-xc)
emf = matrix_norm(ones(n,1)-xc)*matrix_norm(b)/matrix_norm(b-A*xc)
cond_num(A)
```