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)