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Math 143m

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Project 2

Graphical user interface, text, application, email

Description automatically generated

1. **Your computer program (which should be about half a page)**

Matlab

n=20

h\_1 = zeros(n, n); %Initialize n by n matrix

h\_1 = hilb(n); %hilebert 20 matrix

disp(h\_1);

x = zeros(n,1) %X\_0

r = zeros(n,1) %residual

b=zeros(n,1) % b vector

for i = 1:n

b(i)=sum(h\_1(i,:)) %The loop to sum row of h as b vector

x(i)=0 % Set x\_0 vector value . 1, 0, 0, 0, 0, 0, 0, 0...

end

x(1) = 1 %The number of first row X\_0

r = h\_1\*x - b; %r\_0

v = r \* -1 %v\_0

disp(r)

t = (transpose(r) \* v)/(transpose(v)\*h\_1\*v)\*-1 %t\_0

error\_norm=norm(r, 'Inf') %infinity norm for X\_0

if (error\_norm < 0.001) % Determine whether |norm X\_0|infinity is less than 0.001 or not

p=1;

else

p=75; %Set number of iteration

end

j=0; %Counter for number of iteration

for i = 1:p % Start from x\_1 . and calculate conjugate gradient through loop

r = h\_1\*x-b; %The previous steps to get r, t, v, X are repeated during 75-iterations.

v = r\*-1

t = (transpose(r) \* v)/(transpose(v)\*h\_1\*v)\*-1

x = x +t\*v;

j=i;

fprintf('The residual vecdtor in X\_%i \n', i )

fprintf('%6.4f\n', r); %residual vector format

error\_norm = norm(r, 'Inf') %|norm X\_n|infinity

if (error\_norm < 0.001) % If |norm X\_n|infinity is less than 0.0001. The loop end.

break;

end

end

fprintf('The number of iteration : %6i\n', j);

fprintf('|Residual for X\_n| infinity : ');

disp(error\_norm) % the last result for number of iteration and |norm X\_n|infinity

1. **Your converged solution or the vector x75 (the 75th iteration)**

The residual vector in X\_56

0.0010

-0.0008

0.0001

0.0006

0.0008

0.0008

0.0007

0.0006

0.0005

0.0004

0.0002

0.0001

-0.0000

-0.0001

-0.0002

-0.0003

-0.0003

-0.0004

-0.0005

-0.0005

The number of iteration : 56

|Residual for X\_n| infinity : 9.8863e-04

1. **How many iterations did your program take?**

Above the result has shown program took 56 iteration. |Residual for X\_n| infinity was 0.00098863 in 56 iterations. That was less than 0.001 Thus, my program was stopped.