%solve.m

function [solution] = solve(UV)

solution = zeros(size(UV, 1), 1);

for i = size(UV, 1):-1:1

UV(i, :) = UV(i, :) / UV(i, i);

for j = 1:(i - 1)

UV(j, :) = UV(j, :) - UV(j, i) / UV(i, i) \* UV(i, :);

end

solution(i) = UV(i, size(UV, 2));

end

end

3.

%p124.m

UV = [4, -1, 2, 2, -1, 4;

0, -2, 6, 2, 7, 0;

0, 0, 1, -1, -2, 3;

0, 0, 0, -2, -1, 10;

0, 0, 0, 0, 3, 6];

solution = solve(UV);

∴ x1 = 5

x2 = 4

x3 = 1

x4 = -6

x5 = 2

∴ D = 4 \* (-2) \* 1 \* (-2) \* 3 = 48

4.(a) c21 = a21 \* b11 + a22 \* b21 + a23 \* b31 = 0

c31 = a31 \* b11 + a32 \* b21 + a33 \* b31 = 0

c32 = a31 \* b12 + a32 \* b22 + a33 \* b32 = 0

%eliminate.m

function [UY] = eliminate(AB)

for i = 2:size(AB, 1)

for j = 1:(i - 1)

AB(i, :) = AB(i, :) - AB(i, j) / AB(j, j) \* AB(j, :);

end

end

UY = AB;

end

%p137.m

AB1 = [2, 4, -6, -4;

1, 5, 3, 10;

1, 3, 2, 5];

UV1 = eliminate(AB1);

solution1 = solve(UV1);

AB9 = [2, 4, -4, 0, 12;

1, 5, -5, -3, 18;

2, 3, 1, 3, 8;

1, 4, -2, 2, 8];

UV9 = eliminate(AB9);

solution9 = solve(UV9);

1. ∴ 2 4 -6 -4

0 3 6 12

0 0 3 3

∴ x1 = -3

x2 = 2

x3 = 1

2. ∴ 2 4 -4 0 12

0 3 -3 -3 12

0 0 4 2 0

0 0 0 3 -6

∴ x1 = 2

x2 = 3

x3 = 1

x4 = -2

1.

%p153t1.m

L = [1, 0, 0;

1/2, 1, 0;

1/2, 1/3, 1];

B = [-4;

10;

5];

U = [2, 4, -6;

0, 3, 6;

0, 0, 3];

A = [2, 4, -6;

1, 5, 3;

1, 3, 2];

Y = L \ B;

X1 = U \ Y;

X2 = A \ B;

∴ Y = [-4;12;3]

X1 = [-3;2;1]

X2 = [-3;2;1]

∴ X1 = X2

%factorize.m

function [L, U] = factorize(A)

U = A;

for i = 2:size(A, 1)

for j = 1:(i - 1)

U(i, :) = U(i, :) - U(i, j) / U(j, j) \* U(j, :);

end

end

L = A / U;

end

%p153.m

A4a = [4, 2, 1;

2, 5, -2;

1, -2, 7];

[L4a, U4a] = factorize(A4a);

A4b = [1, -2, 7;

4, 2, 1;

2, 5, -2];

[L4b, U4b] = factorize(A4b);

A6 = [1, 1, 0, 4;

2, -1, 5, 0;

5, 2, 1, 2;

-3, 0, 2, 6];

[L6, U6] = factorize(A6);

4. (a)∴ L =

1 0 0

0.5 1 0

0.25 -0.625 1

U =

4 2 1

0 4 -2.5

0 0 5.1875

(b)∴ L =

1 0 0

4 1 0

2 0.9 1

U =

1 -2 7

0 10 -27

0 0 8.3

6. ∴ L =

1 0 0 0

2 1 0 0

5 1 1 0

-3 -1 -1.75 1

U =

1 1 0 4

0 -3 5 -8

0 0 -4 -10

0 0 0 -7.5

%jacobi.m

function [P] = jacobi(A, B, P0, k)

P = zeros(size(A, 2), k);

coef = [-A, B];

for i = 1:size(A, 1)

coef(i, :) = coef(i, :) / A(i, i);

coef(i, i) = 0;

end

P(:, 1) = coef \* [P0; 1];

for i = 2:k

P(:, i) = coef \* [P(:, i - 1); 1];

end

end

%gauss\_seidel.m

function [P] = gauss\_seidel(A, B, P0, k)

P = zeros(size(A, 2), k);

coef = [-A, B];

for i = 1:size(A, 1)

coef(i, :) = coef(i, :) / A(i, i);

coef(i, i) = 0;

end

P(:, 1) = P0;

for j = 1:size(A, 2)

P(j, 1) = coef(j, :) \* [P(:, 1); 1];

end

for i = 2:k

P(:, i) = P(:, i - 1);

for j = 1:size(A, 2)

P(j, i) = coef(j, :) \* [P(:, i); 1];

end

end

end

%gauss\_seidel\_parallel.m

function [P] = gauss\_seidel\_parallel(A, B, P0, k)

P = zeros(size(A, 2), k);

coef = [-A, B];

for i = 1:size(A, 1)

coef(i, :) = coef(i, :) / A(i, i);

coef(i, i) = 0;

end

coef\_ex = coef;

for i = 2:size(A, 1)

for j = 1:i - 1

coef\_ex(i, :) = coef\_ex(i, :) + coef(i, j) \* coef\_ex(j, :);

coef\_ex(i, j) = 0;

end

end

P(:, 1) = coef\_ex \* [P0; 1];

for i = 2:k

P(:, i) = coef\_ex \* [P(:, i - 1); 1];

end

end

%d.m

function [res] = d(A)

res = zeros(1, size(A, 2) - 1);

for i = 1:size(A, 2) - 1

sum(abs(A(:, i + 1) - A(:, i)))

res(1, i) = sum(abs(A(:, i + 1) - A(:, i)));

end

end

%p165.m

A1 = [4, -1;

1, 5];

B1 = [15; 9];

P11 = jacobi(A1, B1, zeros(size(A1, 2), 1), 3);

P12 = gauss\_seidel(A1, B1, zeros(size(A1, 2), 1), 3);

P13 = gauss\_seidel\_parallel(A1, B1, zeros(size(A1, 2), 1), 3);

d11 = d(P11);

d12 = d(P12);

A3 = [-1, 3;

6, -2];

B3 = [1; 2];

P31 = jacobi(A3, B3, zeros(size(A3, 2), 1), 3);

P32 = gauss\_seidel(A3, B3, zeros(size(A3, 2), 1), 3);

P33 = gauss\_seidel\_parallel(A3, B3, zeros(size(A3, 2), 1), 3);

d31 = d(P31);

d32 = d(P32);

A5 = [5, -1, 1;

2, 8, -1;

-1, 1, 4];

B5 = [10; 11; 3];

P51 = jacobi(A5, B5, zeros(size(A5, 2), 1), 3);

P52 = gauss\_seidel(A5, B5, zeros(size(A5, 2), 1), 3);

P53 = gauss\_seidel\_parallel(A5, B5, zeros(size(A5, 2), 1), 3);

d51 = d(P51);

d52 = d(P52);

1. ∴ Jacobi: P1 = 3.75

1.8

P2 = 4.2

1.05

P3 = 4.0125

0.96

∴ d = 1.2, 0.2775

Yes

∴ Gauss-Seidel: P1 = 3.75

1.05

p2 = 4.0125

0.9975

p3 = 3.999375

1.000125

∴ d = 0.315, 0.01575

∴ Yes

3. ∴ Jacobi: P1 = -1

-1

P2 = -4

-4

P3 = -13

-13

∴ d = 6, 18

∴ No

∴ Gauss-Seidel: P1 = -1

-4

p2 = -13

-40

p3 = -121

-364

∴ d = 48, 432

∴ No

5. ∴ Jacobi: P1 = 2

1.375

0.75

P2 = 2.125

0.96875

0.90625

P3 = 2.0125

0.95703125

1.0390625

∴ d = 0.6875, 0.25703125

∴ Yes

∴ Gauss-Seidel: P1 = 2

0.875

1.03125

p2 = 1.96875

1.01171875

0.9892578125

p3 = 2.0044921875

0.9975341796875

1.00173950195313

∴ d = 0.2099609375, 0.0624084472656249

∴ Yes