Assignment 2

Group Number 32

Software used: **Matlab**

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1. Gauss elimination without pivoting

Code	Output

A]
 	
A=[1,1,-1;3,1,1;1,-1,4]
b=[1;9;8]
 	
B] Gauss elimination without pivoting
 	
`fprintf('\n\nGauss Elimination without pivoting\n\n')`
 	
`A=[1,1,-1;3,1,1;1,-1,4];`
`b=[1;9;8];`
`[n, n] = size(A);`
`[n, k] = size(b);`
 	
`%Top-down row reduction`
 	
`for i = 1:n-1`
`  r = -A(i+1:n,i)/A(i,i);`
`  fprintf('Step %d\n',i);`
`  A(i+1:n,:) = A(i+1:n,:) + r*A(i,:)`
`  b(i+1:n,:) = b(i+1:n,:) + r*b(i,:)`
`end;`
 	
`%Back substitution`
 	
`x(n) = b(n)/A(n,n);`
 	
`for i = n-1:-1:1`
`  x(i,:) = (b(i,:) - A(i,i+1:n)*x(i+1:n,:))/A(i,i);`
`end`
`x(1:n)`
	A]
	$x_1 + x_2 - x_3 = 1$
	$3x_1 + x_2 + x_3 = 9$
	$x_1 - x + 4x_3 = 8$
	
	Output:
	
	A =
	
	1 1 -1
	3 1 1
	1 -1 4
	
	b =
	
	1
	9
	8

B]

$$x_1 + x_2 - x_3 = 1$$
$$3x_1 + x_2 + x_3 = 9$$
$$x_1 - x + 4x_3 = 8$$

Output:

Gauss Elimination without pivoting

Step 1

A =

```
    1    1   -1
    0   -2    4
    0   -2    5
```

b =

```
    1
    6
    7
```

Step 2

A =

```
    1    1   -1
    0   -2    4
    0    0    1
```

b =

```
    1
    6
    1
```

ans =

```
    3
   -1
    1
```

C] Matrix Inversion Method

```
fprintf('\n\nMatrix Inversion
Method\n\n')

A=[1,1,-1;3,1,1;1,-1,4];
b=[1;9;8];
[n, n] = size(A);
[n, k] = size(b);

%Top-down row reduction

for i = 1:n-1
    r = -A(i+1:n,i)/A(i,i); % Multiplier
    A(i+1:n,:) = A(i+1:n,:) + r*A(i,:);
    b(i+1:n,:) = b(i+1:n,:) + r*b(i,:);
end;

fprintf('Matrix after Top-down row
reduction\n');
A

%Bottom-up row reduction

for i=n:-1:2
    fprintf('Bottom-up row reduction\n');
    r=-A(1:i-1,i)/A(i,i); % Multiplier
    A(1:i-1,:)=A(1:i-1,:)+r*A(i,:)
    b(1:i-1,:) = b(1:i-1,:) + r*b(i,:);

end

for i = 1:n
    x(i,:) = b(i,:)/A(i,i);
end
x=x(1:n,:)
```

C]

Output:

Matrix Inversion Method

Matrix after Top-down row reduction

A =

1	1	-1
0	-2	4
0	0	1

Bottom-up row reduction

A =

1	1	0
0	-2	0
0	0	1

Bottom-up row reduction

A =

1	0	0
0	-2	0
0	0	1

x =

3
-1
1

Equation	Root
$x_1 + x_2 - x_3 = 1$ $3x_1 + x_2 + x_3 = 9$ $x_1 - x + 4x_3 = 8$	$x_1 = 3$ $x_2 = -1$ $x_3 = 1$

2. Gauss elimination with pivoting

$2x_1 + x_2 + x_3 = 5$
$4x_1 - 6x_2 = -2$
$-2x_1 + 7x + 2x_3 = 9$

Code	Output

B] Gauss elimination with partial pivoting
 	
`fprintf('\n\nGauss Elimination Method with partial pivoting\n')`
`A=[2,1,1;4,-6,0;-2,7,2]`
`b=[5;-2;9];`
`[n,n]=size(A);`
`[n,k]=size(b);`
`for i=1:n-1`
 	
`%Dominant element in column`
`[B,I] = sort(A(1:n,i),'descend') ;`
`[p,q]=size(I);`
 	
`%For repeating elements in column`
`if p>1`
`row = I(i);`
`else`
`row= I(1);`
`end`
 	
`%Dominant row swap`
`T(1,:)=A(i,:);`
`A(i,:)=A(row,:);`
`A(row,:)=T(1,:);`
 	
`BT(1)=b(i);`
`b(i)=b(row);`
`b(row)=BT(1);`
 	
`%Row operations`
`r = -A(i+1:n,i)/A(i,i);`
`fprintf('Step %d\n',i);`
`A(i+1:n,:) = A(i+1:n,:) + r*A(i,:)`
`b(i+1:n,:) = b(i+1:n,:) + r*b(i,:)`
 	
`end`
 	
`% Back Substitution`
`x(n,:) = b(n,:)/A(n,n);`
`for i = n-1:-1:1`
`x(i,:) = (b(i,:) -`
`A(i,i+1:n)*x(i+1:n,:))/A(i,i);`
`end`
`x=x(1:n,:)`
	A]
	$2x_1 + x_2 + x_3 = 5$
	$4x_1 - 6x_2 = -2$
	$-2x_1 + 7x + 2x_3 = 9$
	
	Output:
	
	Gauss Elimination Method with partial pivoting
	
	A =
	
	2 1 1
	4 -6 0
	-2 7 2
	
	Step 1
	
	A =
	
	4 -6 0
	0 4 1
	0 4 2
	
	b =
	
	-2
	6
	8
	
	Step 2
	
	A =
	
	4 -6 0
	0 4 2
	0 0 -1

	b = -2 8 -2 x = 1 1 2

Equation	Root
$2x_1 + x_2 + x_3 = 5$ $4x_1 - 6x_2 = -2$ $-2x_1 + 7x + 2x_3 = 9$	$x_1 = 1$ $x_2 = 1$ $x_3 = 2$