

```

> restart;
>
> jacobi := proc(A::Matrix,b::Vector,x0::Vector,tol::positive,
n::nonnegint,v::name)
local AA, B, OK, N, I, J, X0, X1, TOL, NN, K, ERR, S, X;
with(LinearAlgebra);
N:=RowDimension(A);
AA:=A;
B:=b;
X0:=x0;
TOL:=tol;
NN:=n;
X1:=Vector(N);

```

STEP 1

```

> K := 0;
> OK := FALSE;
printf(`  n      x\n`);
printf(`  -      -\n`);
printf(`%3d    [`,K);
for I from 1 to N do
printf(`% 12.8f`,X0[I]);
if I<>N then printf(`,`) fi;
od;
printf(`]\n`);
K:=1;

```

STEP 2

```

> while OK = FALSE and K <= NN do

```

err is used to test accuracy - it measures the infinity-norm

```

> ERR := 0;

```

STEP 3

```

> for I from 1 to N do
> S := 0;
> for J from 1 to I-1 do
> S := S-A[I,J]*X0[J];
> od;
> for J from I+1 to N do
> S := S-A[I,J]*X0[J];
> od;
> S := evalf((S+B[I])/A[I,I]);
> if abs(S-X0[I]) > ERR then
> ERR := abs(S-X0[I]);
> fi;

```

use X1 for X

```

> X1[I] := S;
> od;
printf(`%3d    [`,K);
for I from 1 to N do
printf(`% 12.8f`,X1[I]);
if I<>N then printf(`,`) fi;
od;
printf(`]\n`);

```

STEP 4

```

> if ERR <= TOL then
> OK := TRUE;
> fi;

```

process is complete

STEP 5

```

> K := K+1;

```

STEP 6

```

> for I from 1 to N do
> X0[I] := X1[I];
> od;
> od;
> if OK = FALSE then
> printf(`Maximum Number of Iterations Exceeded.\n`);

```

STEP 7

procedure completed unsuccessfully

```

> else
> printf(`\nThe solution vector is\n`,args[6]);
> v:=evalm(X1);
  fi;
end;

```

Warning, imaginary unit `I` used as a local variable in procedure jacobi
jacobi := proc (A::Matrix, b::Vector, x0::Vector, tol::positive, n::nonnegint, v::name)

local AA, B, OK,

N, I, J, X0, X1, TOL, NN, K, ERR, S, X;

with(LinearAlgebra);

N := RowDimension(A);

AA := A;

B := b;

X0 := x0;

TOL := tol;

NN := n;

X1 := Vector(N);

K := 0;

OK := FALSE;

*printf(` n x`
`);*

*printf(` - -`
`);*

printf(`%3d [`, K);

for I to N **do**

printf(`% 12.8f`,

X0[I]);

if I <> N **then**

printf(`,`)

end if

end do;

*printf(``
`);*

K := 1;

```

while  $OK = FALSE$  and  $K \leq NN$  do
     $ERR := 0$ ;
    for  $I$  to  $N$  do
         $S := 0$ ;
        for  $J$  to  $I - 1$  do
             $S := S - A[I, J] * XO[J]$ 
        end do;
        for  $J$  from  $I + 1$  to  $N$  do
             $S := S - A[I, J] * XO[J]$ 
        end do;
         $S := evalf((S + B[I]) / A[I, I]);$ 
        if  $ERR < abs(S - XO[I])$  then
             $ERR := abs(S - XO[I])$ 
        end if;
         $XI[I] := S$ 
    end do;
     $printf(\%3d \ [ , K)$ ;
    for  $I$  to  $N$  do
         $printf(\% 12.8f, XI[I])$ ;
        if  $I < > N$  then
             $printf( , \)$ 
        end if
    end do;
     $printf(\)$ 
         $\)$ ;
    if  $ERR \leq TOL$  then
         $OK := TRUE$ 
    end if;
     $K := K + 1$ ;
    for  $I$  to  $N$  do
         $XO[I] := XI[I]$ 
    end do
end do;
if  $OK = FALSE$  then
     $printf(\text{Maximum Number of Iterations Exceeded.}$ 
         $\)$ 

```

else

```
    printf(`  
        The solution vector is  
        `, args[6]);  
    v := evalm(X1)
```

end if

end proc

>

>

```
jacobi_dir:=proc()  
printf(`jacobi returns an approximation to a solution of a vector  
equation.\n\n`);  
printf(`The arguments for jacobi are:\n`);  
printf(`(1)the coefficient matrix (must be square)\n`);  
printf(`(2)the right hand side vector\n`);  
printf(`(3)the initial approximation vector\n`);  
printf(`(4)tolerance\n`);  
printf(`(5)maximum number of iterations\n`);  
printf(`(6)variable for returning the approximate solution\n\n`);  
printf(`If assigning the result to a variable, have the\n`);  
printf(`variable and the 6th argument the same.\n\n`);  
printf(`If v is the variable for returning the approximate  
solution\n`);  
printf(`and has already been given a value,\n`);  
printf(`the procedure should be preceded by the statement:\n`);  
printf(`v:='v'\n`);  
end;
```

jacobi_dir := proc()

printf(`jacobi returns an approximation to a solution of a vector equation.

`);

printf(`The arguments for jacobi are:

`);

printf(`(1)the coefficient matrix (must be square)

`);

printf(`(2)the right hand side vector

`);

printf(`(3)the initial approximation vector

`);

printf(`(4)tolerance

`);

printf(`(5)maximum number of iterations

`);

printf(`(6)variable for returning the approximate solution

```
    `);  
    printf(`If v is the variable for returning the approximate solution  
    `);  
    printf(`variable and the 6th argument the same.
```

```
    `);  
    printf(`If v is the variable for returning the approximate solution  
    `);  
    printf(`and has already been given a value,  
    `);  
    printf(`the procedure should be preceded by the statement:  
    `);  
    printf(`v:='v'`)
```

end proc

