ALGORITHM

On

NUMRICAL METHODS

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ASCENDING ORDER OF A SET OF NUMBERS

Arrange the following set of numbers in ascending order
385, 994, -234, -56, 0.

ALGORITHM

```
Step 1:   Read the number of numbers as n
Step 2:   If n<1 , then
                Write 'Incorrect input'
                Goto step 1
           Endif
Step 3:   For i=1 to n
                Read  a(i)
Step 4:   For i=1 to n
Step 5:         For j=i+1 to n
Step 6:             If (a(i) > a(j) )then
                        t=a(i)
                        a (i)=a(j)
                        a(j)=t
                    Endif
Step 7:   For i=1 to n
                write  a(i)
Step 8:   Stop
```

BISECTION METHOD

Find a root of the equation x^2-5x+6 using bisection method.

ALGORITHM

Step 1: Read a,b numbers between which the root is to be found

Step 2: Read e , error value

Step 3: If f(a)>0 and f(b)<0 then

w=a

a=b

b=w

Endif

Step 4: c=(a+b)/2

Step 5: If |f(c)|<e Goto Step 7

Step 6: If f(c)<0 Then

a=c

Else

b=c

Endif

Go to Step 4

Step 7: write c, the approximate root

Step 8: Stop

EULER'S METHOD

Solve the differential equation dy/dx = (y-x)/y+x) at x = 0 .1 using Euler's method in five steps. Given y(0) = 1

ALGORITHM

```
Step 1  :  Enter the initial values; x,y
Step 2  :  Enter the value at which the result is to be found , a
Step 3  :  Enter the number of steps required, n
Step 4  :  h = (a-x)/n
Step 5  :  write x ,y
Step 6  :  count = 1
Step 7  :  if (count < n)  then
               y = y + h *  f( x,y)
               x = x + h
               write x,y
               count = count + 1
               Goto step 7
            Endif
Step 8  :   Stop
```

FIBONACCI NUMBERS

Write a program to display the first first eight fibonacci numbers.

ALGORITHM

```
Step 1: f1=1
        f2=2
Step 2: Read the number of terms to be displayed
Step 3: If n=1 then
            write f1
        Else
            write f1,f2
Step 4: For i=3 to n
           f3=f1+f2
           write f3
           f1=f2
           f2=f3
Step 5: Stop
```

GAUSS ELIMINATION METHOD

Find the solution of linear system of of equation given by using Gauss elimination method with pivoting.

$$2x+y+z=10$$
$$3x+2y+3z=18$$
$$x+4y+9z=16$$

ALGORITHM

```
Step 1  :   Read number of variables in given system of equations ,n
Step 2  :   For i=1 to n
Step 3  :       For j=1 , n+1
                    Read a(i,j)
Step 4  :    For k=1 to n-1
                mx=|a(k,k)|
                p=k
Step 5  :       For m=k+1 to n
Step 6  :           If  (|a(m,k)|>mx) then
                        mx=|a(m,k)|
                        p=m
                    endif
step 7   :       If (mx<.00001) then
                     write 'ill-conditioned equations'
                     stop
                 endif
step 8   :     For q=k,n+1
                   temp=a(k,q)
                   a(k,q)=a(p,q)
                   a(p,q)=temp
step 9    :    For i=k+1 to n
                   u=a(i,k)/a(k,k)
step 10  :         For j=k to n+1
step 11  :             a(i,j)=a(i,j)-u*a(k,j)
step 12  :   If (|a(n,n)|=0) then
                 write 'ill-conditioned equations'
                 stop
             endif
step 13  :   x(n)=a(n,n+1)/a(n,n)
step 14  :   For i=n-1 to 1 in steps of -1
                 sum=0
step 15 :        For j=i+1 to n in steps of 1
step 16 :            sum=sum+a(i,j)*x(j)
step 17 :        x(i)= (a(i,n+1) – sum) / a(i,i)
step 18 :    For i=1 to n
                 write x(i)
Step 19:     Stop
```

GAUSS - SEIDEL METHOD

Solve the following system of equations using Gauss - Seidel method in 10 iterations.

$$10x-y-z=13$$
$$x+10y+z=36$$
$$-x-y+10z=35$$

ALGORITHM

```
Step 1   :    Read the number of variables,n
Step 2   :    Enter the coefficients in the equations; a(i,j) ,b(i)
Step 3   :    Enter the maximum number of iterations and the allowed relative error; m,e
Step 4   :    For i = 1 to n
                x(i) =0
Step 5   :    For k = 1 to m
               c =0
Step 6   :     For i = 1 to n
                    Sum  = 0
Step  7  :          For j = 1 to n
Step  8  :              If ( j != i) then
                            sum = sum + a(i,j) * x(j)
                        Endif
Step  9  :     t = (b(i) – sum)/a(i,i)
Step  10 :     r = abs ((x(i)-t)/t)
Step  11 :     If(r>c) then
                    c = r
               Endif
Step  12 :     x(i) = t
Step  13 :     If (c < = e) then
                    write ‘ converges to a solution ‘
                    Go to step 15
                Endif
Step  14 :    write ‘ System does not converge in the given number of iterations ‘
Step  15 :     For i  = 1 to n
                    Write  x(i)
Step  16 :     Stop
```

GCD AND LCM OF TWO NUMBERS

Find the gcd and lcm of 45 and lcm of 45 and 87.

ALGORITHM

```
Step 1:    Read a,b two numbers for which gcd and lcm is to be found.
Step 2:    m=a, n=b
Step 3:    If a>b , then
               j=a
               a=b
               b=j
           endif
Step 4:    i=mod(b,a)
Step 5:    If (i = 0) , then
               Write a
           else
               b=a
               a=i
               go to step 4
           endif
Step 6:    l=m*n/a
Step 7:    write l
Step 8:    Stop
```

LAGRANGE INTERPOLATION METHOD

Find the value of the function at x=5 using Lagrange interpolation method, the value of x and the corresponding function values are given below.

x	y
1	-3
3	0
4	30
6	132

ALGORITHM

```
Step 1:     Read n, the number of known function values
Step 2:     For i=1 to n
                read x(i),y(i)
Step 3:     Read a, the value of x for which the function value is to be found
Step 4:     s=0
Step 5:     For i=1 to n
                p=1
Step 6:         For j=1 to n
Step 7:             If (i ! = j ) then
                        p=p*(a-x(j))/(x(i)-x(j))
                    Endif
Step 8:         s=s+p*y(i)
Step 9:     Write a,s
Step 10:    Stop
```

METHOD OF TRIANGULARISATION

Solve the system of equations by method of triangularisation.

x+3y+8z=4
x+4y+3z=2
x+3y+4z=1

ALGORITHM

```
Step1:    Read n the number of equations
Step2:    Read a(i,j),b(i),i=1,2,…,n ;j=1,2,…,n
Step3:    For i=1 to n
Step4:        For j=i+1  to n
                  l(i,j)=0
Step5:        For j=1 to i-1
                  u(i,j)=0
              l(i,i)=1
              u(1,i)=a(1,i)
Step6:        If (i>1) l(i,1)=a(i,1)/u(1,1)
Step7:    For i=2 to n
Step8:        For j=2 to i-1
              s=0
Step9:        For k=1 to j-1
                  s=s+l(i,j)*u(k,j)
          l(i,j)=(a(i,j)-s)/u(j,j)
Step10:   For j=i to n
              s=0
Step11:       For k=1 to i-1
                  s=s+l(i,k)*u(k,j)
              u(i,j)=a(i,j)-s
Step12:   y(1)=b(1)
Step13:   For i=2 to n
              sum=0
Step14:       For j=1 to  i-1
                  sum=sum+l(i,j)*y(j)
              y(i)=b(i)-sum
Step15:   x(n)=y(n)/u(n,n)
Step16:   For i=n-1 to 1, in steps of -1
              sum=0
Step17:       For j=i+1 to n
                  sum=sum+u(i,j)*x(j)
              x(i)=(y(i)-sum)/u(i,i)
Step18:   Write x(i);i=1,2,…,n
Step19:   Stop
```

NEWTON RAPHSON METHOD

Find an approximate root of the function $f=x^2-5x+6$ using Newton-Raphson method

ALGORITHM

Step1: Read x, the initial root
Step2: Count=0
Step3: If (f'(x)=0)then
    Write 'the initial root is incorrect'
    Endif
Step4: y=x-f(x)/f'(x)
Step5: If (|f(y)|<0.00001) then
        Go to step9
    Endif
Step6: Count =count+1
Step7: If count>500 then
    Write 'an error has occurred'
    Endif
Step8: x=y
Step9: Goto step3
Step10: write y
Step11: Stop

NEWTON'S DIVIDED DIFFERENCE INTERPOLATION METHOD

Find the value of a function at x =2 using Newton's divided difference method, the value of x and the corresponding function values are given below:

x	y
0	2
1	1
4	4

ALGORITHM

```
Step 1: Read n, the number of known function values
Step 2: For i=1 to n
                Read x(i),y(i,1)
Step 3:     Read a, the value of x for which the function value is to be found
Step 4:     k=0
Step 5:     For j=2 to n
                k=k+1
Step 6:         For i=1 to n-k
                    y(i,j)=(y(i+1,j-1)-y(i,j-1))/(x(i+k)-x(i))
Step 7:     For i=1 to n
                write x(i)
Step 8:         For j=1 to n-i+1
                write y(i,j)
Step 9:     s=y(1,1)
Step10:     For j=2 to n
                p=1
Step11:         For i=1 to j-1
                  p=p*(a-x(i))
                s=s + p*y(1,j)
Step 12:    Write s
Step13:     Stop
```

NUMERICAL DIFFERENTIATION

Find the value of the derivative of a function at the point x=0.22 using numerical differentiation. The value of x and the corresponding function values are given below.

x	y
0.15	0.1761
0.21	0.3222
0.23	0.3617
0.27	0.4314
0.32	0.5051
0.35	0.5441

ALGORITHM

```
Step1:   Read n, number of known function values.
Step2:   For i=1 to n
              Read x(i) , y(i,1)
Step3:   Read a, value of x at which derivative is to be found.
Step4:   For j=2 to n
Step5:        For i=1 to n-j+1
                  y(i,j)=(y(i+1,j-1)-y(I,j-1))/(x(i+j-1)-x(i))
Step6:   v=y(1,2)
Step7:   For i=3 to n
              s=0
Step8:        For j=1 to i-1
                  p=1
Step9:            For k=1 to i-1
                       If (k != j) then
                            p=p*(a-x(k))
                  s=s+p
              v=v+s*y(1,i)
Step10:  Print v
Step11:  Stop
```

PRODUCT OF TWO MATRICES

Find the product of the following two matrices

$$\begin{matrix} 1 & 2 \\ 3 & 4 \end{matrix} \qquad\qquad \begin{matrix} 9 & 8 & 7 & 6 \\ 5 & 4 & 3 & 2 \end{matrix}$$

ALGORITHM

Step 1: Input the orders m, n and p, q of the two matrices

Step 2: If (n != p)Then

    Write'Matrices are not conformable for multiplication'

    Go to Step 12

Step 3: For i=1 to m

Step 4: For j=1 to n

    Read a(i,j)

Step 5: For i=1 to p

Step 6: For j=1 to q

    Read b(i,j)

Step 7: For i=1 to m

Step 8: For j=1 to q

    c(i,j)=0

Step 9: For k=1 to n

    c(i,j)=c(i,j)+a(i,k)*b(k,j)

Step10: For i=1 to m

Step 11: For j=1 to q

    write c(i,j)

Step 12: Stop

PRODUCT OF TWO MATRICES

Find the product of the following two matrices

1	2		9	8	7	6
3	4		5	4	3	2

ALGORITHM

Step 1: Input the orders m,n and p,q of the two matrices

Step 2: If (n != p)Then
    Write'Matrices are not conformable for multiplication'
    Go to Step 12

Step 3: For i=1 to m

Step 4: For j=1 to n
        Read a(i,j)

Step 5: For i=1 to p

Step 6: For j=1 to q
        Read b(i,j)

Step 7: For i=1 to m

Step 8: For j=1 to q
        c(i,j)=0

Step 9: For k=1 to n
            c(i,j)=c(i,j)+a(i,k)*b(k,j)

Step10: For i=1 to m

Step 11: For j=1 to q
        write c(i,j)

Step 12: Stop

RUNGE-KUTTA FOURTH ORDER METHOD.

Solve dy/dx = x+y at x = 0.4 in 4 steps given y(0)=1 using Runge Kutta fourth order method.

ALGORITHM

Step 1: Read x1,y1 initial values.

Step 2: Read a, value at which function value is to be found.

Step 3: Read n, the number of steps.

Step 4: count=0

Step 5: h=(a-x1)/n

Step 6: write x1,y1

Step 7: s1=f(x1,y1)

Step 8: s2=f(x1+h/2,y1+s1*h/2)

Step 9: s3=f(x1+h/2,y1+s2*h/2)

Step 10: s4=f(x1+h,y1+s3*h)

Step 11: y2=y1+(s1+2*s2+2*s3+s4)*h/6

Step 12: x2=x1+h

Step 13: write x2,y2

Step 14: count=count+1

Step 15: If count<n . then

x1=x2

y1=y2

go to step step 7

endif

Step 16: write x2,y2

Step 17: Stop

RUNGEKUTTA SECOND ORDER METHOD

Solve dy/dx=x+y at x=0.4 in four steps given y(0)=1 using Rungekutta second order method.

ALGORITHM

Step 1: Read x1,y1, initial values

Step 2: Read a,value at which function value is to be found

Step 3: Read n,the number of subintervals

Step 4: count=0

Step 5: h=(a-x1)/n

Step 6: write x1,y1

Step 7: k1=h*f(x1,y1)

Step 8: k2=h*f(x1+h,y1+k1)

Step 9: y2=y1+(k1+k2)/2

Step 10: x2=x1+h

Step 11: write x2,y2

Step 12: count=count+1

Step 13: If count<n Then

x1=x2

y1=y2

Go to Step 7

Endif

Step 14: write x2,y2

Step 15: Stop

SIMPSON'S RULE OF INTEGRATION

To find value of integral of the function f(x)=1/(1+x^2) using Simpson's rule.

ALGORITHM

Step 1 : Read a,b the limits of integration

Step 2 : Read n number of subintervals(number should be even)

Step 3 : h=(b-a)/n

Step 4 : x=a

Step 5 : y=f(x)

Step 6 : sum=y

Step 7 : For i=2 to n

x=x+h

y=f(x)

Step 8: If mod(i,2)=0 then

sum=sum+4*y

Step 9: Else

sum=sum+2*y

Endif

Step 10: x=x+h

Step 11: y=f(x)

Step 12: sum=sum+y

Step 13: sum=h*sum/3

Step 14: write sum

Step 15: Stop

TRAPEZOIDAL RULE

To find the value of the integral of the function 1/1+x^2 in 4 steps using Trapezoidal rule.

ALGORITHM

```
Step 1 :  Read a , b  the limits of integration

Step 2 :  If  b<a   then
                c=a
                a=b
                b=c

Step 3:   Read n , number of subintervals
Step 4:   h=b-a/n
Step 5:   x=a
          y=f(x)
          sum=y

Step 6:   If  count < n   then
                x=x+h
                y=f(x)
                sum=sum+2*y
                count=count+1
                goto  step 6
          else
                x=x+h
                y=f(x)
                sum=sum+y
          endif

Step 7:   sum=h*sum/2
Step 8:   write sum
Step 9:   Stop
```