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CSE 13S

Assignment 2 - A Small Numerical Library

Data Design
Define EPSILON as real constant 0.000000001
Define OPTIONS with string constant of "sctea"
Define SC_MIN as real constant -2*M_PI
Define SC_MAX as real constant 2*M_PI
Define SCT_STEP as real constant M_PI/16
Define TAN_MIN as real constant -M_PI/3
Define TAN_MAX as real constant M_PI/3
Define EXP_MIN as integer constant 0
Define EXP_MAX as integer constant 9
Define EXP_STEP as real constant 0.1

Declare booleans s, c, t, e, a initialized to false each

Main Module Design
Begin Main (pass in argc as integer, in argv as string)
        Declare integer c initialized to 0
        Begin While
        While (c = getopt(pass in argc as integer, in argv as string, in OPTIONS as
                string)) does not equal -1
                Begin if
                If (c == 's')
                        s = true
                        Begin if
                        If (s)
                                Call Sin module()
                        End if
                End if
                Begin else if
                Else if (c == 'c')
                        c = true
                        Begin if
                        If (c)
                                Call Cos module()
                        End if
                End else if

        Begin else if
        Else if (c == 't')
            t = true
            Begin if
            If (t)
                Call Tan module()
            End if
        End else if
        Begin else if
        Else if (c == 'e')
            e = true
            Begin if
            If (e)
                Call Exp module()
            End if
        End else if
        Begin else if
        Else if (c == 'a')
            a = true
            Begin if
            If (a)
                Call Sin module()
                Call Cos module()
                Call Tan module()
                Call Exp module()
            End if
        End else if
        Begin else if
        Else if (c == '?')
            Display "Character not defined in the string"
            Return with exit status fail
        End else if
    End while

<u>Sin Module Data Design</u>
Declare Sin_x as real initialized to 0
Declare sin_lib as real initialized to 0

<u>Sin Module Design</u>
Begin Sin
    Display "x   Sin   Library   Difference"

Display "-   ---   ---------   ------------"
Begin For
For (integer i initialized to SC_MIN, i < SC_MAX, increment i by SCT_STEP)
      Assign to Sin_x value of
      (x*((x*x*(52785432-479249*x*x)-1640635920)*x*x+11511339840) /
      (((18361*x*x+3177720)*x*x+277920720)*x*x+11511339840)
      Assign to sin_lib value from call math function sin(pass in i)
      Display i, Sin_x, sin_lib, (sin_lib - Sin_x)
      End for
End Sin

Cos Module Data Design
Declare Cos_x as real initialized to 0
Declare cos_lib as real initialized to 0

Cos Module Design
Begin Cos
      Display "x   Cos   Library   Difference"
      Display "-   ---   ---------   ------------"
      Begin For
      For (integer i initialized to SC_MIN, i < SC_MAX, increment i by SCT_STEP)
            Assign to Cos_x value of
            ((x*x*(1075032-14615*x*x)-18471600)*x*x+39251520) /
            (((127*x*x+16632)*x*x+1154160)*x*x+39251520)
            Assign to cos_lib value from call math function cos(pass in i)
            Display i, Cos_x, cos_lib, (cos_lib - Cos_x)
      End for
End Cos

Tan Module Data Design
Declare Tan_x as real initialized to 0
Declare tan_lib as real initialized to 0

Tan Module Design
Begin Tan
      Display "x   Tan   Library   Difference"
      Display "-   ---   ---------   ------------"
      Begin For
            For (integer i initialized to SC_MIN, i < SC_MAX, increment i by SCT_STEP)
            Assign to Tan_x value of (x*((x*x((x*x-990)*x*x+135135)-4729725)*x*x+34459425) /
                  ((x*x((45*x*x-13860)*x*x+945945)-16216200)*x*x+34459425)

          Assign to tan_lib value from call math function tan(pass in i)
          Display i, Tan_x, tan_lib, (tan_lib - Tan_x)
     End for
End Tan

Exp Module Data Design

Declare total_num as integer initialized to 0
Declare term as real initialized to 1.0
Declare sum as real initialized to value of term
Declare input_num as static real initialized to EXP_MIN
Declare exp_lib as real initialized to 0.0

Exp Module Design

Begin Exp
     Display "x   Exp   Library   Difference"
     Display "-   ---   ---------   ------------"
     Begin while
     While (total_num < 91)
          Begin For
          For (double k initialized to 1.0, call from math library fabs(pass in term as real) >
              0.000000001, increment k by 1.0)
              Assign to term value of (input_num/k)*term
              Increment sum by value of sum + value of term
          End for
          Assign to exp_lib value from call math function exp(pass in input_num)
          Display input_num, sum, exp_lib, (exp_lib - sum)
          Increment input_num by EXP_STEP
          Increment total_num by 1
     End While
End Exp