3SK3 Code

#include <stdio.h>

#include <stdlib.h>

//absolute returns the absolute value of the input

double absolute(double x)

{

if (x<0)

{

x=-x;

}

return x;

}

//fac returns the factorial of an integer

double fac(int x)

{

double y = 1;

while (x>0)

{

y = y\*x--;

}

return y;

}

//returns b^ex

double pow(double b, int ex)

{

double out = 1;

for (int i = 0;i<ex;i++)

{

out = b\*out;

}

return out;

}

//using the Taylor expansion of e^x it returns e^x approximated

//by a Taylor polynomial of order n

double exp(double x, int n)

{

double y = 0;

for (int i = 0; i <=n; i++)

{

y = y + pow(x,i)/fac(i);

}

return y;

}

//returns the nth term of the Taylor series expansion of cos

double termcos(double x, int n)

{

n--;

double y = pow(-1,n)\*pow(x,2\*n)/fac(2\*n);

return y;

}

//returns cos(x) evaluated until adding another term would not affect

//the machine's value

double cos(double x)

{

int i = 1;

double accum = termcos(x,i);

while (absolute(termcos(x,i+1))+absolute(accum) > absolute(accum))

{

accum = accum + termcos(x,i+1);

i++;

}

return accum;

}

//returns machine precision of a double

double epsilon()

{

double mach = 1;

while ((1+mach/2) > 1)

//mach/2 is the condition because the definition requires

//that fl(1+ep) + 1 > 1, not = 1

//it returns mach, which is the value before it becomes a number

//which is equal

{

mach = mach/2;

}

return mach;

}

//returns the min value that can be represented by a double

double xmin()

{

double min = 1;

while (min/2 > 0)

{

min = min/2;

}

return min;

}

int main()

{

double pi = 3.141592653589793;

double expA = exp(-8.3,25);

double expB = 1/exp(8.3,25);

double cosPiBy3 = cos(pi/3);

double cosPiBy4 = cos(pi/4);

double mach = epsilon();

double min = xmin();

printf("e^(-8.3) = %le\n",expA);

printf("1/e^(8.3) = %le\n\n",expB);

printf("cos(pi/3) = %le\n", cosPiBy3);

printf("cos(pi/4) = %le\n\n", cosPiBy4);

printf("Machine Precision = %le\n",mach);

printf("xmin = %le",min);

}

Output

e^(-8.3) = -1.241249e-003

1/e^(8.3) = 2.485170e-004

cos(pi/3) = 5.000000e-001

cos(pi/4) = 7.071068e-001

Machine Precision = 2.220446e-016

xmin = 4.940656e-324

This output was copied from the command line.