Assignment 2 - DESIGN.pdf

Design.pdf

Exp function

$e^x = \sum_{k=0}^{\infty} \frac{x^k}{k!} \Rightarrow 1 + \frac{x^1}{1} + \frac{x^2}{2\cdot 1} + \frac{x^3}{3\cdot 2\cdot 1} + \frac{x^4}{4\cdot 3\cdot 2\cdot 1}$

$\frac{x}{1}$ $\frac{x}{2}$ $\frac{x}{3}$

$\boxed{\text{Pattern: previous} \cdot \frac{x}{k}}$

Input → x

Set up variables

final_ans = 0 → keep adding previous to it

previous = 0

increment = 0

k = 0 → counter for k

↓

k = 0

if k = 0 ;
increment = 0

↓

while

k = 1 to k = ?

→ while (|increment| > Epsilon)

Previous · $\frac{x}{k}$

→ increment

→ answer += increment

→ previous = increment → remember increment

k++

↓

return answer

sincos Function

k: 1, 3, 5, 7

sin] $\frac{x}{1} - \frac{x^3}{3\cdot2\cdot1} + \frac{x^5}{5\cdot4\cdot3\cdot2\cdot1} - \frac{x^7}{7\cdot6\cdot5!}$

input → x % 2π period is 2π

$\frac{-x^2}{3\cdot2}$ $\frac{-x^2}{5\cdot4}$ $\frac{-x^2}{7\cdot6}$

$\boxed{\text{previous} \cdot \frac{-x^2}{(k)(k-1)}}$

Set up variables

- answer
- previous
- increment

$\boxed{k=0}$ ← for cos

start k=0 for cos

0, 2, 4, 6

cos] $1 - \frac{x^2}{2\cdot1} + \frac{x^4}{4\cdot3\cdot2\cdot1} - \frac{x^6}{6\cdot5\cdot4!}$

$\boxed{k=1}$ ← for sin

start at k=1 for sin

$\boxed{\text{previous} \cdot \frac{-x^2}{(k)(k-1)}}$

if k=0 increment = 1

while

k=1 to k=?

k+=2 ← increment 2 because the summation pattern does that

return final answer ← sum of all increments

Tan Function

inputs → x % π/2 period is $\frac{\pi}{2}$

Do Not Need Tan

sqrt Function

Given

Inputs → x ← x ≥ 0

Set up variables
→ l = 0
→ h = 1

↓

while |h − l| > epsilon

← l = h

← $h = \frac{1}{2}(l + (x/l))$

↓

return h

Log function

Given

Inputs → x

set up vars

y = 1

p = exp(y)

↓

while abs(p − x) > epsilon

y = y + x/p − 1

p = exp(y)

↓

return x

Integrate function

Composite Simpson's 1/3 Rule:

$$\int_a^b f(x)\,dx = \quad \Delta x = \frac{b-a}{n} \qquad n \text{ is even}$$

$$\Rightarrow \frac{\Delta x}{3}\left[1f(x_0) + 4f(x_1) + 2f(x_2) + 4f(x_3) + \ldots 2f(n-2) + 4f(n-1) + f(x_n)\right]$$

Pattern	$k=0$	$= f(x_0)$
$k=$ odd	$4f(x_k)$	
$k=$ even	$2f(x_k)$	
$k=$ final	$1f(x_k)$	

set up variables ← answer ← increment

↓

k=0 ← increment = $f(x_0)$

↓

while k=1 to k=?

f_xk ← $f(x_0 + \Delta x \cdot k)$

if k=final ← break, increment = f_xk

if k even ← increment = 2·f_xk

if k odd ← increment = 4·f_xk

k++

← ~~final~~ answer += increment

↓

return answer

Options

- a) $\sqrt{1-x^4}$ → $|x| \leq 1$ ~~thant~~ if bounds are greater give error

- b) $1/\log(x)$ always undefind ???

- c) e^{-x^2} No bounds for x

- d) $\sin(x^2)$ No Bounds for x

- e) $\cos(x^2)$ No Bounds for x

- f) $\log(\log(x))$ $X \geq 1$ If lower bound is less than 1 give error

- g) $\sin(x)/x$ No x Bounds but looks like it ~~mirrs~~ mirrors

- h) e^{-x}/x $x \mathrel{!}= 0$ If bounds ~~is~~ contain 0 give ~~error~~ ~~undefined~~ undefined

- i) e^{e^x} No obvious bound looks like there is a soft one on the $+x$

- j) $\sqrt{\sin^2(x)+\cos^2(x)}$ it is a straight line the integral is ~~whatever~~ ~~the~~ ~~bounds~~ → $|lower| + |upper| = \int (j)\,dx$

- n) $\frac{|lower| + |upper|}{n}$ = width of partitions