NM Lab Sheet
II Year / II Part
Faculty: Computer/Electrical

Labsheet#10

Objective

1. To Implement **Numerical Integration** techniques (Trapezoidal, Simpson's 1/3rd & Simpson's 3/8th Methods).

Trapezoidal Method [$Let\ \int_4^{5.2} \log x\, dx$]

Algorithm

1. Start
2. Define function f(x)
3. Read lower limit (a) of integration, upper limit (b) of integration and number of sub interval
4. Calculate: step size = (b - a)/number of sub interval
5. Set: integration value = f(a) + f(b)
6. Set: i = 1
7. If i > number of sub interval then
8. Calculate: k = a + i * h
9. Calculate: Integration value = Integration Value + 2* f(k)
10. Increment i by 1 i.e. i = i+1 and go to step 7
11. Calculate: Integration value = Integration value * step size/2
12. Display Integration value as required answer
13. Stop

Simpson's 1/3rd Method [$Let\ \int_0^2 \{e^x + \sin(2x)\} dx$]

Algorithm

1. Start
2. Define function f(x)
3. Read lower limit (a) of integration, upper limit (b) of integration and number of sub interval
4. Calculate: step size = (b - a)/number of sub interval
5. Set: integration value = f(a) + f(b)
6. Set: i = 1
7. If i > number of sub interval then
8. Calculate: k = a + i * h
9. If i mod 2 =0 then
   Integration value = Integration Value + 2* f(k)
   Otherwise
   Integration Value = Integration Value + 4 * f(k)
   End If
10. Increment i by 1 i.e. i = i+1 and go to step 7
11. Calculate: Integration value = Integration value * step size/3
12. Display Integration value as required answer
13. Stop

Simpson's 1/3rd Method [$Let \int_0^{0.5} \frac{x}{1+sinx} dx$]

Algorithm

1. Start
2. Define function f(x)
3. Read lower limit (a) of integration, upper limit (b) of integration and number of sub interval
4. Calculate: step size = (b - a)/number of sub interval
5. Set: integration value = f(a) + f(b)
6. Set: i = 1
7. If i > number of sub interval then
8. Calculate: k = a + i * h
9. If i mod 3 =0 then
   Integration value = Integration Value + 2* f(k)
   Otherwise
   Integration Value = Integration Value + 3 * f(k)
   End If
10. Increment i by 1 i.e. i = i+1 and go to step 7
11. Calculate: Integration value = Integration value * step size*3/8
12. Display Integration value as required answer
13. Stop

Lab Assignment#10

1. Evaluate $\int_0^3 (\sin(x) + \cos(x) + 12) dx$ using **Simpson's 3/8th** rule taking h = **0.5**, Determine the **percent error** by comparing the result with the result with **exact solution**.
2. Evaluate $\int_0^1 \frac{1}{1+x^2} dx$ using
   a. Trapezoidal rule taking h = ¼ = 0.25
   b. Simpson's 1/3rd rule taking n=4, h = ¼ = 0.25
   c. Simpson's 3/8th rule taking n=6, h = 1/6

   Hence compute an approximate value of $\boldsymbol{\pi}$ in each case. [Hint: generate two tables]

3. The velocity v of a particle at a distance s from a point on its path is given in the table below:

s (ft)	0	10	20	30	40	50	60
v (ft/sec)	47	58	64	65	61	52	38

   Estimate the time taken to travel a distance of 60ft by using Simpson's 1/3rd rule. Compare the result with Simpson's 3/8th rule. [**Ans:** $I_{1/3}$ = 1.06352, $I_{3/8}$ = 1.06445]