

PRACTICAL 5

- **Objective:** To write a C++ program for solving numerical integration by Trapezoidal rule.

- **Algorithm:**

1. Start
2. Define function f(x)
3. Read lower limit of integration, upper limit of integration and number of sub interval
4. Calculate: step size = (upper limit - lower limit)/number of sub interval
5. Set: integration value = f(lower limit) + f(upper limit)
6. Set: i = 1
7. If i > number of sub interval then goto
8. Calculate: k = lower limit + 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

- **Theory**

$$\int_a^b f(x) dx \approx \frac{\Delta x}{2} (f(x_0) + 2f(x_1) + 2f(x_2) + 2f(x_3) + 2f(x_4) + \cdots + 2f(x_{N-1}) + f(x_N)) .$$

- **Practical Code:**

```
#include<iostream>
#include<math.h>
#define f(x) 1/(1+pow(x,2))

using namespace std;
int main() {
    float lower, upper, integration=0.0, stepSize, k;
    int i, subInterval;
    cout << "Enter lower limit of integration: ";
    cin >> lower;
    cout << "Enter upper limit of integration: ";
    cin >> upper;
    cout << "Enter number of sub intervals: ";
    cin >> subInterval;
    stepSize = (upper - lower)/subInterval;
    integration = f(lower) + f(upper);

    for(i=1; i<= subInterval-1; i++) {
        k = lower + i*stepSize;
```

```
    integration = integration + 2 * (f(k));  
}  
integration = integration * stepSize/2;  
cout<< endl<<"Required value of integration is: "<< integration;  
  
return 0;  
}
```

- **Output:**

Enter lower limit of integration: 0
Enter upper limit of integration: 1
Enter number of sub intervals: 6
Required value of integration is: 0.784241

- **Application:**

- a. Used for solving complex integration problems.