Cen 103 assignment 9

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P1)

```
#include <iostream>
using namespace std;
float function(float x)
{
return 1 / (1 + (x * x));
}
void integration(float l, float u, int n)
{
    float h = (u - l) / n;
    float table[2][n + 1];
    for (int i = 0; i <= n; i++)
    {

        table[0][i] = l + i * h;
        table[1][i] = function(table[0][i]);
    }
    float trapezoidal = 0, Simpsons_one_third = 0, Simpsons_three_eighth = 0;
    for (int i = 0; i < n + 1; i++)
    {
        if ((i == 0) || (i == n))
        {

            trapezoidal += h * table[1][i] / 2;
        }
        else
        {
            trapezoidal += h * table[1][i];
        }
}
cout << "Trapezoidal value is " << trapezoidal << endl;
for (int i = 0; i < n + 1; i++)
{
    if ((i == 0) || (i == n))
    {

        Simpsons_one_third += table[1][i];
    }
```

```
    else if ((i % 2 == 1) && (i != n))
    {
        Simpsons_one_third += 4 * table[1][i];
    }
    else
    {
        Simpsons_one_third += 2 * table[1][i];
    }
}
Simpsons_one_third = h * Simpsons_one_third / 3;
cout << "Simpsons one third value is " << Simpsons_one_third << endl;
for (int i = 0; i < n+1; i++)
{
    if ((i == 0) || (i == n))
    {
        Simpsons_three_eighth += table[1][i];
    }
    else if ((i%3 == 0) && (i!= n))
    {
        Simpsons_three_eighth += 2*table[1][i];
    }
    else
    {
        Simpsons_three_eighth += 3*table[1][i];
    }
}
Simpsons_three_eighth =h*3*Simpsons_three_eighth /8 ;
cout << "Simpsons three eighth value is " << Simpsons_three_eighth << endl;
}
int main()
{
    float l, u;
    int n ;
    cout << " Enter lower limit"<< endl;
    cin >> l ;
    cout << " Enter upper limit"<< endl ;
    cin >> u ;
    cout << " Enter no of intervel "<<endl;
    cin >> n ;
    integration(l , u , n) ;
    return 0;
}
```

Enter lower limit

0

Enter upper limit

1

Enter no of intervel

6

Trapezoidal value is 0.784241

Simpsons one third value is 0.785398

Simpsons three eighth value is 0.785396

P2)

```
#include <iostream>
using namespace std;
void integration(float array_a[], float array_b[], int n)
{
float table[2][n];
for (int i = 0; i < n; i++)
{
    table[0][i] = array_a[i];
    table[1][i] = array_b[i];
}
float h = (table[0][n - 1] - table[0][0]) / (n - 1);
float trapezoidal = 0, Simpsons_one_third = 0, Simpsons_three_eighth = 0;
for (int i = 0; i < n; i++)
{
    if ((i == 0) || (i == (n - 1)))
    {
        trapezoidal += h * table[1][i] / 2;
    }
    else
    {
        trapezoidal += h * table[1][i];
    }
}
cout << "Trapezoidal value is " << trapezoidal << endl;
```

```
for (int i = 0; i < n; i++)
{
    if ((i == 0) || (i == (n - 1)))
    {
        Simpsons_one_third += table[1][i];
    }
    else if ((i % 2 == 1) && (i != (n - 1)))
    {
        Simpsons_one_third += 4 * table[1][i];
    }
    else
    {
        Simpsons_one_third += 2 * table[1][i];
    }
}
Simpsons_one_third = h * Simpsons_one_third / 3;
cout << "Simpsons one third value is " << Simpsons_one_third << endl;
for (int i = 0; i < n; i++)
{
    if ((i == 0) || (i == (n - 1)))
    {
        Simpsons_three_eighth += table[1][i];
    }
    else if ((i % 3 == 0) && (i != (n - 1)))
    {
        Simpsons_three_eighth += 2 * table[1][i];
    }
    else
    {
        Simpsons_three_eighth += 3 * table[1][i];
    }
}
Simpsons_three_eighth = h * 3 * Simpsons_three_eighth / 8;
cout << "Simpsons three eighth value is " << Simpsons_three_eighth << endl;
}
int main()
{
    int n;
    cout << "Enter the number of points you have " << endl;
    cin >> n;
    float array_a[n];
    float array_b[n];
    for (int i = 0; i < n; i++)
    {
        cout << "Enter the point " << (i + 1) << " in (x,y) format " << endl;
```

```
        cin >> array_x[i] >> array_y[i];
    }
    integration(array_a, array_b, n);
    return 0;
}
```

Enter the number of points you have

7

Enter the point 1 in (x,y) format

0

0

Enter the point 2 in (x,y) format

5

2.12

Enter the point 3 in (x,y) format

10

2.94

Enter the point 4 in (x,y) format

15

3.03

Enter the point 5 in (x,y) format

20

2.77

Enter the point 6 in (x,y) format

25

1.91

Enter the point 7 in (x,y) format

30

0

Trapezoidal value is 63.85

Simpsons one third value is 66.1

Simpsons three eighth value is 66.15

P3)

```
#include <iostream>
#include <cmath>
using namespace std;
double function(double x, float l, float u)
{
    double g = 9.8, m = 68.1, c = 12.5, e = 2.7182818;
    double t = ((u - l) * x / 2) + (u + l) / 2 ;
    return g * m * (1 - pow(e, -((c / m) * t))) * (u - l) / (2 * c);
}
void Gauss_integration(float l, float u ,int n)
{
    double Ans = 0;
    if (n == 2)
    {
        double Gauss[2][2];
        Gauss[0][0] = -0.57735;
        Gauss[0][1] = 0.57735;
        Gauss[1][0] = 1;
        Gauss[1][1] = 1;
    for (int i = 0; i < 2; i++)
    {
        Ans += Gauss[1][i] * function(Gauss[0][i], l, u);
    }
}
else if (n == 3)
{
```

```
    double Gauss[2][3];
    Gauss[0][0] = -0.77460;
    Gauss[0][1] = 0;
    Gauss[0][2] = 0.77460;
    Gauss[1][0] = 0.55555;
    Gauss[1][1] = 0.88889;
    Gauss[1][2] = 0.55555;
    for (int i = 0; i < 3; i++)
    {
        Ans += Gauss[1][i] * function(Gauss[0][i], l, u);
    }
}
else if (n == 4)
{
    double Gauss[2][4];
    Gauss[0][0] = -0.86114;
    Gauss[0][1] = -0.33998;
    Gauss[0][2] = 0.33998;
    Gauss[0][3] = 0.86114;
    Gauss[1][0] = 0.34785;
    Gauss[1][1] = 0.65214;
    Gauss[1][2] = 0.65214;
    Gauss[1][3] = 0.34785;
for (int i = 0; i < 4; i++)
{
    Ans += Gauss[1][i] * function(Gauss[0][i], l, u);
}
}
else if (n == 5)
{
    double Gauss[2][5];
    Gauss[0][0] = -0.90618;
    Gauss[0][1] = -0.53847;
    Gauss[0][2] = 0;
    Gauss[0][3] = 0.53847;
    Gauss[0][4] = 0.90618;
    Gauss[1][0] = 0.23693;
    Gauss[1][1] = 0.47863;
    Gauss[1][2] = 0.56889;
    Gauss[1][3] = 0.47863;
    Gauss[1][4] = 0.23693;
    for (int i = 0; i < 5; i++)
    {
        Ans += Gauss[1][i] * function(Gauss[0][i], l, u);
    }
```

```
}
else{
    cout <<"Invalid input "<<endl ;
}
cout << "The value by gaussian integration is "<< Ans <<endl;
}
int main()
{
    float l, u;
    int n;
    cout << "The lower limit of provided function " << endl;
    cin >> l;
    cout << "The upper limit of provided function " << endl;
    cin >> u;
    cout << "Enter the value of n" << endl;
    cin >> n;
    Gauss_integration(l , u , n);
    return 0;
}
```

Out put ;

The lower limit of provided function

0

The upper limit of provided function

10

Enter the value of n

5

The value by gaussian integration is 289.436