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Practical 13: Lagrange's Interpolation Formula

Objective: To find value of y corresponding given value of x using Lagrange's Interpolation Formula for unequal intervals.

2. Algorithm:

1. Start
2. Input the matrix of equations in arr[n][2] where n is number of given variables in data.
3. Calculate the difference table using:
For (j = 2; j < n+1; j++)
{
 For (i = 0; i < n-j+1; i++)
 {
 mat[i][j]= mat[i][j-1]- mat[i-1][j-1];
 }
}
}
4. Enter the value of x.
5. Find value of y using:
sum=0.0;
for i in range(n)
{
 z= 1.0
 for j in range(n)
 {
 if (i!=j)
 {
 z *= (x - mat[j][0])
 z /= (mat[i][0] - mat[j][0])
 }
 }
 z*=mat[i][1]
 sum+=z
}

6. Print sum
7. Stop.

Code:

```
#include<iostream>
using namespace std;

int main(){
    int n;
    cout<<"Enter the number of known variables: ";
    cin >> n;

    static float mat[10][2] = {0.0};
    for (int i = 0; i < n; i++)
    {
        /* code */
        printf("Enter x%d: ", i + 1);
        cin >> mat[i][0];
        printf("Enter y%d: ", i + 1);
        cin >> mat[i][1];
    }

    cout<<endl<<endl;
    // printing the table
    cout << "x" << '\t' << "y" << endl<< endl;
    for (int i = 0; i < n; i++)
    {
        /* code */
        cout << mat[i][0] << '\t' << mat[i][1] << endl;
    }

    float x;
    cout << "Enter the value of x at which you want to calculate the value of y: ";
    scanf(" %f", &x);

    // applying the Lagrange's Interpolation Formula
    float sum =0.0;
    for (int i = 0; i < n; i++)
    {
        float z= 1.0;
        // cout<<z<<endl;
        /* code */
        for (int j = 0; j < n; j++)
        {
```

```

/* code */
if (i!=j)
{
    /* code */
    z *= (x - mat[j][0]); // -----> x- x[j]
    z /= (mat[i][0] - mat[j][0]); // -----> x[i]- x[j]
    // cout << z << '\t' << sum << endl;
}
}

z*=mat[i][1]; // -----> y[i]
sum+=z;
}

printf("Value of y at x=%f is: %f\n\n", x, sum);

return 0;
}

```

Output:

Windows PowerShell

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```

PS E:\03 Semester\CBNST\Unit 03> cd "e:\03 Semester\CBNST\Unit 03\" ; if ($?) { g++
13_lagrangesInterpolationFormula.cpp -o 13_lagrangesInterpolationFormula } ; if ($?)
{ .\13_lagrangesInterpolationFormula }

```

Enter the number of known variables: 4

Enter x1: 1

Enter y1: 1

Enter x2: 2

Enter y2: 5

Enter x3: 7

Enter y3: 5

Enter x4: 8

Enter y4: 4

x	y
1	1
2	5
7	5
8	4

Enter the value of x at which you want to calculate the value of y: 6

Value of y at x=6.000000 is: 6.238095