物件導向程式設計

Horner's Rule

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Platform

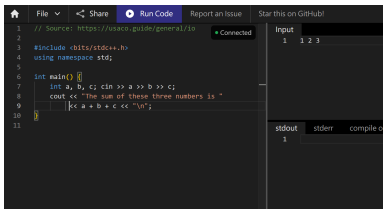
- Dev-C++

  Click here to download.

  Note: Please use this version otherwise you can't compile your programs/projects in Win10.

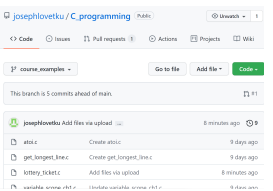
- OnlineGDB (https://www.onlinegdb.com/)

- Real-Time Collaborative Online IDE (https://ide.usaco.guide/)



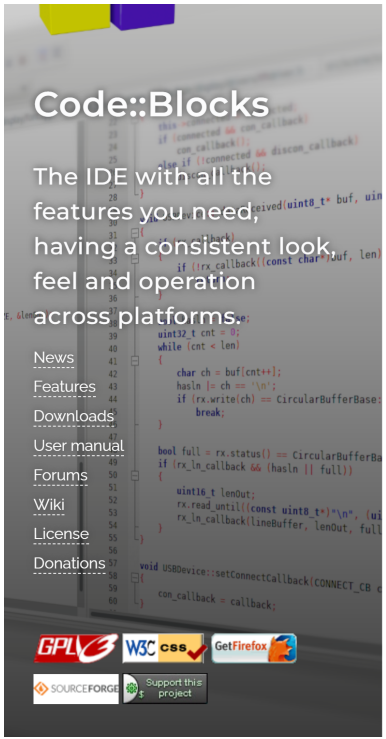
- Other resources:
  - MIT OpenCourseWare - Introduction to C++ [link].
  - Learning C++ Programming [Programiz].
  - GeeksforGeeks [link]

My GitHub page:
click the link here to visit.



Platform/IDE

- https://www.codeblocks.org/



Code::Blocks

Code::Blocks

The free C/C++ and Fortran IDE.

Code::Blocks is a free C/C++ and Fortran IDE built to meet the most demanding needs of its users. It is designed to be very extensible and fully configurable.

Built around a plugin framework, Code::Blocks can be extended with plugins. Any kind of functionality can be added by installing/coding a plugin. For instance, event compiling and debugging functionality is provided by plugins!

If you 're new here, you can read the **user manual** or visit the **Wiki** for documentation. And don't forget to visit and join our **forums** to find help or general discussion about Code::Blocks.

We hope you enjoy using Code::Blocks!

The Code::Blocks Team

Latest news

Migration successful

We are very happy to announce that the process of migrating to the new infrastructure has completed successfully!

Read more

Polynomial Evaluation

Given the polynomial

$$p(x) = \sum_{i=0}^{n} a_i x^i = a_0 + a_1 x + a_2 x^2 + a_3 x^3 + \ldots + a_n x^n,$$

where $a_0, a_1, \ldots, a_n$ are constant coefficients,

the problem is to evaluate the polynomial at a specific value x_0 of x

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$n + (n-1) + (n-2) + \ldots + 1 = (1+n)n/2$ multiplications and $n-1$ additions

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the problem is to evaluate the polynomial at a specific value x_0 of x

Reformulate the same polynomial: **Horner's Rule**

$$
\begin{aligned}
p(x) &= \sum_{i=0}^{n} a_i x^i = a_0 + a_1 x + a_2 x^2 + a_3 x^3 + \ldots + a_n x^n \\
&= a_0 + x\,(a_1 + x\,(a_2 + x\,(a_3 + \ldots + x(a_{n-1} + x a_n)\ldots)))
\end{aligned}
$$

n multiplications and n additions

For example,

$$
\begin{aligned}
p(x) &= 3 + 2x - x^2 + 6x^3 \\
&= 3 + x \cdot (2 + x \cdot ((-1) + x \cdot 6)).
\end{aligned}
$$

Reformulate the same polynomial: **Horner's Rule**

$$
\begin{aligned}
p(x) &= \sum_{i=0}^{n} a_i x^i = a_0 + a_1 x + a_2 x^2 + a_3 x^3 + \ldots + a_n x^n \\
&= a_0 + x\left(a_1 + x\left(a_2 + x\left(a_3 + \ldots + x(a_{n-1} + x a_n)\ldots\right)\right)\right)
\end{aligned}
$$

n multiplications and n additions

```
int HornerRule(int coef[], int start, int degree, int x);


int HornersRule(int c[], int i, int d, int x)
{
    if (i == d) return c[d];
    else
        return c[i] + x*HornerRule(c, i+1, d, x);
}
```

Horner's Rule

1. 考慮以下 Horner's Rule 求多項式之值的程式。請將 int horner(int poly[], int n, int x) 修改為樣板函式，並修改主函式註解處，使主函式能正確執行並依範例輸入得出範例輸出。

```
// returns value of poly[0]x(n-1) + poly[1]x(n-2) + ...
// + poly[n-1]
int horner(int poly[], int n, int x) { // 請修改之使其樣板化
    int result = poly[0];
    for (int i=1; i<n; i++)
        result = result*x + poly[i];
    return result;
}
int main() {
    int i, size;
    double x;
    cin >> size >> x;
    double* poly = new double[size];
    for (i=0; i<size; i++) {  cin >> poly[i];  }
    cout << "Value of polynomial is "
         << horner(poly, size, x);  //請修改此行
    delete poly;
    return 0;
}
```

範例輸入	範例輸出
4 3 2 -6 2 -1	Value of polynomial is 5
5 1 1 2 3 4 5	Value of polynomial is 15
10 -1 1 2 3 4 5 6 7 8 9 10	Value of polynomial is 5