

C Language Programming: Homework #2
Assigned on 10/01/2019, Due on 10/08/2019

(1) (30%) Let a be a positive real number, and let the sequence of real numbers x_i be given by

$$x_0 = 1, \quad x_{i+1} = \frac{1}{2} \left(x_i + \frac{a}{x_i} \right) \quad \text{for } i = 0, 1, 2, \dots$$

It can be shown mathematically that $x_i \rightarrow \sqrt{a}$ as $i \rightarrow \infty$

This algorithm is derived from the Newton-Raphson method in numerical analysis. Write a program that reads in the value of a interactively and uses this algorithm to compute the sequence root of a . As you will see, the program is very efficient. (Nonetheless, it is not the algorithm used by the `sqrt()` function in the standard library.)

Declare `x0` and `x1` to be of type `double`, and initialize `x1` to be 1. Inside a loop do the following

```
x0 = x1;           /* save the current value of x1 */
x1 = 0.5 * (x1 + a / x1); /* compute a new value of x1 */
```

Each time through the loop, print out the values of `xi`

(2) (30%) The constant e , which is the base of the natural logarithms, is given to 41 significant figures by

$e = 2.71828\ 18284\ 59045\ 23536\ 02874\ 71352\ 66249\ 77572$

Define

$$x_n = \left(1 + \frac{1}{n}\right)^n \quad \text{for } n = 1, 2, \dots$$

It can be shown mathematically that $x_n \rightarrow e$ as $n \rightarrow \infty$

Investigate how to calculate e to arbitrary precision using this algorithm. You will find that the algorithm is computationally ineffective. (See exercise 36, on page 195)

(3) (40%) In addition to the algorithm given in the previous exercise, the value for e is also given by the infinite series

$$e = 1 + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \frac{1}{4!} + \dots$$

The above algorithm is computationally effective. Use it to compute e to an arbitrary precision.

(4) update your report to server, otherwise you will get -10 point.

(5) If you will not submit your report, you get 0 point.

Command Line: (You must use Parameter argc and argv)

Q1: ./hw2_1 a i (Please Follow this Sequence , otherwise you will get -20 point)

Q2: ./hw2_2 n

Q3: ./hw2_3 n

Output:

Q1: print result X_i for top-i loop(get the ten digit after the point)

Q2: print result X_n for top-n loop(get the ten digit after the point)

Q3: print result X_n for top-n loop(get the ten digit after the point)

Example

> ./hw2_1 2 2

> 1.5000000000

> 1.4166666666

> ./hw2_2 2

> 2.0000000000

> 2.2500000000

> ./hw2_3 2

> 2.0000000000

> 2.5000000000

Report

除了要交紙本，也要將 report 以電子檔的形式上傳至 server

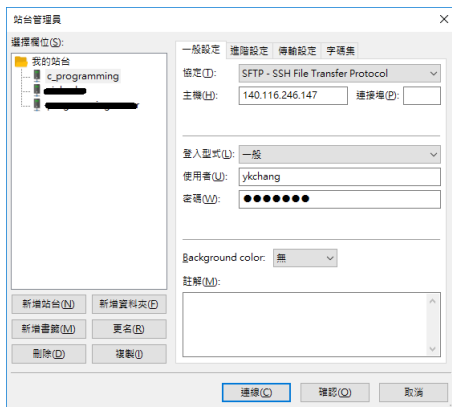
電子檔檔名格式：HW2.docx

以下為教學，若仍有許多不懂的地方，下次上課後助教再實際操作一次

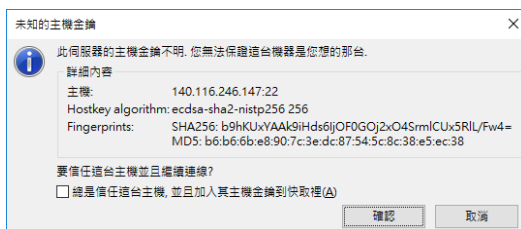
1. 安裝 [FileZilla](#)
2. 連線方式：打開 FileZilla 後>檔案>站台管理員



3. 如圖設定好連線方式後連線



4. 這邊直接確認就好



5. 進到對應的目錄並上傳你的電子檔，一份作業一個電子檔

