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

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

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

It can be shown mathematically that $\boldsymbol{x_i \to \sqrt{a}\quad as\quad i \to \infty}$
This algorithm is derived from the Newton-Raphson method in numerical analysis. Write a program that reads in the value of $\boldsymbol{a}$ interactively and uses this algorithm to compute the sequence root of $\boldsymbol{a}$. As you will see, the program is very efficient. (Non-theless, 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 */
```

The body of the loop should be executed as long as x0 is not equal to x1. Each time through the loop, print out the iteration count and the values of x1 (converging to the square root of a) and a – x1 * x1 (a check on accuracy)

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

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

Define

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

It can be shown mathematically that $\boldsymbol{x_n \to e\quad as\quad n \to \infty}$

Investigate how to calculate $\boldsymbol{e}$ 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 $\boldsymbol{e}$ is also given by the infinite series

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

The above algorithm is computationally effective. Use it to compute $\boldsymbol{e}$ to an arbitrary precision.

(4) updata 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

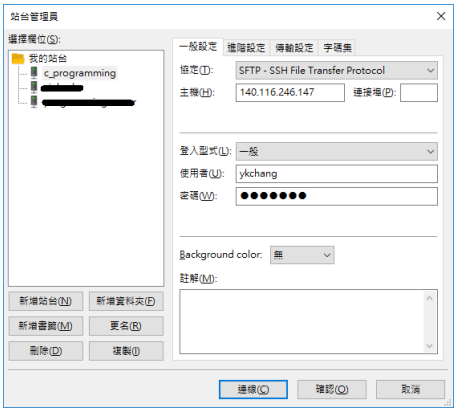
> ./hw2_1 1 2
> 1.0000000000
> 1.0000000000
> ./hw2_2 2
> 2.0000000000
> 2.2500000000
> ./hw2_3 2
> 2.0000000000
> 2.5000000000

Report

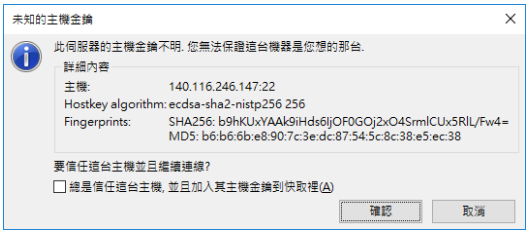
除了要交紙本，也要將 report 以電子檔的形式上傳至 server
電子檔檔名格式：HW2.docx
以下為教學，若仍有許多不懂的地方，下次上課後助教再實際操作一次

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