Homework 004

THE BIG APPLICATION

DEADLINE: 5/6 SUN. 23:59

The big number

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- A Big Number in computer science means a big number which could not been stored inside ONE fundamental type (int, float, char…)
- For example, the maximum integer in the C++ is long long int, the legal range of this number is

$$-2^{64-1} \sim 2^{64-1} -1$$

Basic idea of class BigNUM

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- Use an array of integer to implement a big number. Each integer store parts of this big number.

- 435230457893405238475034857O =

4 352 304 578 934 052 384 750 348 570

- Then, implement your OWN operators to achieve specific goal
  - ***Beware negative input / result!

This time, …

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- We prepare 2 easy tasks and ask you to complete with BigNUM class
- **1st Task is Big Fibonacci number**
- **2nd Task is Big N^M**
  - To complete these 2 task, you may need several constructor, operator and help functions.
  - Include but not limited to: construct a BigNUM with integer, copy constructor, destructor, operator +,-,*=,++,=,==,<,<<, >> …

Please be advised…

Everyone should rewrite entire the entire program from scratch

Task 1: F(0) = 0, F(1) = 1, F(2) = 1, ... F(n) = F(n-1) + F(n-2)

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```
cout << "Here is the 1st part (Big Fibonacci number):\n";
    //F(0) = 0, F(1) = 1, F(2) = 1, ... F(n) = F(n-1) + F(n-2)

    //*Option 1 of Task 1 (without user input)
    //BigNUM tN(123456), tFirst(0), tSecond(1), tFNumber(0);
    //cout << "input tN (calculate nth Fib#) : " << tN;

    //*Option 2 of Task 1 (with user input)
    BigNUM tN, tFirst(0), tSecond(1), tFNumber(0);
    cout << "input tN (calculate nth Fib#) : ";
    cin >> tN;
    cout << "tN : " << tN << endl;
```

Task 1: F(0) = 0, F(1) = 1, F(2) = 1, ... F(n) = F(n-1) + F(n-2)

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```
clock_t Start_t1 = clock(); // do not remove it!!!
  if (tN == 0) tFNumber = 0;
  else if (tN == 1)  tFNumber = 1;
  else  {
      tFNumber = 0;
      tFirst = 0;
      tSecond = 1;
      for (BigNUM i = 0; i < tN - 1; ++i) {
          tFNumber = tSecond + tFirst;
          tFirst = tSecond;
          tSecond = tFNumber; }}
  cout << "the " << tN << "th Fibonacci number is : " << tFNumber << " (" <<
              tFNumber.getSize() << ")" << endl;
  cout << "Clock:" << (clock() - Start_t1) * 1.0 / CLOCKS_PER_SEC << " sec." << endl;
```

getSize(): get the size of your array (bigNUM)

12 234 111 -> size = 3
1 234 -> size = 2
123 423 213 232 -> size = 4

Task 2: N^M

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```
cout << "Here is the 2nd part (BIGGGGG N^M)\n";
//*Option 1 of Task 2 (without user input)
//BigNUM tA(12345),tB(54321),tC(1);
BigNUM tA,tB,tC(1);
cout << "input tA : ";    cin >> tA;
cout << "input tB : ";    cin >> tB;
for(BigNUM tF = 0; tF < tB; ++tF){
    tC *= tA;
}
```

Requirements !!

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- Dynamic array!
  - (the size of your bigNUM object should be depended on the size of number)
- The **correctness** of results
- The **performance** (each of task should be complete within 120sec.)
- **Operator >> is required! In hw4**

Notes/Reference

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- 106hw4_bignumV3.pdf
  - This slides
- 106hw4_main.cpp
  - Driver program
- Reference Answer
  - PG2MidtermV2015.exe / PG2MidtermV2017.exe
  - Example Program (with user input)
- http://www.javascripter.net/math/calculators/fibonaccinumberscalculator.htm
  - A online Fibonacci number calculator

Submit your codes to TA

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- Please design your own class **BigNUM** to fulfill all challenge in the driver program (106hw4_main.cpp).
- Make sure the code could be compile with TA's driver program.
  - If we can't compile your code, you get **0** point too. (**you may modify part of main function to make your code compilable**)
  - If you have modified your driver program please upload it, too.

Submit your codes to Portal

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- Please use s1234567_bignumV3.h , s1234567_bignumV3.cpp , s1234567_main.cpp as your file names.
  - Replace s1234567 by your own student ID.
  - And upload **ONLY** these codes.
    - Please ZIP them with your student ID, s1234567_bignumV3.zip
    - If you try to upload another files (for example *.sln or others), you get **0** point.
  - Then, submit your midterm program to Portal.