DS and OOP

lab3

Question 1 - Basic Class Implementation(30%)

Given a complete class header file “IntegerNumber.h” and
an uncomplete class cpp file “IntegerNumber.cpp”

Please complete the cpp file. In addition, you are not allowed to modify IntegerNumber.h.

Question 1 - Basic Class Implementation

IntegerNumber has two constructors.

```
IntegerNumber(){
    printf("constructor\n");
    number = 0;
}
IntegerNumber(int n);
```

One is already completed, you have to complete the other one.
when a integer number is passed to constructor, the private data number should be assigned to n, and the constructor should print "constructor\n" as well.

Question 1 - Basic Class Implementation

```
void add(IntegerNumber n);
void sub(IntegerNumber n);
void mul(IntegerNumber n);
void div(IntegerNumber n);
void mod(IntegerNumber n);
```

When these functions are invoked, the number should be add/substract/multiple/divide/modular by n.

Question 1 - Basic Class Implementation

```
int getNumber();
void setNumber(int n);
```

When getNumber() is invoked, then return number;
When setNumber() is invoked, then set number to n;

Demo Example

If I have a main.cpp like this…

main.cpp

```cpp
#include <iostream>
using namespace std;
#include "IntegerNumber.h"
int main()
{
    IntegerNumber n1(10);
    IntegerNumber n2(5);
    IntegerNumber n3;
    IntegerNumber n4(2);
    n1.add(n2);
    printf("%d\n", n1.getNumber());
    n1.add(n3);
    printf("%d\n", n1.getNumber());
    n1.sub(n4);
    printf("%d\n", n1.getNumber());
    n1.mul(n4);
    printf("%d\n", n1.getNumber());
    n1.div(n2);
    printf("%d\n", n1.getNumber());
    n4.setNumber(9);
    printf("%d\n", n4.getNumber());
    n1.mod(n4);
    printf("%d\n", n1.getNumber());
    return 0;
}
```

Demo Example

then I compile both class.cpp and main.cpp
and finally execute the output file

```
>g++ IntegerNumber.cpp main.cpp
>./a.out
```

I can get the output like this:

```
constructor
constructor
constructor
constructor
15
15
13
26
5
9
5
```

However, TA will use **ANOTHER** main.cpp to score your grade

Question 2 - A Little Advanced Class Implementation(40%)

Given a complete class header file “MyStack.h” and
an uncomplete class cpp file “MyStack.cpp”
Please complete the cpp file. In addition, you are not allowed to modify MyStack.h.

Question 2 - A Little Advanced Class Implementation

In this question, you have to use dynamic integer array to simulate a stack of simple version.
MyStack has three private data member

```
private:
    int * arr;
    int cap;
    int len;
```

- arr is the dyanmic array to simulate stack
- cap is the stack capacity which means the maximum numbers of element that the stack can contain.
- len is the current number of element that the stack contains.

Question 2 - A Little Advanced Class Implementation

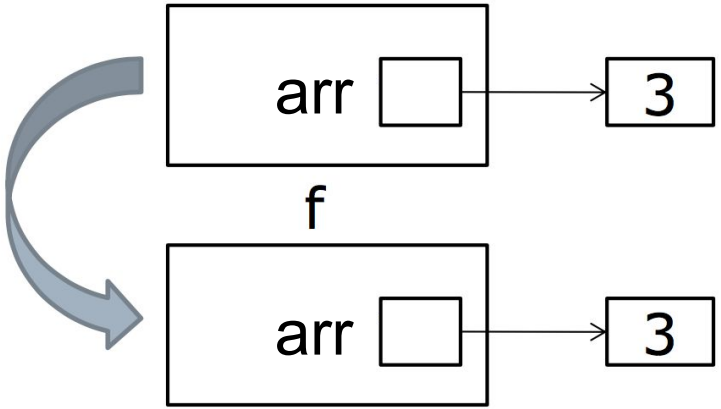
MyStack has two constructors and one copy constructor.

```
MyStack();
MyStack(int c);
MyStack(const MyStack & s);
```

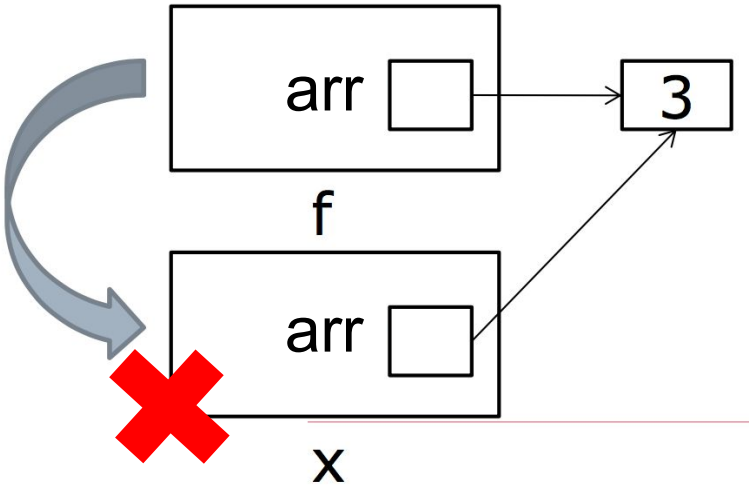
- if the first one constructor is invoked (no any arguments), the capacity should be set to **5**.
- if the second constructor is invoked, the capacity is set to argument c.

Question 2 - A Little Advanced Class Implementation

if the copy constructor is invoked the new instance should allocate its own memory for arr.



Copy by copy constructor



Question 2 - A Little Advanced Class Implementation

MyStack has a destructor

```
~MyStack();
```

- When the destructor is invoked, you should release the memory of dynamic array

Question 2 - A Little Advanced Class Implementation

MyStack has another three member function

```
void print();
void push(int n);
void pop();
```

- print() has already been completed by TA, you are not allowed to modify.
- when push(int) is invoked, you should insert argument n to the back of arr However, if the stack is full then do nothing.
- when pop() is invoked, the last element in stack should be remove. However, if the stack is empty then do nothing.

Question 2 - A Little Advanced Class Implementation

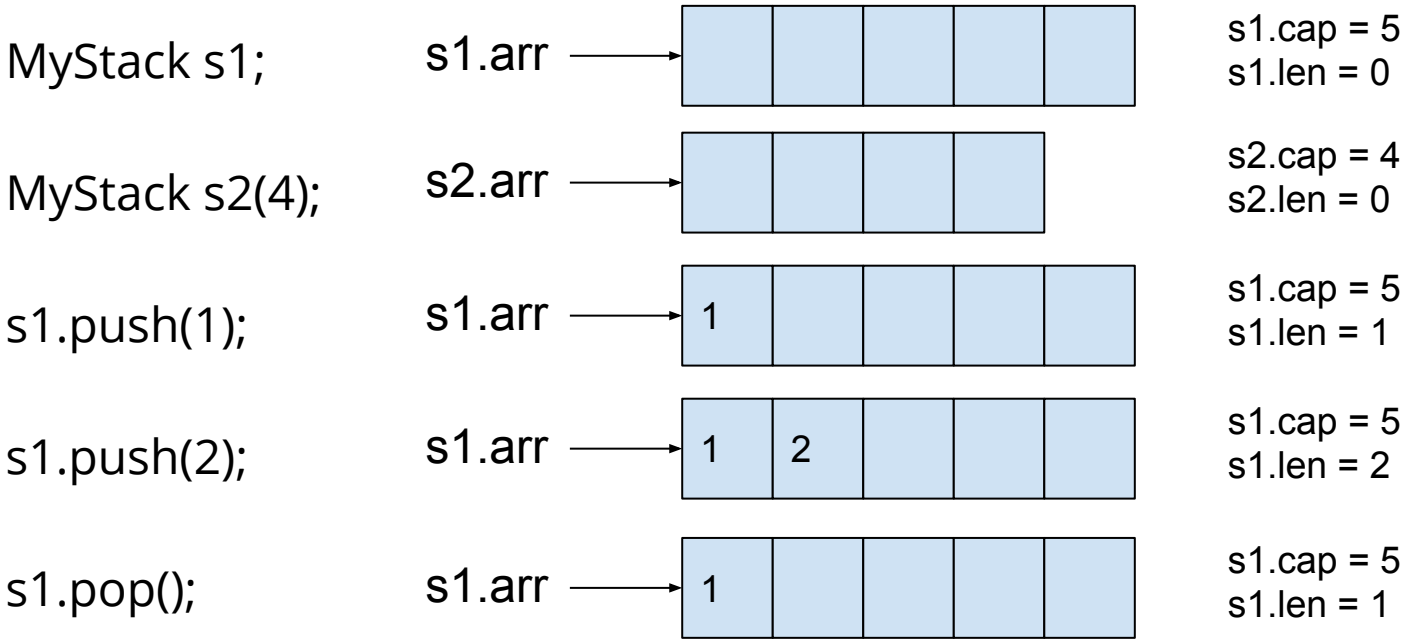
MyStack has a friend member function

```
friend int getAvailCap(MyStack & s);
```

- when the function is invoked, please return the remaining available number of elements that the stack can contain.

Example

Stack is a Last-In-First-Out(LIFO) list.



Example

Stack is a Last-In-First-Out(LIFO) list.

s1.push(2);

s1.cap = 5
s1.len = 2

s1.push(3);

s1.cap = 5
s1.len = 3

s1.push(4);

s1.cap = 5
s1.len = 4

s1.push(5);

s1.cap = 5
s1.len = 5

s1.push(6);

s1.cap = 5
s1.len = 5

Stack s1 is full, so the new element cannot be inserted!

Example

Stack is a Last-In-First-Out(LIFO) list.

```
cout << getAvailCap(s2) << endl;
```

s2.cap = 4
s2.len = 0

```
>>4
```

```
s2.push(4);
cout << getAvailCap(s2) << endl;
```

s2.cap = 4
s2.len = 1

```
>>3
```

Question 3 - Operator Overloading(30%)

[Extend Question 1]
Please **modify both "IntegerNumber.h" and "IntegerNumber.cpp"**, make class IntegerNumber can suport operator overloading.
you should perform following operator functions:
+, -(for both unary and binary form), *(multiply), /, %, =, ++, --, +=, -=
Remember, you should keep original function working well.
Except that the constructors should not print anything
Except that the constructors should not print anything
Except that the constructors should not print anything
and the operators not only can perform between IntegerNumbers but also between IntegerNumber and built-in integer numbers.

Question 3 - Operator Overloading

We offer a main.cpp to help you debug your code.

Example

```
IntegerNumber n1(10);
IntegerNumber n2 = 5;

IntegerNumber n3 = n1 + n2;

// operators can perform between IntegerNumber and int values as well.
IntegerNumber n4 = n1 - 5;
```

Upload code to E3

Remember to upload your source code to E3~
you can create folders like this figure,
then zip it.

- 0616071
  - Lab3_1
    - IntegerNumber.cpp
    - IntegerNumber.h
  - Lab3_2
    - MyStack.cpp
    - MyStack.h
  - Lab3_3
    - IntegerNumber.cpp
    - IntegerNumber.h

Last but not least

Reference

Putty:
https://help.cs.nctu.edu.tw/help/index.php/HOWTO_-_%E4%BD%BF%E7%94%A8PuTTY%E7%99%BB%E5%85%A5%E7%B3%BB%E4%B8%8A%E5%B7%A5%E4%BD%9C%E7%AB%99

Filezilla:
https://help.cs.nctu.edu.tw/help/index.php/HOWTO_-_%E9%80%A3%E4%B8%8A%E7%B3%BB%E4%B8%8A%E5%B7%A5%E4%BD%9C%E7%AB%99%E7%9A%84_FTP

Command line:
http://crasseux.com/books/ctutorial/argc-and-argv.html

Putty

Please connect to:

linux1.cs.nctu.edu.tw

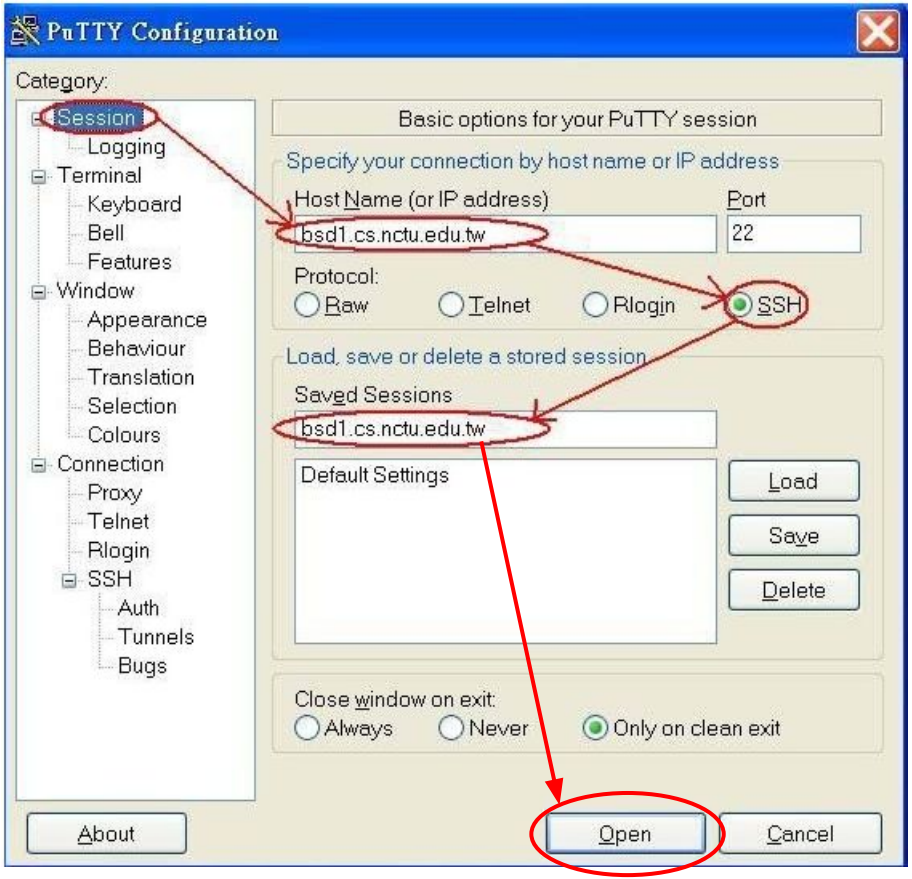
linux2.cs.nctu.edu.tw

linux3.cs.nctu.edu.tw

linux4.cs.nctu.edu.tw

linux5.cs.nctu.edu.tw

linux6.cs.nctu.edu.tw



Download:

https://goo.gl/bFz961

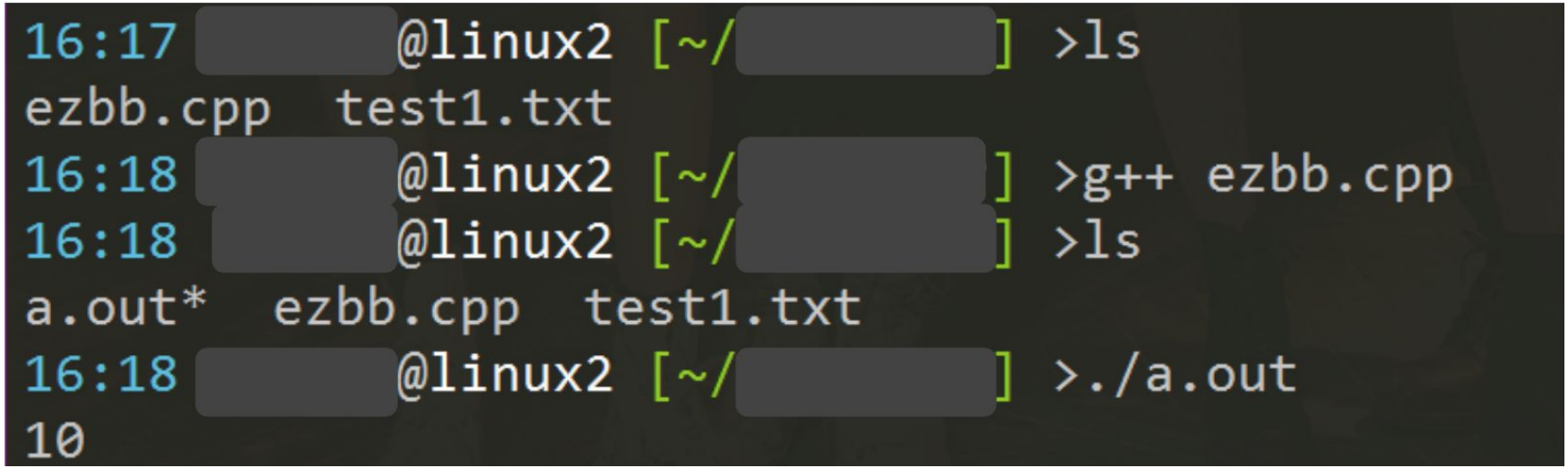
More Settings:

https://goo.gl/y5zc2d

Upload to Work Station

Linux command

command you may use: cd, ls, g++ [-o outputfilename], ./[outputfilename]



* Redirect file to standard input : [executable] < [file] (i.e., ./a.out < input.txt)