EEEC10008(515169) S23: Object-Oriented Programming

Advanced Input and Output

What you will learn from Lab 6

In this laboratory, you will learn about file stream and string stream.

TASK 6-1 MEMBER FUNCTIONS OF ISTREAM

❖ Please compile and execute the program `lab6-1`.

```
// lab6-1.cpp
#include <iostream>
using std::cout;   using std::cin;
using std::endl;

int main()
{
    char c;
    char str[100];

    // first example: getline()
    cout << "Enter a sentence: " << endl;
    cin.getline(str,100,'\n');
    cout << "The sentence you enter is: " << str << endl;

    // second example: get()
    cout << "Enter a character: " << endl;
    cin.get(c);
    cout << "The character you type is: " << c << endl;

    return 0;
}
```

A. In the first example, if you enter less than 100 characters, `getline()` will insert a NULL character to end this string.

B. In the second example, if you enter more than one character, `get()` will remain the first character for you.

TASK 6-2 STRING STREAM

❖ String stream provides an interface to manipulate strings. Remember to include `sstream`.

```
// lab6-2-1.cpp
#include <iostream>
#include <    ?     >

using std::cout;            using std::endl;
using std::ostringstream;

int main()
{
    int i = 1024;
    double d = 3.14159;

    ostringstream message;
    message << "i = " << i << ", d = " << d << endl;

    cout << message << endl;
    cout << message.str() << endl;
    return 0;
}
```

a. The line `cout << message.str() << endl;` is equal to `string msg =  message.str();` plus `cout << msg << endl;`

b. Use member function `str()` to convert an `ostringstream` to a `string` object.

❖ `lab6-2-2.cpp` is an example to use `istringstream`.

```
// lab6-2-2.cpp
#include <iostream>
#include <sstream>
using std::cout;            using std::endl;
using std::istringstream; using std::string;

int main()
{
    string s1 = "value 6";
    istringstream format_str(s1);

   int a;
    string s2;
    format_str >> s2 >> a;
    cout << a << endl << s2 << endl;
    return 0;
}
```

a. You can use `string` object to initialize an `istringstream`.

TASK 6-3 BINARY FILE

❖ In this example, you will learn how to write the binary file.

```
// lab6-3-1.cpp
#include <iostream>
#include <fstream>
using namespace std;
int main()
{
	ofstream out("out.dat", ios::binary);
	for ( int i = 0 ; i < 10 ; ++i) {
		out.write((char*)&i,sizeof(i));
	}
	out.close();
	return 0;
}
```

a. Use member function `write( (char*)&var , sizeof(var) )` to write a binary file.

❖ In this example, you will learn how to read the binary file.

```
// lab6-3-2.cpp
#include <iostream>
#include <fstream>
using namespace std;
int main()
{
	int num = 0;
	ifstream in("out.dat");
	for ( int i = 0 ; i < 10 ; ++i) {
		in.read((char*)&num,sizeof(i));
		cout << num << endl;
	}
	in.close();
	return 0;
}
```

a. Use member function `read( (char*)&var , sizeof(var) )` to read a binary file.

EXERCISE 6-1: TEXT PROCESSING

❖ Please write a program to process the specified file and output the proccessing results to another file. The specified input file name and the output file name would enter simultaneously when you execute the file.

```
$ ./ex6-1 ./6-1/1.txt ./6-1/1-out.txt↵
```

```
$ cat ./6-1/1.txt↵
Across Japan, nearly 1.5 million people have withdrawn from society,
leading reclusive lives largely confined within the walls of their home,
according to a new government survey.

These are Japan’s hikikomori, or shut-ins, defined by the government as
people who have been isolated for at least six months. Some only go out to
buy groceries or for occasional activities, while others don’t even leave
their bedrooms.
```

```
$ cat ./6-1/1-out.txt
The number of words is: 66
The number of sentences is: 3
The longest sentence has a length of: 27
The longest word has a length of: 10
The longest words are: government hikikomori government occasional
activities
```

```
$ ./ex6-1 ./6-1/2.txt ./6-1/2-out.txt↵
```

```
$ cat ./6-1/2.txt↵
The drills would focus on the country’s “capabilities” to seize control of
sea, air and information under the support of our joint combat system,”
said the PLA.

Soon after the announcement by China, Taiwan’s defense ministry said it had
detected a total of 42 Chinese warplanes over the Taiwan Strait, which
separates the island from the Chinese mainland. It said 29 Chinese
warplanes had crossed the median line in the strait into its air defense
identification zone. It added that eight PLA vessels had been spotted in
the strait.
```

```
$ cat ./6-1/2-out.txt
The number of words is: 89
The number of sentences is: 4
The longest sentence has a length of: 31
The longest word has a length of: 14
The longest words are: identification
```

```
$ ./ex6-1 ./6-1/3.txt ./6-1/3-out.txt↵
```

```
$ cat ./6-1/3.txt↵
The IRA is probably the best known paramilitary group of the Troubles
because of the scale of its attacks, two of which struck at the heart of
the British establishment.
In 1979, an IRA volunteer assassinated Lord Louis Mountbatten, a member of
the royal family who mentored the now King Charles. In 1984, the group
bombed a hotel in which then-British Prime Minister Margaret Thatcher was
staying, killing members of her governing Conservative Party.
```

```
$ cat ./6-1/3-out.txt
The number of words is: 74
The number of sentences is: 3
The longest sentence has a length of: 30
The longest word has a length of: 13
The longest words are: establishment
```

- You can get the test case files "`1.txt`", "`2.txt`", "`3.txt`" from /home/share/lab6/6-1.

EXERCISE 6-2: HEAPSORT WITH MIN-HEAP

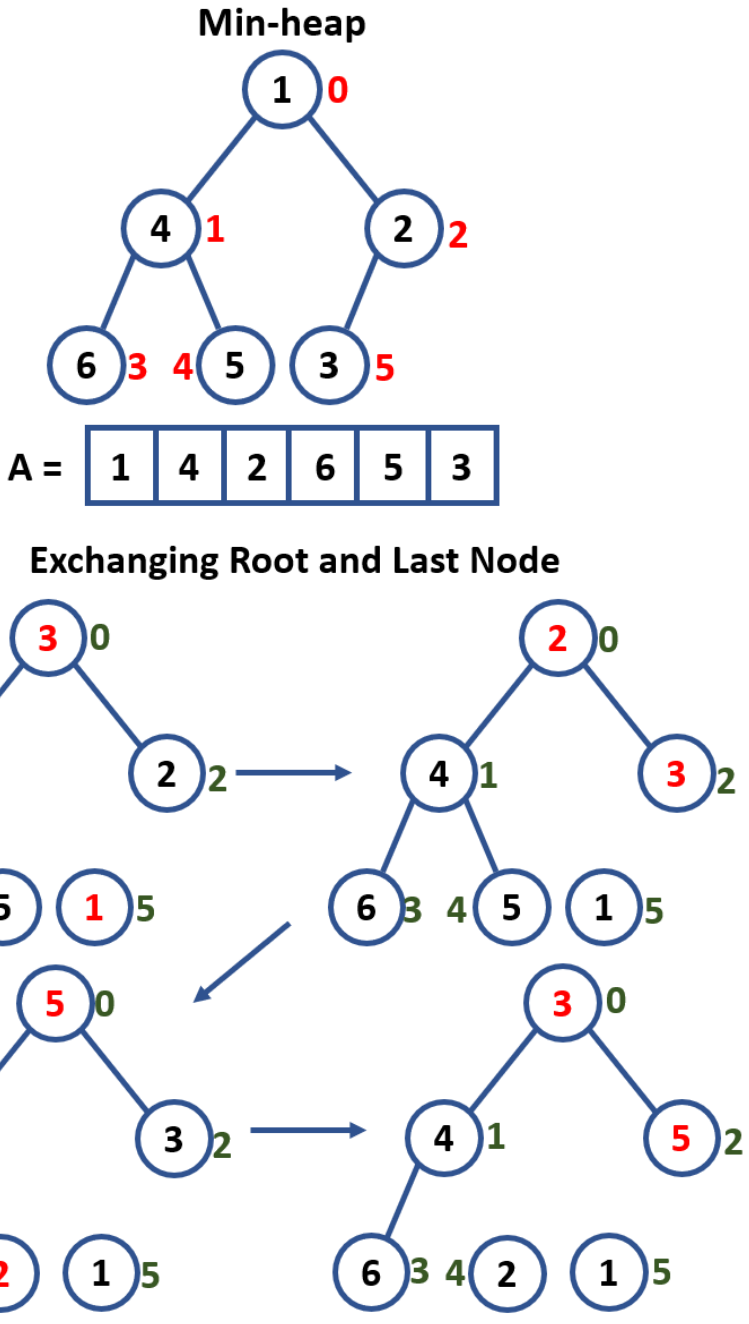
❖ A min-heap is a binary tree whose left and right subtrees have values greater than their parents. The following are the rules of min-heap:

a. Rule 1: the binary tree is complete or nearly complete.

b. Rule 2: the key value of each node is less than or equal to the key value in each of its descendents.

c. A heap tree is often implemented in an array rather than a linked list which makes for very efficient processing.

d. It's meaningless to traverse the heap tree.



- In this exercise, you have to
  a. Read the input integers from the binary file then print them on the terminal.
  b. Build a min-heap with the input integers then print the min-heap on the terminal.
  c. Print the result of heapsort in ascending order.

```
$ ./ex6-2 6-2/1.dat   ↵
3 1 5 4 2

      1
  2       5
4   3

1 2 3 4 5
$ ./ex6-2 6-2/2.dat   ↵
7 8 10 6 3 1 4 9 5 2

               1
      2                3
  6       5       10       4
9   8   7

1 2 3 4 5 6 7 8 9 10
$ ./ex6-2 6-2/3.dat   ↵
20 2 9 7 6 15 13 12 5 18 11 4 16 8 17 10 14 1 3 19

                                 1
               2                                   4
      3                7                9                8
  10       5       18       11       15       16       13       17
20   14   12   6   19

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
```

- Note: the numbers (nodes) of the bottom level heap should be split by two spaces “ ”.
- Note: your heap could be not exactly the same as the above example, but it has to follow the rules of min-heap.
- You can get the test case files “1.dat”, “2.dat”, “3.dat” from /home/share/lab6/6-2

```
$ hexdump -d 6-2/1.dat   ↵
0000000   00003   00000   00001   00000   00005   00000   00004   00000
0000010   00002   00000
0000014
```

```
$ hexdump -d 6-2/2.dat   ↵
0000000   00007   00000   00008   00000   00010   00000   00006   00000
0000010   00003   00000   00001   00000   00004   00000   00009   00000
0000020   00005   00000   00002   00000
0000028
```

```
$ hexdump -d 6-2/3.dat   ↵
0000000   00020   00000   00002   00000   00009   00000   00007   00000
0000010   00006   00000   00015   00000   00013   00000   00012   00000
0000020   00005   00000   00018   00000   00011   00000   00004   00000
0000030   00016   00000   00008   00000   00017   00000   00010   00000
0000040   00014   00000   00001   00000   00003   00000   00019   00000
0000050
```