Lab 5

**Data Structures
C++ for C Coders**

한동대학교 김영섭교수
idebtor@gmail.com

bubble sort
insertion sort
quicksort
selection sort
#if

Lab 05:

1. Working with sort algorithms:
   - Bubble sort, Insertion sort, Selection sort, Quicksort
2. Handling multiple source files, include files, and external functions.
3. Creating header file (#include file)
4. Using a macro "**#if**", "**#else**" and "**#endif**"
5. Files provided
   - `bubble.cpp, insertion.cpp, selection.cpp, quicksort.cpp`
   - `sort.cpp`
   - `sortx.exe, sortx`

Lab 05: Step 1 – Learn sort algorithms

In this lab, we would like to write a program that works like **sortx.exe**.

1. Run **sortx.exe** provided in this lab and experience how it works.

2. Each file shown below contains one specific sort algorithm.
   - bubble.cpp, insertion.cpp, quicksort.cpp, selection.cpp

3. Build and run each file separately.
   - Study the algorithms by your own and understand how each algorithm works.

4. Build and run the source file with **-DDEBUG** may help you trace the code.
   - For example, the following commands show you compiling without or with -DDEBUG.
     $ g++ bubble.cpp -o sort
     $ g++ bubble.cpp -o sort –DDEBUG

Lab 05: Step 2 – Create print_list.cpp

- Now we would like to build one executable `sort.exe` that uses all those sort functions and **print_list()** function defined in separate files.

- Take a look at **sort.cpp**
  - This is a skeleton file provided.
  - Your code should go in this file.

- Create **print_list.cpp**
  - Create this external file that contrains **printlist()** function.
  - Copy **print_list()** from one of sort files into its own file named `print_list.cpp.`
  - Add a prototype for **print_list()** in **sort.cpp.**

Lab 05: Step 3 – Create sort.h

- Create **nowic/include/sort.h** file that contains all four sort function prototypes.
- The head file such as `sort.h` must begin and end with a macro to prevent it from duplicated inclusion. For example,

```
#ifndef SORT_H
#define SORT_H

// declare the function prototypes for sort.h
void bubbleSort(int *list, int n);
...
...

// This is the end of the header guard
#endif
```

Good explanation can be found here: https://boycoding.tistory.com/144

Lab 05: Step 4 – Edit sort.cpp

- In `sort.cpp`, we want to invoke sort functions as defined in four sort files. Then, we need to **exclude** `main()` and `print_list()` in those files. Otherwise, it causes errors because of a multiply defined functions.

- In each sort file, set the macro `#if 0`.
  This will actually exclude all codes between `#if 0` and `#endif` from compiling.

- Add the following line to in `sort.cpp`.

  - `#include "sort.h"`

Lab 05: Step 5 – Build the executable, sort.exe

- Let us suppose we place source files and include folders as shown below:
  - `~/nowic/include/sort.h`
  - `~/nowic/src/bubble.cpp, insertion.cpp, quicksort.cpp, selection.cpp, print_list.cpp`

- The following command line would not work since it cannot find `sort.h`.

  ```
  $ g++ sort.cpp bubble.cpp insertion.cpp quicksort.cpp selection.cpp
  print_list.cpp -o sort
  ```

- Use `-Idir` option such that the compiler looks for header files in **dir** folder. `../` goes up by one level, `../../` by two levels in the tree folder structure.

  ```
  $ g++ sort.cpp bubble.cpp insertion.cpp quicksort.cpp selection.cpp
  print_list.cpp -I../include -o sort
  ```

Lab 05: Sample run without -DDEBUG

```
$ g++ sort.cpp bubble.cpp insertion.cpp quicksort.cpp selection.cpp
print_list.cpp -I../../include -o sort
```

may be different depending on your folder structure

```
$ ./sort
b for bubble, i for insertion, q for quick, s for selection
Enter an algorithm to sort(x to exit): q
UNSORTED(10):
3 4 1 7 0 9 6 5 2 8
SORTED(10):
0 1 2 3 4 5 6 7 8 9
b for bubble, i for insertion, q for quick, s for selection
Enter an algorithm to sort(x to exit): x
```

Lab 05: Sample run with -DDEBUG

```
$ g++ sort.cpp bubble.cpp selection.cpp insertion.cpp quicksort.cpp print_list.cpp -I./../include -o
sort -DDEBUG
$ ./sort
b for bubble, i for insertion, q for quick, s for selection
Enter an algorithm to sort(x to exit): b
UNSORTED(10):
3 4 1 7 0 9 6 5 2 8
BUBBLE SORTING...
3 1 4 0 7 6 5 2 8 9
1 3 0 4 6 5 2 7 8 9
1 0 3 4 5 2 6 7 8 9
0 1 3 4 2 5 6 7 8 9
0 1 3 2 4 5 6 7 8 9
0 1 2 3 4 5 6 7 8 9
0 1 2 3 4 5 6 7 8 9
0 1 2 3 4 5 6 7 8 9
0 1 2 3 4 5 6 7 8 9
SORTED(10):
0 1 2 3 4 5 6 7 8 9
b for bubble, i for insertion, q for quick, s for selection
Enter an algorithm to sort(x to exit):
```

may be different depending
on your folder structure

Lab 05:

- Files to submit:
  - **`sort.h, print_list.cpp, sort.cpp`**
- Due:
  - 11:55 pm, on the day of this lecture
- Grade:
  - 1.0

Lab 5

**Data   Structures
C++ for C Coders**

한동대학교 김영섭교수
idebtor@gmail.com

insertion sort
selection sort
bubble sort
quick sort
#if