/*
Full Name: Jasper Wu
Student ID: 2339715
Chapman email: jaswu@chapman.edu
Course number and section: 350-01
Assignment Number: 6
*/

1. Were the time differences more drastic than you expected?
   Yes, the time spent on the BubbleSort is almost 20 times compared to QuickSort.

2. What tradeoffs are involved in picking one algorithm over another?
   - Space complexity
   - Run time complexity

3. How did your choice of programming language affect the results?
   In this assignment I only use C++ programming language so I don't have any comparison to other programming languages. I would imagine the modern compiler should compile the high level programming language into lower level machine code in a very optimized way so the difference should not show too much in terms of sorting operation. But there may be some limitations on the programming language itself that does not support certain functions like recursive operation so it may not be able to perform well in Quicksort and MergeSort that requires recursive operation.

4. What are some shortcomings of this empirical analysis?
   - The pattern of the unsorted data can affect the result. As shown below, a completely unsorted data shows almost 80 times faster of QuickSort vs BubbleSort. And a random data shows almost 20 times faster of QuickSort vs BubbleSort.

     - Random Pattern
       ***** BubbleSort *****
       Start time: 241072287445 microseconds
       End time : 241072289574 microseconds
       Time used : 2129 microseconds

       ***** QuickSort *****
       Start time: 241072291464 microseconds
       End time : 241072291572 microseconds
       Time used : 108 microseconds

     - Completely Unsorted Pattern
       ***** BubbleSort *****
       Start time: 241667275877 microseconds

End time : 241667278519 microseconds
Time used : 2642 microseconds

***** QuickSort *****
Start time: 241667281081 microseconds
End time : 241667281112 microseconds
Time used : 31 microseconds

- We have to implement the algorithms and run the simulation to get the comparison results.