ECE368 Project 1
Milestone 1
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This program requires the following:
gcc version 4.7 or higher
C11 standard
Support for new C functions such as getline(), itoa() and atoi()

On the latest version of gcc, the C11 standard is the default standard.
The program utilizes 'Shell Insertion' and 'Improved Bubble' to sort an unsorted list of integers from an input text file. The 'Shell Insertion' sort makes use of the three smooth number sequence generated using the formula pow(2, i) * pow(3, j) as the gap, while the 'Improved Bubble' sort uses a sequence of integers generated by dividing the previous integer by 1.3 as the gap.

Several improvements were made, such as the early termination of a sub shell sort when no swapping occurs in the first comparison. This is illustrated below.

Gap = 3
3 4 6 8 2 7 9 1 5
3 4 6 8 2 7 9 1 5 – increment comparison pair by one
3 2 6 8 4 7 9 1 5 – swapping occurs
3 2 6 8 4 7 9 1 5 – increment comparison pair by one
3 2 6 8 4 7 9 1 5 – increment comparison pair by one
3 2 6 8 4 7 9 1 5 – normally the next comparison would be 3 and, but given that no swapping occurred for '8' and '9', there is no point in comparing '3' and '8' since the same comparison has been done in step one and no values in the relevant positions were changed since.

The improved bubble sort utilizes the generated N / 1.3 sequence which significantly reduces the number of comparisons required as the elements can now move through multiple positions in the array at once instead of moving one position at a time using the gap=1 bubble sort.

Four header files are included, namely <stdio.h>, <stdlib.h>, <string.h> and <stdbool.h>. Naming conventions such as INPUT_FILE, OUTPUT_FILE and SEQ_FILE are defined at the top.

The program consists of 6 functions and 2 helper functions. The Load_File and Save_File functions are called by several other functions in the program. The sequence generating functions generate and save the sequence as a list into a text file. Due to the difficulty in generating a sorted three smooth number sequence, the sequence is generated unsorted, and then Load_File and qsort are called to sort the sequence. As such, the shell sort starts reading its gap sequence from the end, while the bubble sort reads its gap sequence as usual.