N8 SWALLEY 3/2/2022

SE463 – Spring 2022
Assignment #2
Equivalence Class Testing and Decision Table Testing

Introduction

This document outlines the analysis for Equivalence Class Testing and Decision Table Testing of a sorting system in C++. The sorting system is menu driven and consists of two sorting algorithms: bubble sort and insertion sort.

Equivalence Class Testing

Equivalence Class Testing is a black-box testing technique used in software testing that deals with partitioning the test input data into a number of different classes. The four different types of Equivalence Class Testing include Weak Normal, Strong Normal, Weak Robust, and Strong Robust. Weak Normal ECT focuses on one variable from each equivalence class and is also known as single fault assumption. Strong Normal ECT is known as multiple fault assumption, and it focuses on test cases from each element of the Cartesian product of the equivalence. Weak Robust ECT tests one variable from each equivalence class but is focused on invalid values. Strong Robust ECT produces test cases for all valid and invalid elements of the product of the equivalence class. Equivalence Class Testing is an effective form of software testing because it improves the quality of test cases by removing large amounts of redundancy and gaps.

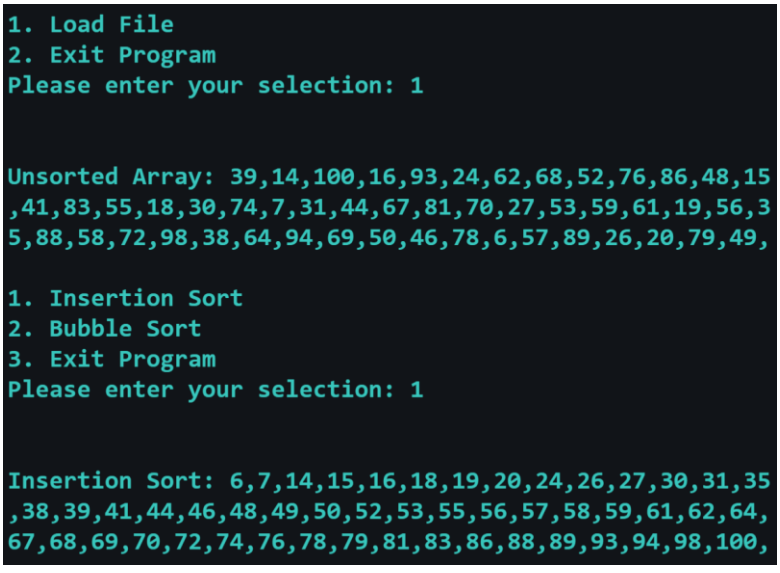
Equivalence Classes and Test Cases

For this assignment, the equivalence classes include valid and invalid inputs. The user is prompted to enter input values in a menu system, “1” loads data values from a file, “2” exits the program. After the first input, the user is prompted again to enter either “1” for insertion sort, “2” for bubble sort, and “3” to exit the program. The following section illustrates the different test cases in the menu system for each of the different types of equivalent class testing. The range of valid values for the first user input is 1-2. The range of valid values for the second user input is 1-3. The data file is either valid or invalid, with valid being a file of integers separated by a comma.

Weak Normal Equivalence Class Testing

In Weak Normal ECT, we use a single-fault assumption. Weak Normal is concerned with valid inputs only and assumes a fault in one of the variable inputs. This variable is outlined in red.

Cases:	userInput1	userInput2	dataFile	Outcome
1	1	1	ints	Valid
2	1	2	ints	Valid
3	1	1	ints	Valid



```
1. Load File
2. Exit Program
Please enter your selection: 1


Unsorted Array: 39,14,100,16,93,24,62,68,52,76,86,48,15
,41,83,55,18,30,74,7,31,44,67,81,70,27,53,59,61,19,56,3
5,88,58,72,98,38,64,94,69,50,46,78,6,57,89,26,20,79,49,

1. Insertion Sort
2. Bubble Sort
3. Exit Program
Please enter your selection: 2


Bubble Sort: 6,7,14,15,16,18,19,20,24,26,27,30,31,35,38
,39,41,44,46,48,49,50,52,53,55,56,57,58,59,61,62,64,67,
68,69,70,72,74,76,78,79,81,83,86,88,89,93,94,98,100,
```

In Weak Normal Equivalence Class Testing, all expected outcomes were reported successfully.

Strong Normal Equivalence Class Testing

In Strong Normal ECT, we use a multiple-fault assumption. In Strong Normal we select test cases from each element of the Cartesian product of the equivalence. This ensures the notion of completeness as it offers possible combinations of inputs. The cases in blue represent the different cases actually tested in the system.

Cases:	userInput1	userInput2	dataFile	Outcome
1	1	1	ints	Valid
2	2	1	ints	Valid
3	1	2	ints	Valid
4	1	3	ints	Valid

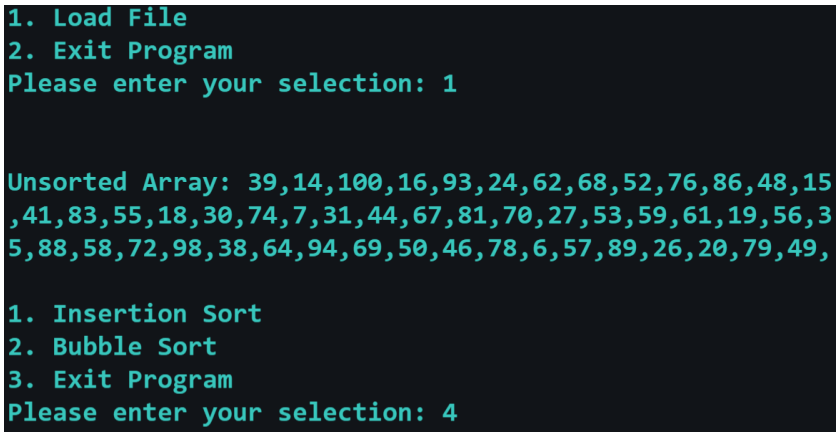
```
1. Load File
2. Exit Program
Please enter your selection: 2
Goodbye!
```

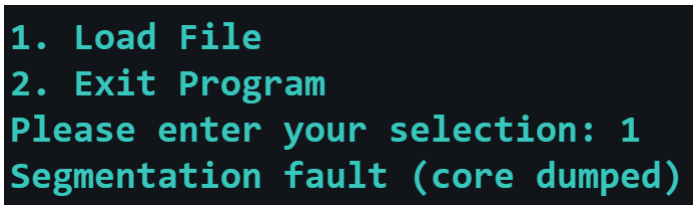
```
1. Load File
2. Exit Program
Please enter your selection: 1


Unsorted Array: 39,14,100,16,93,24,62,68,52,76,86,48,15
,41,83,55,18,30,74,7,31,44,67,81,70,27,53,59,61,19,56,3
5,88,58,72,98,38,64,94,69,50,46,78,6,57,89,26,20,79,49,

1. Insertion Sort
2. Bubble Sort
3. Exit Program
Please enter your selection: 3
Goodbye!
```

Weak Robust Equivalence Class Testing

Weak Robust ECT is very similar to Weak Normal ECT except now we are concerned with invalid inputs. We test one invalid variable from each equivalence class. This variable is outlined in red.

Cases:	userInput1	userInput2	dataFile	Outcome
1	0	1	ints	Invalid
2	1	4	ints	Invalid
3	1	1	strings	Invalid





*invalid input file

In Weak Robust Equivalence Class Testing, all expected outcomes were reported successfully. The sorting menu system handles invalid inputs and prompts the user to re-enter a value but does not handle an invalid data file.

Strong Robust Equivalence Class Testing

In Strong Robust ECT, we produce test cases for all valid and invalid elements of the product of the equivalence class. However, it is incapable of reducing the redundancy in testing.

Cases:	userInput1	userInput2	dataFile	Outcome
1	1	1	ints	Valid
2	1	2	ints	Valid
3	1	3	ints	Valid
4	2	1	ints	Valid
5	2	2	ints	Valid
6	2	3	ints	Valid
7	0	1	ints	Invalid
8	0	4	ints	Invalid
9	0	4	strings	Invalid
10	1	4	ints	Invalid
11	1	2	strings	Invalid
12	0	2	strings	Invalid
13	1	4	strings	Invalid
14	0	4	strings	Invalid

In Strong Robust Equivalence Class Testing, all expected outcomes were reported successfully.

Decision Table Testing

If the user provides a valid data file and valid menu selections, the program will execute successfully. If any of the input is invalid, the user will either be prompted to enter a new value, or an error message will possibly be displayed. Decision Table testing is used to test the system behavior for different input combinations. In this specific sorting system, we could use either limited entry decision tables or extended entry decision tables, depending on how you look at the equivalence classes. I decided to use a Limited Entry Decision Table because the equivalence classes are invalid and valid values. The following section illustrates Decision Table Testing for the sorting system.

Conditions	Set #1	Set #2	Set #3	Set #4	Set #5	Set #6	Set#7
UserInput1	Invalid	Invalid	Invalid	Valid	Valid	Valid	Valid
UserInput2	Invalid	Valid	Invalid	Invalid	Valid	Invalid	Valid
DataFile	Invalid	Invalid	Valid	Invalid	Invalid	Valid	Valid
Output	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	SUCCESS