Writing Test Cases II

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Overview

Introduction

To introduce our project we will be reusing the triangle program that we tested in the very beginning of this class. The background of the project is that it will check if the inputs that has been entered by the user are valid or not. The program will have the ability to check if any string, character, or negative numbers, and reject them as an input. If the input is not valid, the user will be prompt again to enter 3 new valid positive integers. The overall program will check if the 3 input values will form a triangle or not, and let the user know if the values create an equilateral, scalene, or an isosceles triangle.

Purpose

The purpose of this project is to see if we can apply as many techniques to our simple triangle program that we started off with at the beginning of the semester.

Oracle

Test Oracle

Environment

The hardware used for programming and testing is an iPhone running the operating system of iOS 11.3. The program used for creating the State diagram was draw.io (a plugin by Google) and Code2flow (https://code2flow.com/app) for verification of the diagram through a third party software.

Testing Techniques

1. Mutation Testing (*Not Chosen*)
2. Control Flow
3. Data Flow *(Not Applicable)*
4. Domain Testing
5. Equivalent Class Testing
6. Decision Tables
7. Conformance Testing
8. Feature Testing (*Not Applicable*)

Control Flow Testing

Control Flow Diagram

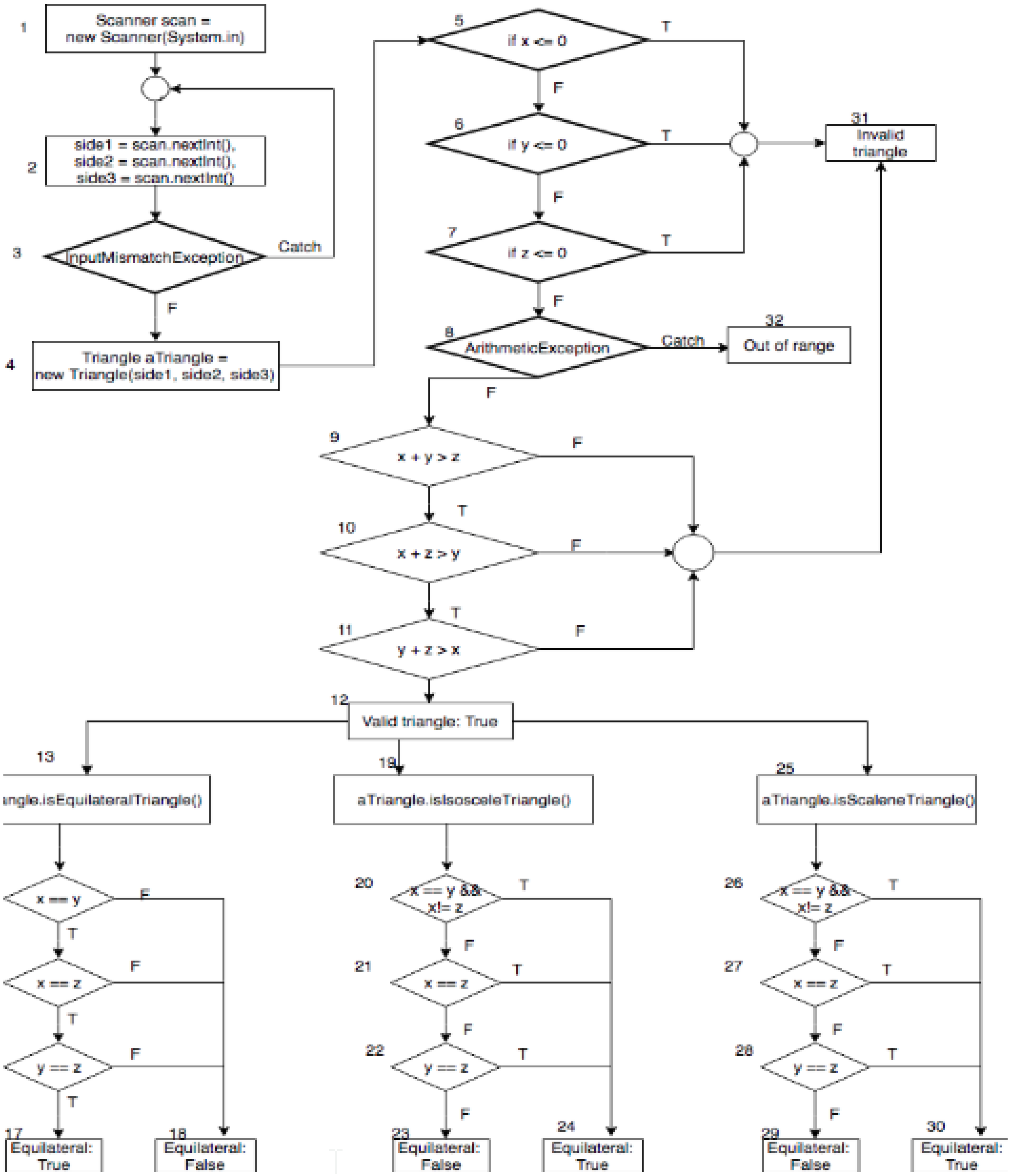


Figure 1. Control Flow Diagram of Triangle Program

Domain Testing

Inputs

The inputs of the triangle program will be provided by the user in which they will enter three values for each side of the triangle. The user can input any integer value between 1 to 2147483647, which is the positive range for an integer in Java.

Output

The output of this program will consist of two parts. First, the program will validate if the given lengths can build a valid triangle or not (String of True/False). Secondly, if the given lengths construct a valid triangle, the program will determine what type of triangle it is depending on the value of the lengths (True/False of “Equilateral”, “Isosceles”, “Scalene”).

Equivalent Class Testing

Equivalent Classes

Triangle	Property
Equilateral	Triangle has three equal sides and three equal angles. Each angle is 60°
Isosceles	Triangle has **two** equal sides and two equal angles.

Scalene	Triangle has no congruent sides. In other words, each side must have a different length

Boundaries

Input	Boundaries
Side A	1 - 2,147,483,647
Side B	1 - 2,147,483,647
Side C	1 - 2,147,483,647

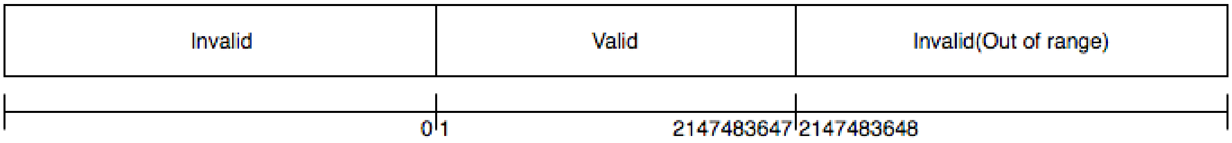


Figure 2. Input Domain Diagram for Triangle Program

Test Cases

Test ID	Purpose	Input	Expected Output	Actual Output	Pass/Fail
1	Test first length domain	0, 1, 1	Invalid length	Invalid length	Pass
2	Test first length domain	2147483648, 2, 2	Invalid length	Invalid length	Pass
3	Test first length domain	1, 2, 2	Valid triangle,	Valid triangle,	Pass

			Isosceles	Isosceles	
4	Test second length domain	1, 0, 1	Invalid length	Invalid length	Pass
5	Test second length domain	3, 2147483648, 2	Invalid length	Invalid length	Pass
6	Test second length domain	3, 1, 4	Valid triangle, Isosceles	Valid triangle, Isosceles	Pass
7	Test third length domain	2, 3, 0	Invalid length	Invalid length	Pass
8	Test third length domain	2, 3, 2147483648	Invalid length	Invalid length	Pass
9	Test third length domain	2, 3, 1	Invalid triangle	Invalid triangle	Pass
10	Test valid triangle domain	1, 1, 2	Invalid triangle	Invalid triangle	Pass
11	Test valid triangle	2, 4, 5	Valid triangle, Scalene	Valid triangle, Scalene	Pass
12	Test valid equilateral triangle	0, 0, 0	Invalid length	Invalid length	Pass
13	Test valid equilateral triangle	1, 1, 1	Valid triangle, Equilateral	Valid triangle, Equilateral	Pass

14	Test Valid equilateral triangle	2, 2, 3	Valid triangle, Isosceles(not equilateral)	Valid triangle, Isosceles	Pass
15	Test Valid equilateral triangle	3, 4, 5	Valid triangle, Scalene(not equilateral)	Valid triangle, Scalene	Pass
16	Test valid isosceles	2, 2, 4	Invalid triangle	Invalid triangle	Pass
17	Test valid isosceles	3, 3, 5	Valid triangle, Isosceles	Valid triangle, Isosceles	Pass
18	Test Valid isosceles	1, 1, 1	Valid triangle, Equilateral,	Valid triangle, Equilateral	Pass
19	Test Valid isosceles	3, 5, 7	Valid triangle, Scalene(not Isosceles)	Valid triangle, Scalene	Pass
20	Test Valid scalene	2, 2, 2	Valid triangle, Equilateral(not scalene)	Valid triangle, Equilateral	Pass
21	Test Valid scalene	3, 3, 5	Valid triangle, (not scalene)	Valid triangle,	Pass

22	Test Valid scalene	3, 4, 5	Valid triangle, Scalene	Valid triangle, Scalene	Pass

Decision Tables

Conditions	**Values**	**Rules or Combinations**										
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
a < b + c?	**T, F, -**	**F**	**T**	**T**	**T**	**T**	**T**	**T**	**T**	**T**	**T**	**T**
b < a + c?	**T, F, -**	**-**	**F**	**T**	**T**	**T**	**T**	**T**	**T**	**T**	**T**	**T**
c < a + b?	**T, F, -**	**-**	**-**	**F**	**T**	**T**	**T**	**T**	**T**	**T**	**T**	**T**
A = B?	**T, F, -**	**-**	**-**	**-**	**T**	**T**	**T**	**T**	**F**	**F**	**F**	**F**
A = C?	**T, F, -**	**-**	**-**	**-**	**T**	**T**	**F**	**F**	**T**	**T**	**F**	**F**
B = C?	**T, F, -**	**-**	**-**	**-**	**T**	**F**		**F**		**F**		**F**
Actions												
Not a Triangle	**T, F, -**	**X**	**X**	**X**								
Scalene	**T, F, -**											**X**
Isosceles	**T, F, -**						**X**			**X**	**X**	
Equilateral	**T, F, -**				**X**							
Impossible	**T, F, -**					**X**	**X**		**X**			
Checksum		32	16	8	1	1	1	1	1	1	1	1

Conformance Testing

Description of the Problem

The goal of this assignment is to check if three integer input makes an isosceles, equilateral or scalene triangle.

Business Rules

1. The program will take three integers x, y and z
2. The program will determine if a triangle is an equilateral, isosceles, scalene or a combination of one of them

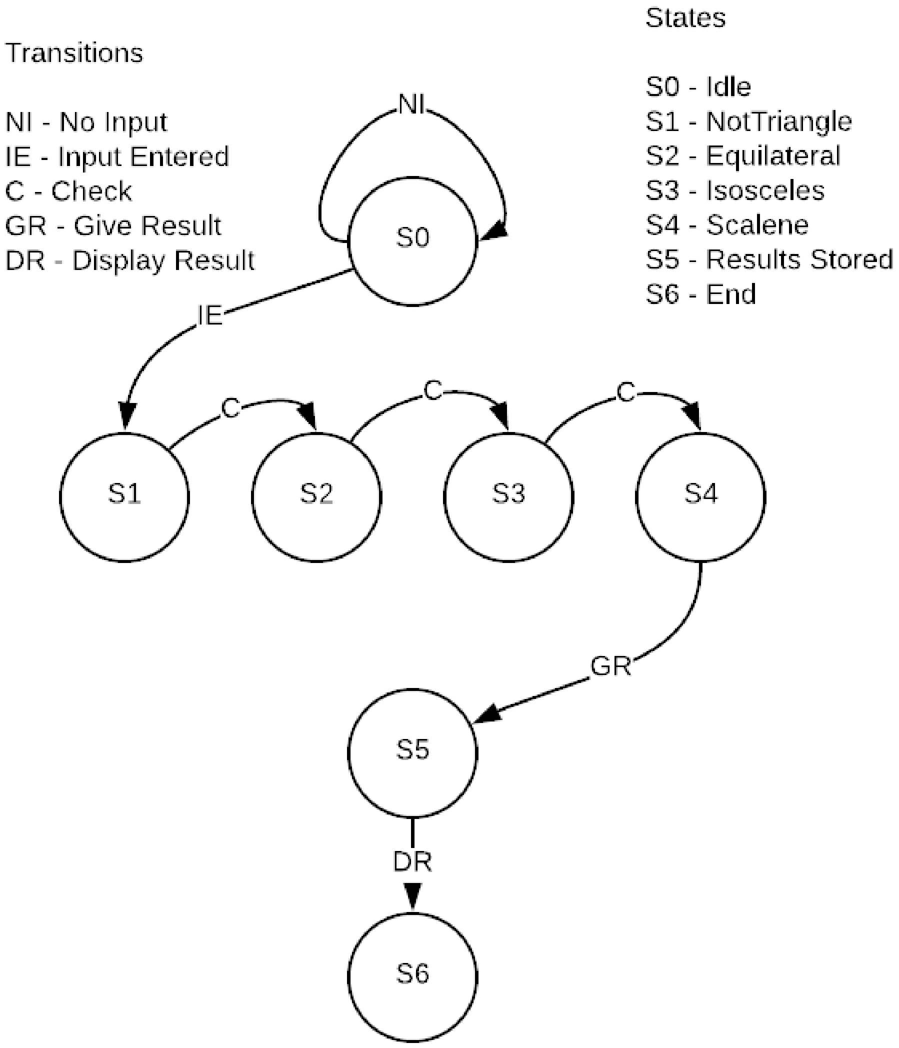
States and Transitions

Transitions		
Symbol	Name	Definition
NI	No Input	Nothing is entered
IE	Integer Entered	Three integers entered
DR	Display Result	Result determined and printed on screen

States		
Symbol	Name	Definition
S0	Idle	Program is waiting for input

S1	NotTriangle	Inputs are not a triangle
S2	Equilateral	Inputs are equilateral triangle
S3	Isosceles	Inputs are isosceles triangle
S4	Scalene	Inputs are scalene triangle
S5	End	Program ends

Finite State Machine



Triangle FSM

Transition Tours

Transition Tour #	Sequence
1	**Idle** — Input Entered → **NotTriangle** — Check → **Equilateral** — Check → **Isoceles** — Check → **Scalene** — Give Results → **Results Stored** — Display Results → **End**

Exceptions

#	Reason	Scenario	Input	Expected	Actual	Pass/Fail	Sequence
1.	Abnormal Input	Inputs are unnatural numbers that are not part of the domain	-1	Invalid	Invalid	Pass	S0-S1
2.	Gigantic Input	Inputs are too large and computation takes forever	9 x 10^{99}	Doesn't end	Doesn't end	Pass	S0-S1 S0-S2 S0-S3 S0-S4
3.	Undetermined Result	Inputs are mathematically uncomputable like zero divided by zero	0,1,0	Exception	Exception	Pass	S0-S4

Lessons Learned

At the start of the class, the professor had mentioned how we will continue our first assignment as our last assignment. The goal of such a task was to implement our knowledge learned in class to gauge our readiness for testing real world applications.

In this particular project, our team learned how control flow testing, domain testing, equivalence class testing, boundary values, decision tables, and conformance testing were all techniques that were applicable to our simple triangle program.