Assignment 1: Black Box Testing

SEG 3103 [Z] - Software Quality Assurance

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University of Ottawa

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Problem 1:

Question 1.1: Using the Equivalence Class Partitioning and the Boundary Value Analysis approaches, design black box tests for the method easterDate. Show your equivalence classes with a short descriptive note and the boundary values that should be checked. (15%)

Input Condition	EC #	Valid Classes	Invalid Classes	Boundary Values	Comments
Year	1	1584 <= year <= 4098		1583, 1584, 4098, 4099	The valid range of values is between 1584 to 4098. It can be decomposed
	1.1	Year such that the output is in March		Year such that the output is March 22 Year such that the output is March 31 Year such that the output is April 1	The set of all years in the valid range where Easter falls in March
	1.2	Year such that the output is in April		Year such that the output is March 31 Year such that the output is April 1 Year such that the output is April 25	The set of all years in the valid range where Easter falls in April
	2		year < 1584	1583, 1584	Any number less than 1584 is not a valid input
	3		year > 4098	4098, 4099	Any number less greater than 4098 is not a valid input

	4	year = 1954		{1954, 1981, 2049, 2076}	special year where the computed date should be reduced by 7 The boundary is the set of all specified years since the boundary of a set is the set itself.
	5	year = 1981		{1954, 1981, 2049, 2076}	
	6	year = 2049		{1954, 1981, 2049, 2076}	
	7	year = 2076		{1954, 1981, 2049, 2076}	

Question 1.2: Write enough test cases to cover all the equivalence classes, and boundary values identified in question 1.1. Provide a table showing the link between your test data and the equivalence classes. (10%)

Test Case Number	Test Data	Expected Results	Covers Equivalence	Boundary Values
1	Year = 1818	March 22	1.1	Year such that the output is March 22
2	Year = 1771	March 31	1.1	Year such that the output is March 31
3	Year = 1584	April 1	1.2	**TWO BOUNDARIES TESTED:** Year such that the output is April 1 1584
4	Year = 1943	April 25	1.2	Year such that the output is April 25
5	Year = 1583	null	2	1583
6	Year = 4098	April 6	1.2	4098
7	Year = 4099	null	3	4099

8	year = 1954	April 18	4, 1.2	1954
9	year = 1981	April 19	5, 1.2	1981
10	year = 2049	April 18	6, 1.2	2049
11	year = 2076	April 19	7, 1.2	2076

Question 1.3: Implement your test suite using JUnit and the provided EasterCalculatorTest. You are required to hand the source code of your test suite (20%)

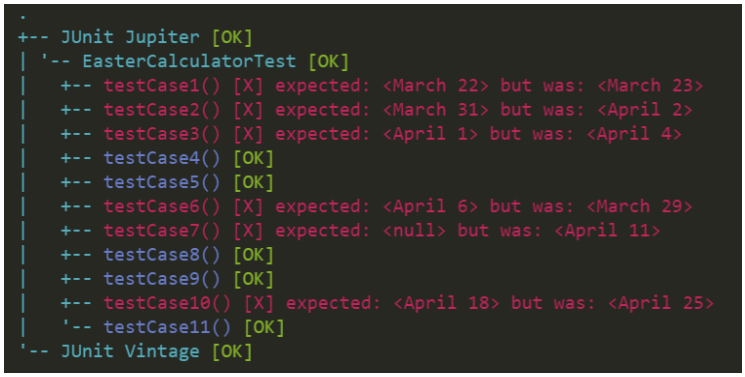
Junit tests are in test/EasterCalculatorTest.java

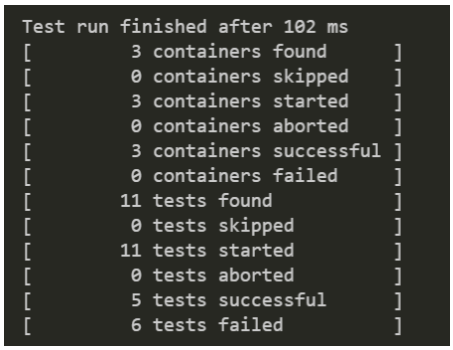
Question 1.4: Report your test results by providing a table with the following format (the test case numbers correspond to the ones in Question 1.2) (5%)

Test Case Number	Expected Results	Actual Results	Verdict (Pass/Fail)
1	March 22	March 23	**Fail**
2	March 31	April 2	**Fail**
3	April 1	April 4	**Fail**
4	April 25	April 25	**Pass**
5	null	null	**Pass**
6	April 6	March 29	**Fail**
7	null	April 11	**Fail**
8	April 18	April 18	**Pass**
9	April 19	April 19	**Pass**
10	April 18	April 25	**Fail**
11	April 19	April 19	**Pass**

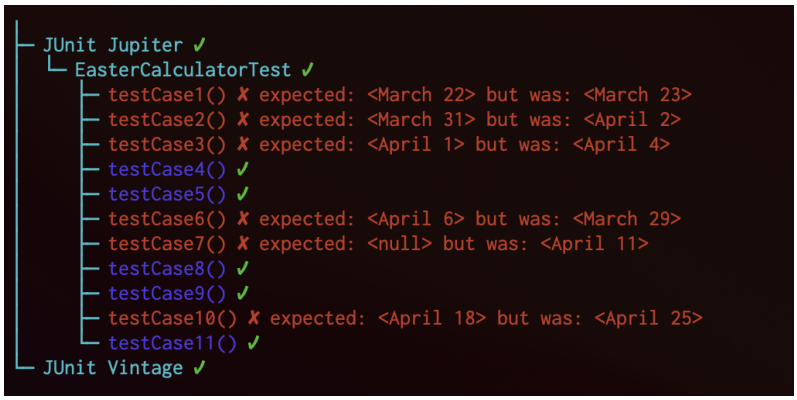
Screenshots from the terminal after running the JUnit command line :

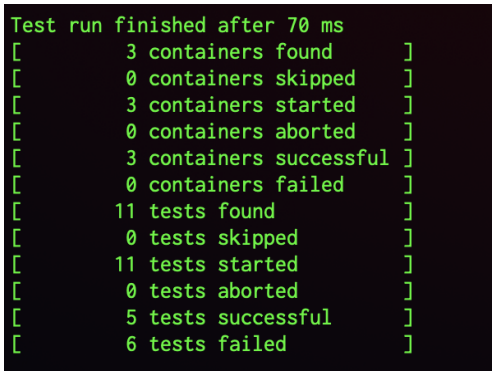
Windows:





MacOs:





Problem 2:

Question 2.1: Identify the causes and the effects for this problem (5%)

Causes:

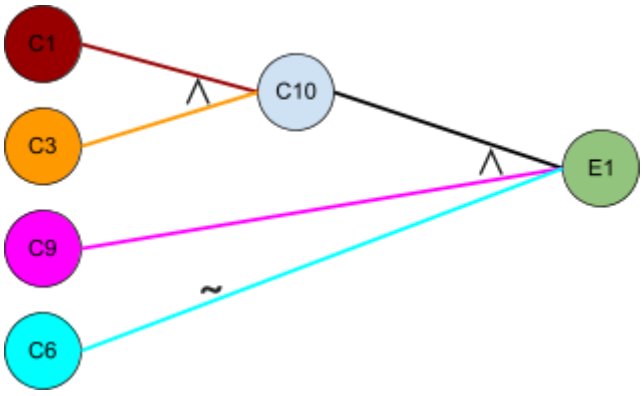
- C1: Elevator is travelling up
- C2: Elevator is travelling down
- C3: The floor up button outside the elevator is pressed
- C4: The floor down button outside the elevator is pressed
- C5: The corresponding elevator button for that floor is pressed
- C6: The charge in the elevator more or equivalent to the maximum
- C7: Elevator reaches the top floor
- C8: Elevator reaches the bottom floor
- C9: The elevator reaches the desired floor

Effects:

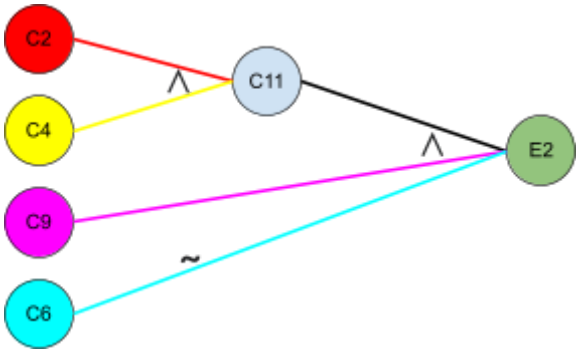
- E1: Controller stops the elevator and turns off the illumination of the floor up button
- E2: Controller stops the elevator and turns off the illumination of the floor down button
- E3: Controller stops the elevator on the floor requested by the passenger and the inner button's illumination is turned off
- E4: Controller doesn't stop the elevator and leaves the illumination on floor up button
- E5: Controller doesn't stop the elevator and leaves the illumination on floor down button
- E6: Controller stops the elevator at the top floor
- E7: Controller stops the elevator at the bottom floor

Question 2.2: Draw a cause-effect graph for this problem (20%)

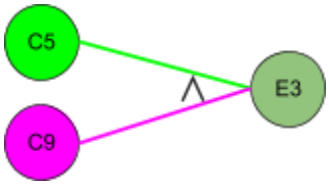
Cause-effect graph for Effect 1 (E1):



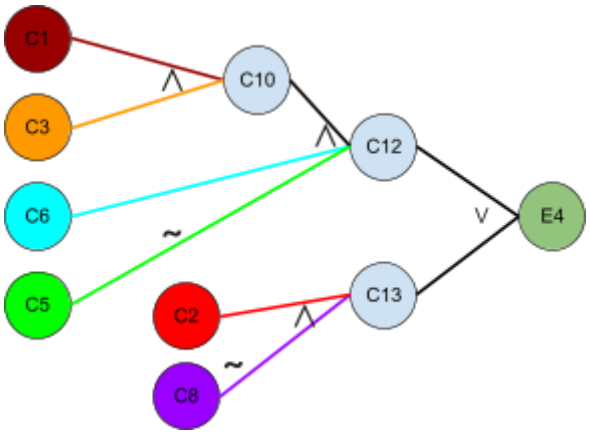
Cause-effect graph for Effect 2 (E2):



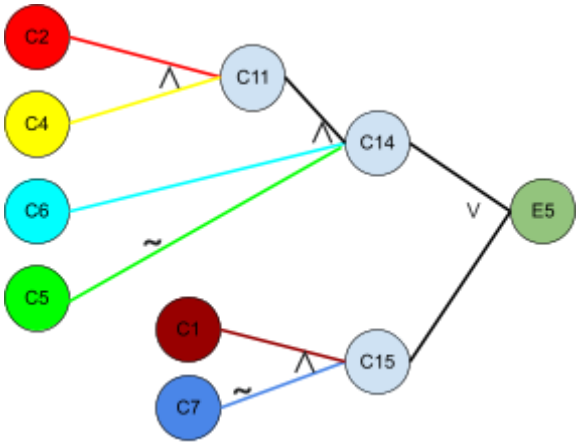
Cause-effect graph for Effect 3 (E3):



Cause-effect graph for Effect 4 (E4):



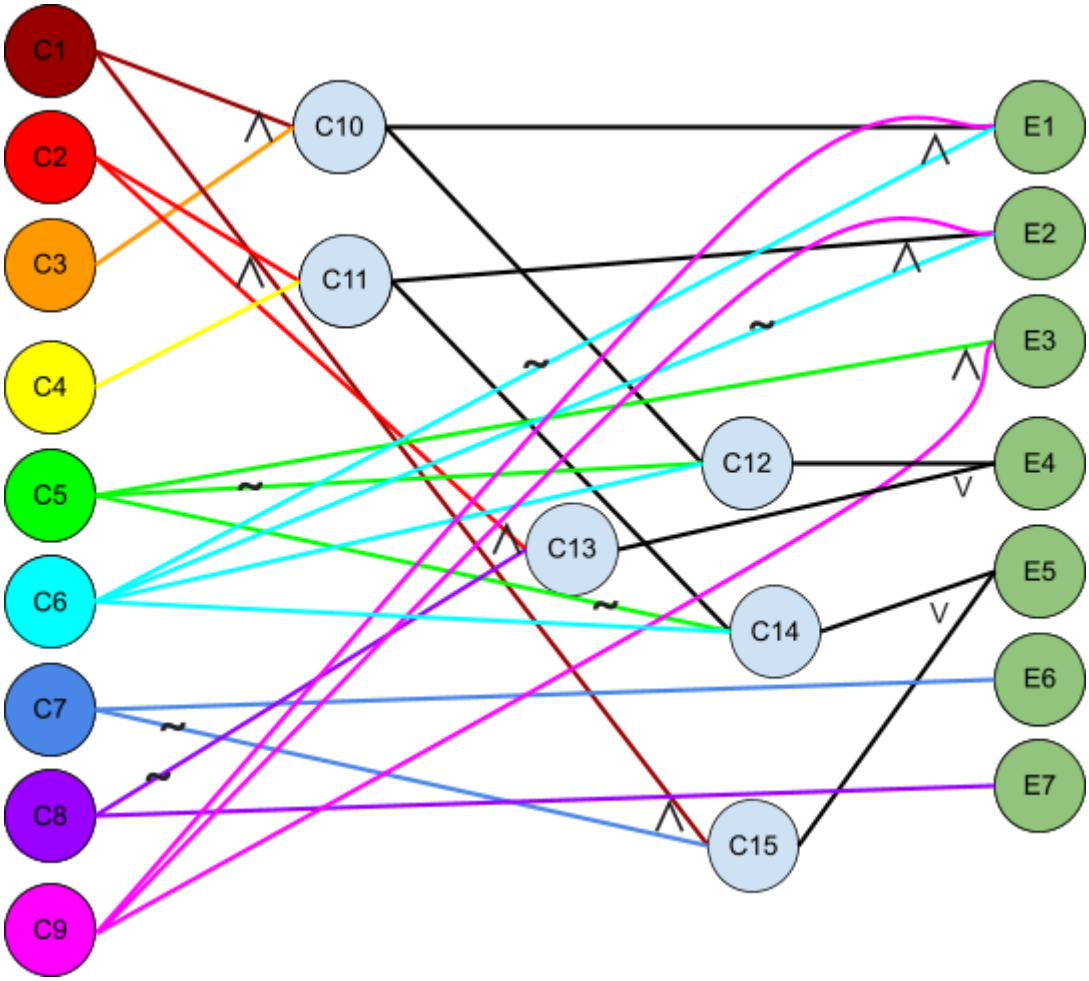
Cause-effect graph for Effect 5 (E5):



Cause-effect graph for Effect 6 (E6):

Cause-effect graph for Effect 7 (E7):

Cause-effect graph for the problem:



Question 2.3: Provide a Boolean formula corresponding to each of the possible effects (10%)

E1 = (C1 ∧ C3) ∧ (C9 ∧ ˜C6)
E2 = (C2 ∧ C4) ∧ C9 ∧ ˜C6
E3 = C5 ∧ C9
E4 = ((C1 ∧ C3) ∧ ˜C5 ∧ C6) V (C2 ∧ ˜C8)
E5 = ((C2 ∧ C4) ∧ ˜C5 ∧ C6) V (C1 ∧ ˜C7)
E6 = C7
E7 = C8

Question 2.4: Provide a decision table obtained by applying Each - Condition / All - Conditions approach (10%)

	E1		E2		E3		E4				E5				E6		E7	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
C1	T	F	-	-	-	-	T	T	F	F	T	F	T	F	-	-	-	-
C2	-	-	T	F	-	-	T	F	T	F	T	T	F	F	-	-	-	-
C3	T	T	-	-	-	-	T	T	F	F	-	-	-	-	-	-	-	-
C4	-	-	T	T	-	-	-	-	-	-	T	T	F	F	-	-	-	-
C5	-	-	-	-	T	F	F	F	T	T	F	F	T	T	-	-	-	-
C6	F	F	F	F	-	-	T	T	F	F	T	T	F	F	-	-	-	-
C7	-	-	-	-	-	-	-	-	-	-	F	T	F	T	T	F	-	-
C8	-	-	-	-	-	-	F	T	F	T	-	-	-	-	-	-	T	F
C9	T	T	T	T	T	T	-	-	-	-	-	-	-	-	-	-	-	-
E1	x																	
E2			x															
E3					x													
E4							x	x	x									
E5											x	x	x					
E6															x			
E7																	x	

Question 2.5: Give five test cases derived from the decision table in question 2.4 (5%)

Test	C1	C2	C3	C4	C5	C6	C7	C8	C9	Expected
1	T	F	T	F	T	F	F	F	T	**E1**
2	F	T	F	T	T	F	F	F	T	**E2**
3	F	T	T	F	T	F	F	F	F	**E4**
4	F	F	F	F	F	F	T	F	F	**E6**
5	F	F	F	F	T	T	F	T	F	**E7**

Legend:

Causes:

- C1: Elevator is travelling up
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- E5: Controller doesn’t stop the elevator and leaves the illumination on floor down button
- E6: Controller stops the elevator at the top floor
- E7: Controller stops the elevator at the bottom floor