

# Software Engineering

## LAB REPORT 8

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### Question 1:

#### Equivalence Partitioning:

##### Valid Date Classes:

- Class for dates in January to December with valid days.
- Class for leap years.

##### Invalid Date Classes:

- Class for invalid months (0 or 13).
- Class for invalid days (e.g., 32 in any month).
- Class for days out of range for specific months (e.g., February 30).
- Class for invalid years (e.g., 1899 or 2016).

Test Case/Input Data	Expected Outcome
1, 1, 2000	31, 12, 1999
1, 2, 2000	31, 1, 2000
1, 3, 2000	29, 2, 2000
1, 4, 1900	31, 3, 1900
32, 1, 2000	Error
1, 13, 2000	Error
1, 0, 2000	Error
30, 2, 2001	Error

#### Boundary Value Analysis:

**Identified Boundaries:**

- The maximum and minimum days for each month.
- Edge cases for leap years.
- Year boundaries (1900 and 2015).

Test Case/Input Data	Expected Outcome
1, 1, 1900	31, 12, 1899
1, 1, 2015	31, 12, 2014
1, 2, 2000	31, 1, 2000
29, 2, 2000	28, 2, 2000
29, 2, 2001	Error
31, 3, 2015	30, 3, 2015
1, 4, 2015	31, 3, 2015
31, 12, 2015	30, 12, 2015

## Question 2:

P1:

**Equivalence partitioning:**

Test Case description	Input values	Expected output
Value is present in the array	(6, [2, 4, 6, 8, 10], 5)	2
Value is the first element	(2, [2, 4, 6, 8, 10], 5)	0
Value is the last element	(10, [2, 4, 6, 8, 10], 5)	4
Value is not present	(5, [2, 4, 6, 8, 10], 5)	-1
Array contains duplicate values	(4, [2, 4, 4, 8, 10], 5)	1
Search in an empty array	(1, [], 0)	-1

**Boundary value analysis:**

Test Case description	Input values	Expected outcome
The array has zero elements.	(1, [])	-1
The array has one element (found).	(1, [1])	0
The array has one element (not found).	(2, [1])	-1
An array with multiple elements (found).	(3, [1, 2, 3])	2
An array with multiple elements (not found).	(5, [1, 2, 3])	-1
Array size at an arbitrary limit (e.g., 1000).	(500, [0, 1, ..., 999])	Varies based on actual array contents

P2:

**Equivalence partitioning:**

Test case description	Input values	Expected output
Value <b>v</b> is present multiple times	2, [1, 2, 2, 3, 2]	3
Value <b>v</b> is present once	3, [1, 3, 2]	1
Value <b>v</b> is not present	4, [1, 2, 3]	0
The array is empty	1, []	0
Array has one element that matches <b>v</b>	1, [1]	1
Array has one element that does not match	2, [1]	0
Array has multiple occurrences	2, [2, 2, 3, 2]	3

of $v$		
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### Boundary value analysis:

Test case description	Input values	Expected output
The array has zero elements	1, []	0
The array has one element (found)	1, [1]	1
The array has one element (not found)	2, [1]	0
An array with multiple elements (mixed counts)	3, [3, 1, 2, 3]	2
An array with multiple elements (not found)	4, [1, 2, 3]	0
Array size at a maximum limit (e.g., 1000)	500, [0, 1, ..., 999]	Varies based on actual array contents

### P3:

### Equivalence partitioning:

Test case description	Input values	Expected outcome
The array has zero elements	(5, [])	-1
The array has one element (value not found)	(5, [3])	-1
The array has one element (value found)	(3, [3])	0
The array contains multiple elements (value found)	(5, [1, 3, 5, 7])	2
The array contains multiple elements (value not found)	(4, [1, 3, 5, 7])	-1

**Boundary value analysis:**

Test case description	Input values	Expected outcome
Array has one element (value not found)	(5, [3])	-1
Array has one element (value found)	(3, [3])	0
Value searched is at the beginning of the array	(1, [1, 2, 3, 4, 5])	0
Value searched is at the end of the array	(5, [1, 2, 3, 4, 5])	4
Value searched is just above the largest value in the array	(6, [1, 2, 3, 4, 5])	-1

**P4:**

**Equivalence partitioning:**

Test Case Description	Input Values	Expected output
Invalid triangle (sum of two sides $\leq$ third)	(1, 2, 3)	INVALID
Equilateral triangle (all sides equal)	(3, 3, 3)	EQUILATERAL
Isosceles triangle (two sides equal)	(4, 4, 6)	ISOSCELES
Scalene triangle (no sides equal)	(3, 4, 5)	SCALENE
Invalid triangle (negative side length)	(-1, 4, 5)	INVALID

**Boundary value analysis:**

Test Case Description	Input Values	Expected Outcome
Invalid triangle (boundary case where $a \geq b + c$ )	(1, 1, 2)	INVALID
Equilateral triangle (minimum positive sides)	(1, 1, 1)	EQUILATERAL
Isosceles triangle (two sides just greater than third)	(2, 2, 3)	ISOSCELES
Scalene triangle (valid with smallest distinct sides)	(2, 3, 4)	SCALENE
Invalid triangle (one side length is zero)	(0, 4, 5)	INVALID

P5:

**Equivalence partitioning:**

Test Case Description	Input Values	Expected Outcome
s1 is an empty string (always a prefix)	("", "hello")	true
s1 is a prefix of s2	("he", "hello")	true
s1 is not a prefix of s2 (same length)	("hey", "hel")	false
s1 is not a prefix of s2 (different length)	("hello", "hell")	false
s1 is longer than s2	("hello", "hi")	false
s1 and s2 are identical strings	("abc", "abc")	true

**Boundary value analysis:**

Test Case Description	Input Values	Expected Outcome
s1 is an empty string	("", "abc")	true
s2 is an empty string	("", "abc")	false
s1 and s2 are empty strings	("", "")	true
s1 has length 1 and is a prefix	("a", "abc")	true
s1 has length 1 and is not a prefix	("b", "abc")	false
s1 has length equal to s2 (and is a prefix)	("abc", "abc")	true
s1 has length equal to s2 (and is not a prefix)	("abd", "abc")	false

P6:

### a) Identify the equivalence classes for the system

For the triangle classification program, the following equivalence classes can be identified:

1. **Invalid Triangle:**
  - The values A, B, and C do not satisfy the triangle inequality (i.e.,  $A+B \leq C$ ,  $A+C \leq B$ , or  $B+C \leq A$ ).
  - Any of the sides A, B, or C are non-positive (negative or zero).
2. **Equilateral Triangle:**
  - All sides are equal ( $A = B = C$ ).
3. **Isosceles Triangle:**
  - Exactly two sides are equal ( $A = B \neq C$ ,  $A = C \neq B$ , or  $B = C \neq A$ ).
4. **Scalene Triangle:**
  - All sides are unequal ( $A \neq B \neq C$ ).
5. **Right-Angled Triangle:**
  - The triangle satisfies Pythagoras' theorem ( $A^2 + B^2 = C^2$ , or its permutations).

**b) Test cases to cover the identified equivalence classes**

Test Case Description	Input Values (A, B, C)	Expected Outcome	Equivalence Class Covered
Invalid triangle (violates triangle inequality)	(1, 2, 3)	Invalid	Invalid Triangle
Invalid triangle (negative side)	(-1, 2, 3)	Invalid	Invalid Triangle
Invalid triangle (zero side)	(0, 3, 4)	Invalid	Invalid Triangle
Equilateral triangle	(3, 3, 3)	Equilateral	Equilateral Triangle
Isosceles triangle	(4, 4, 5)	Isosceles	Isosceles Triangle
Scalene triangle	(3, 4, 5)	Scalene	Scalene Triangle
Right-angled triangle	(3, 4, 5)	Right-angled	Right-Angled Triangle

**c) Boundary condition for  $A + B > C$  (scalene triangle)**

Test Case Description	Input Values (A, B, C)	Expected Outcome	Boundary Condition Verified
Sum of two sides is just greater than the third side	(2.5, 2.5, 5)	Invalid	Scalene Triangle Boundary
Sum of two sides is just less than the third side	(2.5, 2.5, 4.9)	Scalene	Scalene Triangle Boundary

**d) Boundary condition for  $A = C$  (isosceles triangle)**

Test Case Description	Input Values (A, B, C)	Expected Outcome	Boundary Condition Verified
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Exactly two sides equal	(5, 5, 4.999)	Isosceles	Isosceles Triangle Boundary
Third side slightly greater	(5, 5, 5.001)	Isosceles	Isosceles Triangle Boundary

**e) Boundary condition for  $A = B = C$  (equilateral triangle)**

Test Case Description	Input Values (A, B, C)	Expected Outcome	Boundary Condition Verified
All sides equal	(5, 5, 5)	Equilateral	Equilateral Triangle Boundary
One side slightly greater	(5, 5, 5.001)	Isosceles	Equilateral Triangle Boundary

**f) Boundary condition for  $A^2 + B^2 = C^2$  (right-angle triangle)**

Test Case Description	Input Values (A, B, C)	Expected Outcome	Boundary Condition Verified
Satisfies Pythagoras' theorem	(3, 4, 5)	Right-angled	Right-angled Triangle Boundary
Does not satisfy Pythagoras' theorem	(3, 4, 6)	Scalene	Right-angled Triangle Boundary

**g) Boundary condition for non-triangle case**

Test Case Description	Input Values (A, B, C)	Expected Outcome	Boundary Condition Verified
Triangle inequality fails	(1, 2, 3)	Invalid	Non-Triangle Boundary
Triangle inequality just holds	(1.5, 2.5, 3)	Scalene	Non-Triangle Boundary

### **h) Test points for non-positive input**

Test Case Description	Input Values (A, B, C)	Expected Outcome	Test Condition Verified
One side is zero	(0, 4, 5)	Invalid	Non-Positive Input
One side is negative	(-1, 4, 5)	Invalid	Non-Positive Input
All sides are zero	(0, 0, 0)	Invalid	Non-Positive Input