

LAB 8: LAB SESSION - FUNCTIONAL TESTING (BLACK-BOX)

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Equivalence Classes

1. Valid Equivalence Classes:

- Valid Dates:
 - Class 1: Valid dates in a non-leap year.
 - Example: (1, 1, 2000) - January 1, 2000
 - Example: (31, 12, 2015) - December 31, 2015
 - Class 2: Valid dates in a leap year.
 - Example: (29, 2, 2012) - February 29, 2012
 - Class 3: Boundary dates.
 - Example: (1, 1, 1900) - January 1, 1900
 - Example: (1, 1, 2015) - January 1, 2015
 - Example: (1, 3, 2015) - March 1, 2015 (previous date should be Feb 28)

2. Invalid Equivalence Classes:

- Invalid Dates:
 - Class 4: Day out of range.
 - Example: (32, 1, 2000) - Invalid day
 - Example: (0, 1, 2000) - Invalid day
 - Class 5: Month out of range.
 - Example: (15, 0, 2000) - Invalid month
 - Example: (15, 13, 2000) - Invalid month
 - Class 6: Year out of range.
 - Example: (15, 1, 1899) - Invalid year
 - Example: (15, 1, 2016) - Invalid year

- Class 7: Invalid date combinations.
 - Example: (30, 2, 2000) - February 30 is invalid
 - Example: (31, 4, 2000) - April 31 is invalid

TESTING TABLE:

Test Case	Day	Month	Year	Expected Output
TC1	1	1	2000	Previous date: 31/12/1999
TC2	31	12	2015	Previous date: 30/12/2015
TC3	29	2	2012	Previous date: 28/2/2012
TC4	32	1	2000	Invalid date
TC5	15	0	2000	Invalid date
TC6	15	13	2000	Invalid date
TC7	15	1	1899	Invalid date
TC8	15	1	2016	Invalid date
TC9	30	2	2000	Invalid date
TC10	31	4	2000	Invalid date

1.b) Write a set of test cases (i.e., test suite) – specific set of data – to properly test the programs. Your

The test suite should include both correct and incorrect inputs.

1. Enlist which set of test cases have been identified using Equivalence Partitioning and

Boundary Value Analysis separately.

2. Modify your programs such that it runs, and then execute your test suites on the program.

While executing your input data in a program, check whether the identified expected outcome (mentioned by you) is correct or not.

1. Test Cases Identified Using Equivalence Partitioning

Tester Action and Input Data	Expected Outcome
(1, 1, 2000)	Previous date: 31/12/1999
(31, 12, 2015)	Previous date: 30/12/2015
(29, 2, 2012)	Previous date: 28/2/2012
(32, 1, 2000)	Invalid date
(15, 0, 2000)	Invalid date
(15, 13, 2000)	Invalid date
(15, 1, 1899)	Invalid date

(15, 1, 2016)	Invalid date
(30, 2, 2000)	Invalid date
(31, 4, 2000)	Invalid date

2. Test Cases Identified Using Boundary Value Analysis

Tester Action and Input Data	Expected Outcome
(1, 1, 1900)	Invalid date (year out of range)
(1, 1, 2015)	Previous date: 31/12/2014
(31, 12, 1900)	Previous date: 30/12/1900
(31, 12, 2015)	Previous date: 30/12/2015
(29, 2, 1900)	Invalid date (not a leap year)
(29, 2, 2000)	Previous date: 28/2/2000
(1, 1, 2000)	Previous date: 31/12/1999
(31, 12, 2000)	Previous date: 30/12/2000
(1, 13, 2000)	Invalid date (month out of range)
(32, 1, 2000)	Invalid date (day out of range)

Python implementation of the previous date program:

```
from datetime import datetime, timedelta

def get_previous_date(day, month, year):
    try:
        date = datetime(year, month, day)
        previous_date = date - timedelta(days=1)
        return previous_date.strftime("%d/%m/%Y")
    except ValueError:
        return "Invalid date"

# Test suite
test_cases = [
    (1, 1, 2000), (31, 12, 2015), (29, 2, 2012),
    (32, 1, 2000), (15, 0, 2000), (15, 13, 2000),
    (15, 1, 1899), (15, 1, 2016), (30, 2, 2000),
    (31, 4, 2000), (1, 1, 1900), (1, 1, 2015),
    (31, 12, 1900), (31, 12, 2015), (29, 2, 1900),
    (29, 2, 2000), (1, 1, 2000), (31, 12, 2000),
    (1, 13, 2000), (1, 1, 2000), (31, 1, 2000),
    (32, 1, 2000)
]

for test_case in test_cases:
    day, month, year = test_case
    expected_output = get_previous_date(day, month, year)
    print(f"Input: ({day}, {month}, {year}) - Expected Output: {expected_output}")
```

Execution and Verification

- **Run the Program:** Execute the modified program to see the outputs for each test case.
- **Verify Outcomes:** Compare the printed outputs against the expected outcomes listed in the tables above to check for correctness.

Program Analysis

Programs Overview

The assignment contains six programs (P1-P6) implementing various algorithms:

1. Linear Search Implementation
2. Count Item Occurrence
3. Binary Search in Sorted Array
4. Triangle Classification
5. String Prefix Checker
6. Enhanced Triangle Classification with Test Cases

Let's analyze each program and develop test cases for P6 in detail.

Detailed Analysis

P1: Linear Search

```
int linearSearch(int v, int a[])
```

- **Purpose:** Finds first occurrence of value v in array a
- **Return Value:** Index of first occurrence or -1 if not found
- **Time Complexity:** $O(n)$

- **Key Characteristics:** Sequential search, no preprocessing required

P2: Count Item

```
int countItem(int v, int a[])
```

- **Purpose:** Counts occurrences of value v in array a
- **Return Value:** Total count of occurrences
- **Time Complexity:** O(n)
- **Key Characteristics:** Complete array traversal required

P3: Binary Search

```
int binarySearch(int v, int a[])
```

- **Purpose:** Efficiently finds value in sorted array
- **Prerequisite:** Array must be sorted
- **Time Complexity:** O(log n)
- **Key Characteristics:** Divide and conquer approach

P4: Triangle Classification

```
int triangle(int a, int b, int c)
```

- **Purpose:** Classifies triangle type based on side lengths
- **Return Values:**
 - EQUILATERAL (0)
 - ISOSCELES (1)
 - SCALENE (2)
 - INVALID (3)

P5: String Prefix Check

```
boolean prefix(String s1, String s2)
```

- **Purpose:** Checks if s1 is prefix of s2
- **Return Value:** Boolean indicating prefix status

- **Key Characteristics:** String comparison with length check

Detailed Analysis of P6

A) Equivalence Classes Identification

1. Valid Triangle Classes:

- EC1: Equilateral triangles (all sides equal)
- EC2: Isosceles triangles (two sides equal)
- EC3: Scalene triangles (no sides equal)
- EC4: Right-angled triangles

2. Invalid Triangle Classes:

- EC5: Non-triangle cases (sum of any two sides \leq third side)
- EC6: Zero or negative length sides
- EC7: Non-numeric inputs

B) Test Cases for Equivalence Classes

Test ID	Test Case	Equivalence Class	Expected Output
TC1	(5, 5, 5)	EC1	Equilateral
TC2	(5, 5, 3)	EC2	Isosceles
TC3	(3, 4, 5)	EC3, EC4	Right-angled Scalene
TC4	(2, 3, 6)	EC5	Invalid
TC5	(0, 4, 5)	EC6	Invalid
TC6	(7, 8, 9)	EC3	Scalene

C) Boundary Testing for $A + B > C$

Test ID	Test Case	Description	Expected Output
TC7	(4, 5, 8.9)	Just within boundary	Valid Scalene
TC8	(4, 5, 9)	On boundary	Invalid
TC9	(4, 5, 9.1)	Just outside boundary	Invalid

D) Boundary Testing for Isosceles ($A = C$)

Test ID	Test Case	Description	Expected Output
TC10	(5, 3, 5)	Perfect isosceles	Isosceles
TC11	(5, 3, 5.0001)	Just outside equality	Scalene
TC12	(5, 3, 4.9999)	Just inside equality	Scalene

E) Boundary Testing for Equilateral ($A = B = C$)

Test ID	Test Case	Description	Expected Output
TC13	(5, 5, 5)	Perfect equilateral	Equilateral
TC14	(5, 5, 5.0001)	Just outside equality	Isosceles
TC15	(5.0001, 5, 5)	Just outside equality	Isosceles

F) Right-Angle Triangle Testing ($A^2 + B^2 = C^2$)

Test ID	Test Case	Description	Expected Output
TC16	(3, 4, 5)	Perfect right angle	Right-angled
TC17	(5, 12, 13)	Perfect right angle	Right-angled
TC18	(8, 15, 17)	Perfect right angle	Right-angled

G) Non-Triangle Case Testing

Test ID	Test Case	Description	Expected Output
TC19	(2, 3, 5)	Sum equals	Invalid
TC20	(2, 3, 4.9)	Just valid	Valid
TC21	(2, 3, 5.1)	Just invalid	Invalid

H) Non-Positive Input Testing

Test ID	Test Case	Description	Expected Output
TC22	(0, 4, 5)	Zero length	Invalid
TC23	(-1, 3, 5)	Negative length	Invalid
TC24	(3, -2, 5)	Negative length	Invalid

Test Implementation Guidelines

1. Setup Requirements:

- Floating-point comparison tolerance should be defined
- Input validation mechanisms should be in place
- Error handling should be implemented

2. Test Execution:

- Tests should be automated where possible
- Each test case should be independent
- Results should be logged for analysis

3. Validation:

- Compare actual vs expected results
- Document any deviations
- Track test coverage

Conclusion

The test cases designed cover all major equivalence classes and boundary conditions for the triangle classification program. Special attention has been paid to:

- Boundary conditions
- Invalid inputs
- Special cases (right angles, equilateral, isosceles)
- Error conditions

Declaration

I hereby declare that this assignment is my own work and has not been submitted elsewhere.

A handwritten signature in blue ink, appearing to be 'Rita', with a long horizontal stroke extending to the right.

Signature:

Date: October 21, 2024