Software Engineering IT314

Lab-7

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➔ Main Function Code:

```
package test;

public class programs {

    public int linearSearch(int v, int a[]) // p1
    {
```

```
        int i = 0;
        while (i < a.length)
        {
        if (a[i] == v)
        return(i);
        i++;
        }
        return (-1);
        }
```

public int countItem(int v, int a[]) //p2

```
{

int count = 0;

for (int i = 0; i < a.length; i++)

{

if (a[i] == v)

count++;
}
return (count);

}
```

public int binarySearch(int v, int a[]) //p3

```
{
        int lo,mid,hi;
```

```
lo = 0;

hi = a.length-1;
while (lo <= hi)

{

mid = (lo+hi)/2;

if (v == a[mid])

return (mid);

else if (v < a[mid])

hi = mid-1;

else

lo = mid+1;

}

return(-1);

}
```

```
final int EQUILATERAL = 0;
final int ISOSCELES = 1;
final int SCALENE = 2;
final int INVALID = 3;
```

public int triangle(int a, int b, int c) //p4

```
{
if (a >= b+c || b >= a+c || c >= a+b)
```

```
        return(INVALID);
        if (a == b && b == c)
        return(EQUILATERAL);
        if (a == b || a == c || b == c)
        return(ISOSCELES);
        return(SCALENE);

        }

        public boolean prefix(String s1, String s2) //p5
        {
        if (s1.length() > s2.length())
        {
        return false;
        }
        for (int i = 0; i < s1.length(); i++)
        {
        if (s1.charAt(i) != s2.charAt(i))
        {
        return false;
        }
        }
        return true;
        }

}
```

➔ Programs:

❖ **P1**

➔ **Equivalence Partitioning and Boundary Value Analysis**

Tester Action and Input Data	Expected Outcome
Equivalence Partitioning	
a = [1, 2, 3, 4], v = 2	1
a = [5, 6, 7, 8], v = 10	-1
a = [1, 1, 2, 3], v = 1	0
a = null, v = 5	An error message
Boundary Value Analysis	
Minimum array length: a = [], v = 7	-1
Maximum array length: a = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20], v = 3.	2
Minimum value of v: a = [5, 6, 7], v = 5	0
Maximum value of v: a = [1, 2, 3], v = 3	2

- ❖ **P2**

➔ **Equivalence Partitioning and Boundary Value Analysis**

Tester Action and Input Data	Expected Outcome
Equivalence Partitioning	
Invalid input: v is not an integer	An Error message
Empty array: a = []	0
Single item array: a = [v], v = a[0]	1
Multiple item array with v appearing:	
v appears once	1
v appears multiple times	count>1
Multiple item array with v not appearing	0
Boundary Value Analysis	
Minimum input values: v = a[0] = 1	count>0
Maximum input values: v = a[9999] = 10000	count>0
One occurrence of v: a = [1, 2, 3, ..., 9999, v-1, 10000]	1
All occurrences of v: a = [v, v, v, ..., v, v]	10000
No occurrences of v: a = [1, 2, 3, ..., 9999]	0

- **P3**
- **Equivalence Partitioning:**

Test Cases for Correct Inputs:

Tester Action and Input Data	Expected Outcome
v = 5, a = [1, 3, 5, 7, 9]	2
v = 1, a = [1, 3, 5, 7, 9]	0
v = 9, a = [1, 3, 5, 7, 9]	4

Test Cases for Incorrect Inputs:

Tester Action and Input Data	Expected Outcome
v = 2, a = [1, 3, 5, 7, 9]	-1
v = 10, a = [1, 3, 5, 7, 9]	-1
v = 6, a = []	-1

§ **Boundary Value Analysis:**

Test Cases for Correct Inputs:

Tester Action and Input Data	Expected Outcome
v = 5, a = [5, 6, 7]	0
v = 6, a = [5, 6, 7]	1
v = 7, a = [5, 6, 7]	2
v = 5, a = [1, 5, 6, 7, 9]	1
v = 6, a = [1, 5, 6, 7, 9]	2
v = 7, a = [1, 5, 6, 7, 9]	3
v = 9, a = [1, 5, 6, 7, 9]	4
v = 1, a = [1]	0
v = 5, a = [5]	0
v = 1, a = []	-1

Test Cases for Incorrect Inputs:

Tester Action and Input Data	Expected Outcome

v = 2, a = [1, 3, 5, 7, 9]	-1
v = 10, a = [1, 3, 5, 7, 9]	-1
v = 6, a = [1, 3, 5, 7, 9]	-1
v = 1, a = [2, 3, 4, 5, 6]	-1
v = 7, a = [2, 3, 4, 5, 6]	-1
v = 4, a = [5, 6, 7, 8, 9]	-1

- **P4**

Tester Action and Input Data	Expected Outcome
Equivalence Partitioning:	
a=b=c, where a, b, c are positive integers	EQUILATERAL
a=b<c, where a, b, and c are positive integers	ISOSCELES
a=b=c=0	INVALID
a<b+c, b<a+c, c<a+b, where a, b, c are positive integers	SCALENE

a=b>0, c=0	INVALID
a>b+c	INVALID
Boundary Value Analysis:	
a=1, b=1, c=1	EQUILATERAL
a=1, b=2, c=2	ISOSCELES
a=0, b=0, c=0	INVALID
a=2147483647, b=2147483647, c=2147483647	EQUILATERAL
a=2147483646, b=2147483647, c=2147483647	ISOSCELES
a=1, b=1, c=2^31-1	SCALENE
a=0, b=1, c=1	INVALID

- **P5**

Tester Action and Input Data	Expected Outcome
Equivalence Partitioning:	
s1 is empty, s2 is non-empty string	true

s1 is non-empty string, s2 is empty	**false**
s1 is a prefix of s2	**true**
s1 is not a prefix of s2	**false**
s1 has same characters as s2, but not a prefix	**false**
Boundary Value Analysis:	
s1 = "a", s2 = "ab"	**true**
s1 = "ab", s2 = "a"	**false**
s1 = "a", s2 = "a"	**true**
s1 = "a", s2 = "A"	**false**
s1 = "abcdefghijklmnopqrstuvwxyz", s2 = "abcdefghijklmnopqrstuvwxyz"	**true**
s1 = "abcdefghijklmnopqrstuvwxyz", s2 = "abcdefghijklmno"	**true**
s1 = "", s2 = ""	**true**

➔ Testing Code:

```
package test;

import static org.junit.Assert.*;

import org.junit.Test;
```

```
public class testing {

    @Test
    public void test1_1() {    // P1

    programs test = new programs();

    int a[] = {1,2,3,4,5};

    int output = test.linearSearch(2, a);
    assertEquals(1,output);
    }

    @Test
    public void test1_2() {    // P1

    programs test = new programs();

    int a[] = {1,2,3,4,5};

    int output = test.linearSearch(1, a);
    assertEquals(0,output);
    }

    @Test
    public void test1_3() {    // P1

    programs test = new programs();

    int a[] = {1,2,3,4,5};

    int output = test.linearSearch(7, a);
    assertEquals(-1,output);
    }
```

```
@Test
public void test2_1() {    // P2
programs test = new programs();

int a[] = {1,2,2,3,4,5};

int output = test.countItem(2, a);
assertEquals(2,output);
}

@Test
public void test2_2() {    // P2

programs test = new programs();

int a[] = {1,2,2,3,4,5};

int output = test.countItem(6, a);
assertEquals(0,output);
}

@Test
public void test3_1() {    // P3

programs test = new programs();

int a[] = {1,2,2,3,4,5};

int output = test.binarySearch(3, a);
assertEquals(3,output);
}
```

```
@Test
public void test3_2() {    // P3

programs test = new programs();

int a[] = {1,2,2,3,4,5};

int output = test.binarySearch(8, a);
assertEquals(-1,output);
}

@Test
public void test3_3() {    // P3

programs test = new programs();

int a[] = {1,2,2,3,4,5};

int output = test.binarySearch(8, a);
assertEquals(-1,output);
}

@Test
public void test4_1() {    // P4
programs test = new programs();
int output = test.triangle(8,8,8);
assertEquals(0,output);
}

@Test
public void test4_2() {    // P4
programs test = new programs();
int output = test.triangle(8,8,10);
assertEquals(1,output);
}
```

```
	@Test
	public void test4_3() {    // P4
	programs test = new programs();
	int output = test.triangle(0,0,0);
	assertEquals(3,output);
	}

	@Test
	public void test5_1() {    // P5
	programs test = new programs();
	boolean output = test.prefix("","nonEmpty");
	assertEquals(true,output);
	}

	@Test
	public void test5_2() {    // P5
	programs test = new programs();
	boolean output = test.prefix("hello","hello world");
	assertEquals(true,output);
	}

	@Test
	public void test5_3() {   // P5
	programs test = new programs();
	boolean output = test.prefix("hello","world hello");
	assertEquals(false, output);
	}

}
```

P6)

a) Equivalence classes for the system are

Class 1: Invalid inputs (negative or zero values)
Class 2: Non-triangle (sum of the two shorter sides is not greater than the longest side)
Class 3: Scalene triangle (no sides are equal)
Class 4: Isosceles triangle (two sides are equal)
Class 5: Equilateral triangle (all sides are equal)
Class 6: Right-angled triangle (satisfies the Pythagorean theorem)

b) Test cases to cover the identified equivalence classes:

Class 1: -1, 0
Class 2: 1, 2, 5
Class 3: 3, 4, 5
Class 4: 5, 5, 7
Class 5: 6, 6, 6
Class 6: 3, 4, 5
Test case 1 covers class 1, test case 2 covers class 2, test case 3 covers class 3, test case 4 covers class 4, test case 5 covers class 5, and test case 6 covers class 6.

c) Test cases to verify the boundary condition A + B > C for the scalene triangle:

2, 3, 6
3, 4, 8
Both test cases have two sides shorter than the third side and should not form a triangle.

d) Test cases to verify the boundary condition A = C for the isosceles triangle:

2, 3, 3,

5, 6, 5
Both test cases have two equal sides, and should form an isosceles triangle.

e) Test cases to verify the boundary condition A = B = C for the equilateral triangle:

5, 5, 5
9, 9, 9
Both test cases have all sides equal and should form an equilateral triangle.

f) Test cases to verify the boundary condition A^2 + B^2 = C^2 for the right-angled triangle:

3, 4, 5,
5, 12, 13
Both test cases satisfy the Pythagorean theorem and should form a right-angled triangle.

g) For the non-triangle case, identify test cases to explore the boundary.

2, 2, 4
3, 6, 9
Both test cases have two sides that add to the third side and should not form a triangle.

h) For non-positive input, identify test points.

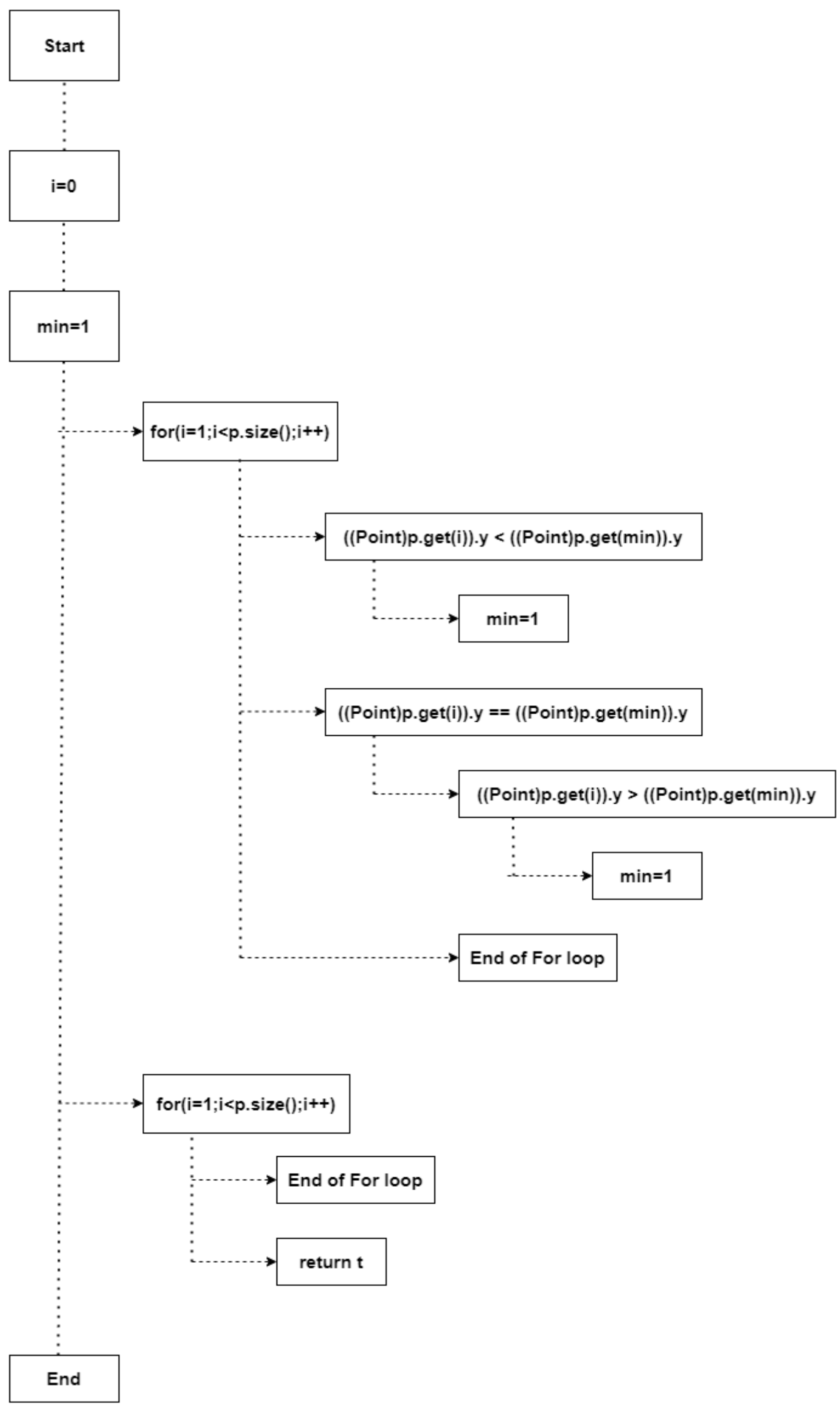
0, 1, 2
-1, -2, -3
Both test cases have at least one non-positive value, an invalid input.

Section: B

1. **Convert the Java code comprising the beginning of the doGraham method into a control flow graph (CFG).**

Below is the control flow graph of the converted Java code.

Control Flow Graph



2. Test sets for the given criteria:

a. Statement Coverage:

To achieve statement coverage, the following test cases should be sufficient:

- p with a single point.
- p with two or more points, where the first point has the smallest y-coordinate.

b. Branch Coverage:

To achieve branch coverage, the following test cases should be sufficient:

- p with a single point.
- p with two or more points, where the first point has the smallest y-coordinate.
- p with two or more points, where there are two or more points with the same smallest y-coordinate.

c. Basic Condition Coverage:

To achieve basic condition coverage, the following test cases should be sufficient:

- p with a single point.
- p with two or more points, where the first point has the smallest y-coordinate.
- p with two or more points, where there are two or more points with the same smallest y-coordinate.
- p with two or more points, where there are no points with the same smallest y-coordinate.