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Lab-7

Section-A

Tester Action and Input Data Expected Outcome	**Equivalence Partitioning**
Invalid Month (less than 1)	An Error message
Invalid Month (greater than 12)	An Error message
Valid Month, Invalid Day (less than 1)	An Error message
Valid Month, Invalid Day (greater than 31)	An Error message
Valid Month, Valid Day, Invalid Year (less than 1900)	An Error message
Valid Month, Valid Day, Invalid Year (greater than 2015)	An Error message
Valid Month, Valid Day, Valid Year	Previous date or Invalid date

Previous date or Invalid date	
Month is 1, Day is 1, Year is 1900	An Error message
Month is 12, Day is 31, Year is 2015	Previous date or Invalid date
Month is 2, Day is 29, Year is 1900	An Error message
Month is 2, Day is 28, Year is 1900	Previous date or Invalid date
Month is 2, Day is 29, Year is 2000	Previous date or Invalid date
Month is 2, Day is 28, Year is 2000	Previous date or Invalid date
Month is 4, Day is 31, Year is 2010	An Error message
Month is 4, Day is 30, Year is 2010	Previous date or Invalid date

P1

The function linearSearch searches for a value v in an array of integers a. If v appears in the array

a, then the function returns the first index i, such that a[i] == v; otherwise, -1 is returned.

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

{

int i = 0;

while (i < a.length)

{

if (a[i] == v)

return(i);

i++;

}

return (-1);

}
```

Equivalence Partitioning:-

Tester Action and Input Data	Expected Outcome	
Input with a valid value that exists in the array v = 7, a = [2, 4, 7, 9, 11]	2	
Input with a valid value that does not exist in the array v = 6, a = [3, 8, 12, 15]	-1	
Input with a valid value at the index of the array v = 10, a = [10, 20, 30, 40]	0	

Boundary Value Analysis:-

Tester Action and Input Data	Expected Outcome
Input with the minimum valid array length v:5, a:[]	-1
Input with the maximum valid arraylength v : 25, a : [10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100]	3
Input with the value not found in alarge array v: 200 a: [50, 100, 150, 250, 300, 350, 400, 450, 500]	-1
Input with the value found at the last index of the array v: 60 a: [30, 40, 50, 60]	3
Input with the value found at the first index of a large array v: 5 a: [5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100]	0

P2

The function countItem returns the number of times a value v appears in an array of integers a.

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

{

int count = 0;

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

```
{
if (a[i] == v)
count++;
}
return (count);
}
```

Equivalence partitioning:-

Tester Action and Input Data	Expected Outcome
v = 7, a = [2, 4, 7, 9, 11]	1
v = 6, a = [3, 8, 12, 15]	0
v = 10, a = [10, 20, 30, 40]	1

Boundary Value Analysis:

Tester Action and Input Data	Expected Outcome
v = -1, a = [] 0	0
v = 0, a = [0]	1
v = 5, a = [5, 5, 5, 5, 5, 5, 5]	7
v = -999, a = [999]	0

P3

The function binarySearch searches for a value v in an ordered array of integers a. If v appears in

the array a, then the function returns an index i, such that a[i] == v; otherwise, -1 is returned.

Assumption: the elements in the array a are sorted in non-decreasing order.

```
int binarySearch(int v, int a[])
{
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);
}
```

Equivalence partitioning:-

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

Boundary Value Analysis:

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

P4

The following problem has been adapted from The Art of Software Testing, by G. Myers (1979). The

function triangle takes three integer parameters that are interpreted as the lengths of the sides of a

triangle. It returns whether the triangle is equilateral (three lengths equal), isosceles (two lengths equal),

scalene (no lengths equal), or invalid (impossible lengths).

```
final int EQUILATERAL = 0;

final int ISOSCELES = 1;

final int SCALENE = 2;

final int INVALID = 3;

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

{

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);
```

Equivalence partitioning:-

Tester Action and Input Data	Expected Outcome
a = 5, b = 5, c = 5	(Equilateral triangle)
a = 5, b = 5, c = 6	(Isosceles triangle)
a = 3, b = 4, c = 5	(Scalene triangle)
a = 0, b = 0, c = 0	(Invalid triangle)
a = 3, b = 4, c = 8	(Invalid triangle)

Boundary Value Analysis:

Tester Action and Input Data	Expected Outcome
a = 1, b = 1, c = 1	(Equilateral triangle)
a = 1, b = 1, c = 2	(Isosceles triangle)
a = 1, b = 2, c = 1	(Isosceles triangle)
a = 2, b = 1, c = 1	(Isosceles triangle)
a = 1, b = 2, c = 3	(Scalene triangle)
a = 3, b = 4, c = 5	(Scalene triangle)
a = 0, b = 0, c = 0	(Invalid triangle)
a = 1, b = 2, c = 4	(Invalid triangle)
a = 3, b = 4, c = 8	(Invalid triangle)

P5

The function prefix (String s1, String s2) returns whether or not the string s1 is a prefix of string s2 (you may assume that neither s1 nor s2 is null).

```
public static boolean prefix(String s1, String s2)
{
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;
}
```

Equivalence partitioning:-

Tester Action and Input Data	Expected Outcome
s1 is a prefix of s2. prefix("hello", "helloworld")	True
s1 is not a prefix of s2. prefix("java", "javascript")	False
s1 and s2 are empty strings. prefix("", "")	True
s1 is null. prefix(null, "world")	NullPointerException
s2 is null. prefix("hello", null)	NullPointerException
s1 and s2 are null. prefix(null, null)	NullPointerException

Boundary Value Analysis:

Tester Action and Input Data	Expected Outcome
s1 and s2 are minimum length strings. prefix("a", "a")	True
s1 and s2 are maximum length strings. prefix("abcdefghijklmnopqrstuvwxyz", "abcdefghijklmnopqrstuvwxyz")	True
s1 is an empty string and s2 is a non-empty string. prefix("", "hello")	True
s1 is a non-empty string and s2 is an empty string. prefix("hello", "")	False
s1 is longer than s2. prefix("world", "hi")	False

P6

P6: Consider again the triangle classification program (P4) with a slightly different specification: The program

reads floating values from the standard input. The three values A, B, and C are interpreted as

representing the lengths of the sides of a triangle. The program then prints a message to the standard output that states whether the triangle, if it can be formed, is scalene, isosceles, equilateral, or right angled.

Determine the following for the above program:

a) Identify the equivalence classes for the system

b) Identify test cases to cover the identified equivalence classes. Also, explicitly mention which test case

would cover which equivalence class.

(Hint: you must need to be ensure that the identified set of test cases cover all identified equivalence

classes)

c) For the boundary condition A + B > C case (scalene triangle), identify test cases to verify the

boundary.

d) For the boundary condition A = C case (isosceles triangle), identify test cases to verify the

boundary.

e) For the boundary condition A = B = C case (equilateral triangle), identify test cases to verify the

boundary.

f) For the boundary condition A

2 + B2 = C2

case (right-angle triangle), identify test cases to verify

the boundary.

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

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

Equivalence Class	Condition
Valid triangle	A + B > C, B + C > A, C + A > B
Scalene triangle	All sides have different lengths
Isosceles triangle	Two sides have equal lengths
Equilateral triangle All three sides have the same length	All three sides have the same length
Right-angle triangle	One angle is equal to 90 degrees
Non-triangle	One of the conditions for a valid triangle is not met

b) Test case:-

Test case	Condition	Expected Outcome
1	A=5, B=5, C=5	Equilateral Triangle
2	A=3, B=4, C=5	Right Angle triangle
3	A=2, B=2, C=3	Isosceles Triangle
4	A=4, B=4, C=7	Scalene Triangle
5	A=1, B=1, C=3	Non-Triangle

C) Boundary condition for Scalene Triangle:-

Test case	Condition	Expected Outcome
1	A=2.0, B=3.0, C=5.0	Not a valid triangle
2	A=1.0, B=2.0, C=3.0	Not a valid triangle
3	A=1.0, B=1.0, C=2.0	Not a valid triangle
4	A=0.1, B=0.1, C=0.3	Not a valid triangle
5	A=1.0, B=2.0, C=2.9	Scalene Triangle

d) Boundary condition for Isosceles Triangle:-

Test case	Condition	Expected Outcome
1	A=4, B=4, C=7	Isosceles
2	A=7, B=4, C=4	Isosceles
3	A=4, B=7, C=4	Isosceles

e) Boundary condition for Equilateral Triangle:-

Test case	Condition	Expected Outcome
1	A=4, B=4, C=4	Equilateral
2	A=7, B=7, C=7	Equilateral
3	A=0.4, B=0.4, C=0.4	Equilateral

f) Boundary condition for Right Angle Triangle:-

Test case	Condition	Expected Outcome
1	3 4 5	Right Angle
2	4 3 5	Right Angle
3	5 4 3	Right Angle
4	6 8 10	Right Angle
5	8 6 10	Right Angle
6	10 6 8	Right Angle
7	1 1.4 1.7	Not Right Angle
8	1.4 1.7 1	Not Right Angle
9	1.7 1.4 1	Not Right Angle
10	1.414213 1 2	Right Angle
11	1 1.414213 2	Right Angle
12	1.414213 2 1	Right Angle
13	2 1.414213 1	Right Angle
14	2 1 1.414213	Right Angle
15	1 2 1.414213	Right Angle
16	1.414213 1.414213 2	Not Right Angle

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

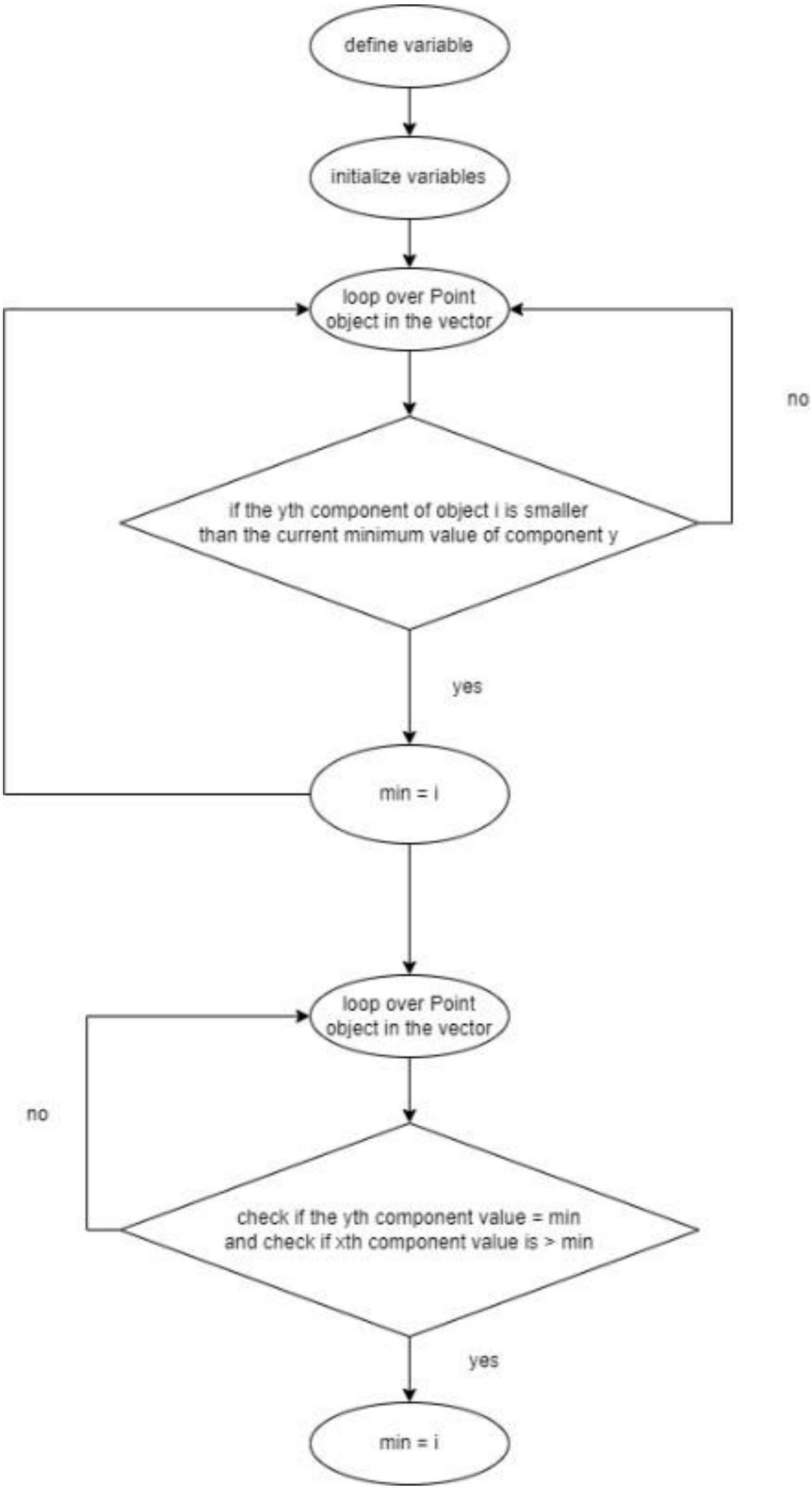
Test case	Condition	Expected Outcome
TC1	A = 0, B = 1, C = 2	Not a Triangle
TC2	A = 1, B = 0, C = 2	Not a Triangle
TC3	A = 1, B = 2, C = 0	Not a Triangle
TC4	A = 1, B = 2, C = 3	Not a Triangle
TC5	A = 2, B = 3, C = 5	Not a Triangle

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

Test case	Condition	Expected Outcome
TC1	A = -1, B = 2, C = 3	Invalid Input
TC2	A = 1, B = -2, C = 3	Invalid Input
TC3	A = 1, B = 2, C = -3	Invalid Input
TC4	A = -1, B = -2, C = -3	Invalid Input
TC5	A = 0, B = 1, C = 2	Invalid Input

Section-B:-

1) **Control Flow Graph:-**



2)

a. Statement Coverage:

Test case	Condition	Expected Outcome
1	p = []	Empty Vector
2	p = [(1,1)]	Vector with single point
3	p = [(1,1), (2,2)]	Vector with two points
4	p = [(1,1), (2,2), (3,1)]	Vector with three points
5	p = [(1,1), (2,2), (3,1), (4,3)]	Vector with four points

b. Branch Coverage:

Test case	Condition	Expected Outcome
1	p = []	Empty Vector
2	p = [(1,1)]	Vector with single point
3	p = [(1,1), (2,2)]	Vector with two points
4	p = [(1,1), (2,2), (3,1)]	Vector with three points
5	p = [(1,1), (2,2), (3,1), (4,3)]	Vector with four points
6	p = [(1,2), (3,1), (2,1)]	Vector with three points in different order

c. Basic Condition Coverage:

Test case	Condition	Expected Outcome
1	p = []	Empty Vector
2	p = [(1,1)]	Vector with single point
3	p = [(1,1), (2,2)]	Vector with two points
4	p = [(1,1), (2,2), (3,1)]	Vector with three points
5	p = [(1,1), (2,2), (3,1), (4,3)]	Vector with four points
6	p = [(1,2), (3,1), (2,1)]	Vector with three points in different order
7	p = [(1,1), (1,1), (1,1)]	Vector with three identical points
8	p = [(1,1), (2,2), (1,1)]	Vector with two identical points
9	p = [(1,1), (1,2), (2,1)]	Vector with two points with same y component