CS 474 – Software Testing Techniques

Assignment No. 02

Submitted to Dr. Mudassar Azam Sindhu

Group Members

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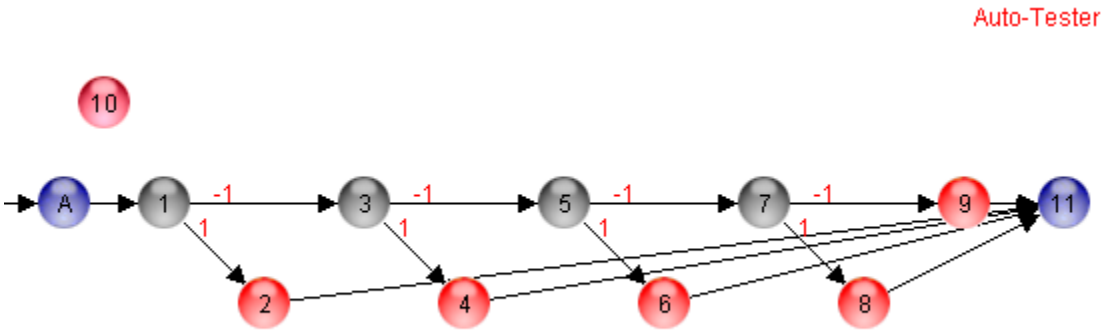
Auto Tester



Node Coverage Criteria:

Supports: Yes (Statement Coverage Criteria)

Test Paths:

S. No.	Paths	Executable
1	A → 1 → 3 → 5 → 7 → 9 → 11	Yes
2	A → 1 → 3 → 5 → 7 → 8 → 11	Yes
3	A → 1 → 3 → 5 → 6 → 11	Yes
4	A → 1 → 3 → 4 → 11	Yes
5	A → 1 → 2 → 11	Yes

Test Cases:

Test Path	S1	S2	S3	Expected Output	Observed Output	Verdict
1	4	5	6	Scalene	Scalene	Pass
2	4	4	7	Isosceles	Isosceles	Pass
	4	7	4	Isosceles	Isosceles	Pass
	7	4	4	Isosceles	Isosceles	Pass
3	4	4	4	Equilateral	Equilateral	Pass
4	4	4	8	No triangle	No triangle	Pass
	4	8	4	No triangle	No triangle	Pass
	8	4	4	No triangle	No triangle	Pass
	1	1	3	No triangle	No triangle	Pass
	1	3	1	No triangle	No triangle	Pass
	3	1	1	No triangle	No triangle	Pass
5	4	-1	0	Bad side	Bad side	Pass
	0	0	0	Bad side	Bad side	Pass

Minimized: Yes

Edge Coverage Criteria:

Supports: Yes (Decision Coverage Criteria)

Test Paths:

S. No.	Paths	Executable
1	A → 1 → 3 → 5 → 7 → 9 → 11	Yes
2	A → 1 → 3 → 5 → 7 → 8 → 11	Yes
3	A → 1 → 3 → 5 → 6 → 11	Yes
4	A → 1 → 3 → 4 → 11	Yes
5	A → 1 → 2 → 11	Yes

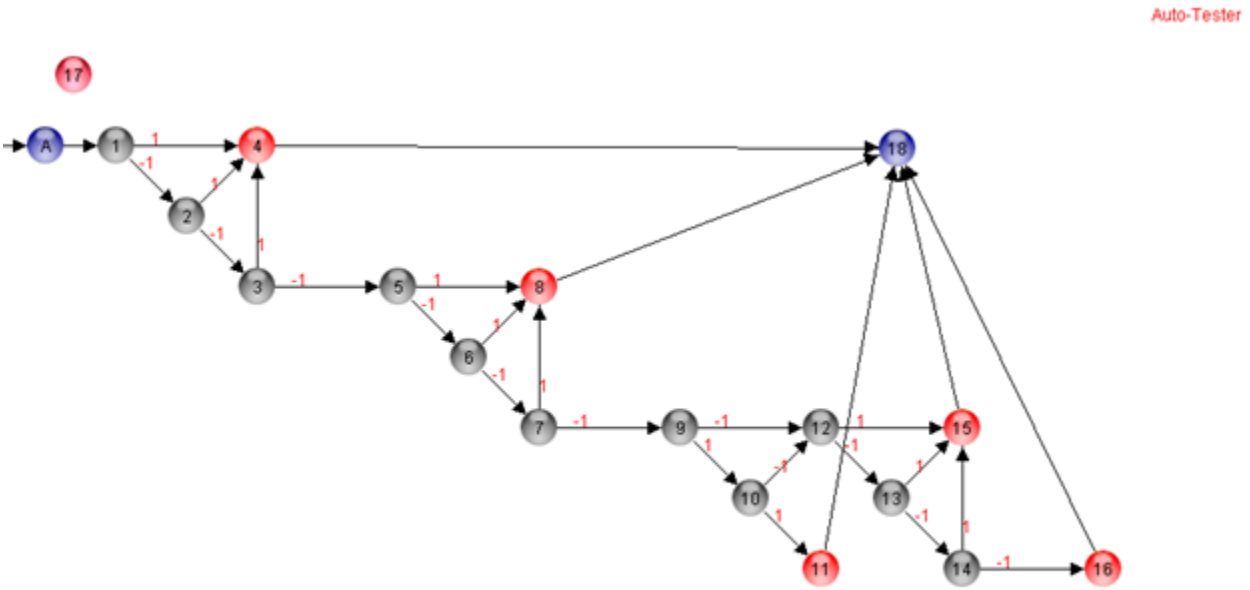
Test Cases:

Test Path	S1	S2	S3	Expected Output	Observed Output	Verdict
1	4	5	6	Scalene	Scalene	Pass
2	4	4	7	Isosceles	Isosceles	Pass
	4	7	4	Isosceles	Isosceles	Pass
	7	4	4	Isosceles	Isosceles	Pass
3	4	4	4	Equilateral	Equilateral	Pass
4	4	4	8	No triangle	No triangle	Pass
	4	8	4	No triangle	No triangle	Pass
	8	4	4	No triangle	No triangle	Pass
	1	1	3	No triangle	No triangle	Pass
	1	3	1	No triangle	No triangle	Pass
	3	1	1	No triangle	No triangle	Pass
5	4	-1	0	Bad side	Bad side	Pass
	0	0	0	Bad side	Bad side	Pass

Minimized: Yes

Predicate Coverage Criteria:

As we know from lecture, when predicates come from conditions on edges, predicate coverage is equivalent to edge coverage.



Clause Coverage Criteria:

Supports: Yes (Condition Coverage Criteria)

Test Paths:

S. No.	Paths	Executable
1	A → 1 → 4 → 18	Yes
2	A → 1 → 2 → 4 → 18	Yes
3	A → 1 → 2 → 3 → 5 → 8 → 18	Yes
4	A → 1 → 2 → 3 → 5 → 6 → 8 → 18	Yes
5	A → 1 → 2 → 3 → 5 → 6 → 7 → 9 → 12 → 15 → 18	No
6	A → 1 → 2 → 3 → 5 → 6 → 7 → 9 → 12 → 13 → 15 → 18	Yes
7	A → 1 → 2 → 3 → 5 → 6 → 7 → 9 → 12 → 13 → 14 → 16 → 18	Yes
8	A → 1 → 2 → 3 → 5 → 6 → 7 → 9 → 12 → 13 → 14 → 15 → 18	Yes
9	A → 1 → 2 → 3 → 5 → 6 → 7 → 9 → 10 → 12 → 15 → 18	Yes
10	A → 1 → 2 → 3 → 5 → 6 → 7 → 9 → 10 → 11 → 18	Yes
11	A → 1 → 2 → 3 → 5 → 6 → 7 → 8 → 18	Yes
12	A → 1 → 2 → 3 → 4 → 18	Yes

Explanation:

Test Path # 05 is infeasible because node 15 is semantically unreachable in this particular test path because this path considers condition *s1==s2* false at node 9 and then it considers the same condition to become true at node 12. To make it executable, we can add node 13 before node 15 but a separate test path for it exists.

Test Cases:

Test Path	S1	S2	S3	Expected Output	Observed Output	Verdict
1	0	0	0	Bad side	Bad side	Pass
2	4	0	5	Bad side	Bad side	Pass
3	4	5	9	No Triangle	No Triangle	Pass
	4	5	10	No Triangle	No Triangle	Pass
4	9	4	5	No Triangle	No Triangle	Pass
	10	4	5	No Triangle	No Triangle	Pass
5	-	-	-	-	-	-
6	5	4	4	Isosceles	Isosceles	Pass
7	5	4	6	Scalene	Scalene	Pass
8	4	5	4	Isosceles	Isosceles	Pass
9	5	5	4	Isosceles	Isosceles	Pass
10	5	5	5	Equilateral	Equilateral	Pass
11	3	5	2	No Triangle	No Triangle	Pass
	3	6	2	No Triangle	No Triangle	Pass
12	4	5	-1	Bad side	Bad side	Pass

Minimized: Yes

Restricted Active Clause Coverage:

Supports: Yes

Test Paths:

S. No.	Paths	Executable
1	A → 1 → 4 → 18	Yes
2	A → 1 → 2 → 4 → 18	Yes
3	A → 1 → 2 → 3 → 5 → 8 → 18	Yes
4	A → 1 → 2 → 3 → 5 → 6 → 8 → 18	Yes
5	A → 1 → 2 → 3 → 5 → 6 → 7 → 9 → 12 → 15 → 18	No
6	A → 1 → 2 → 3 → 5 → 6 → 7 → 9 → 12 → 13 → 15 → 18	Yes
7	A → 1 → 2 → 3 → 5 → 6 → 7 → 9 → 12 → 13 → 14 → 16 → 18	Yes
8	A → 1 → 2 → 3 → 5 → 6 → 7 → 9 → 12 → 13 → 14 → 15 → 18	Yes
9	A → 1 → 2 → 3 → 5 → 6 → 7 → 9 → 10 → 12 → 15 → 18	Yes
10	A → 1 → 2 → 3 → 5 → 6 → 7 → 9 → 10 → 11 → 18	Yes
11	A → 1 → 2 → 3 → 5 → 6 → 7 → 8 → 18	Yes
12	A → 1 → 2 → 3 → 4 → 18	Yes

Explanation:

TP: 05 is infeasible because node 15 is semantically unreachable in this test path, as it considers s1==s2 false in node 9, but at node 12 it s1 == s2 as true. Which is not possible.

Test Cases:

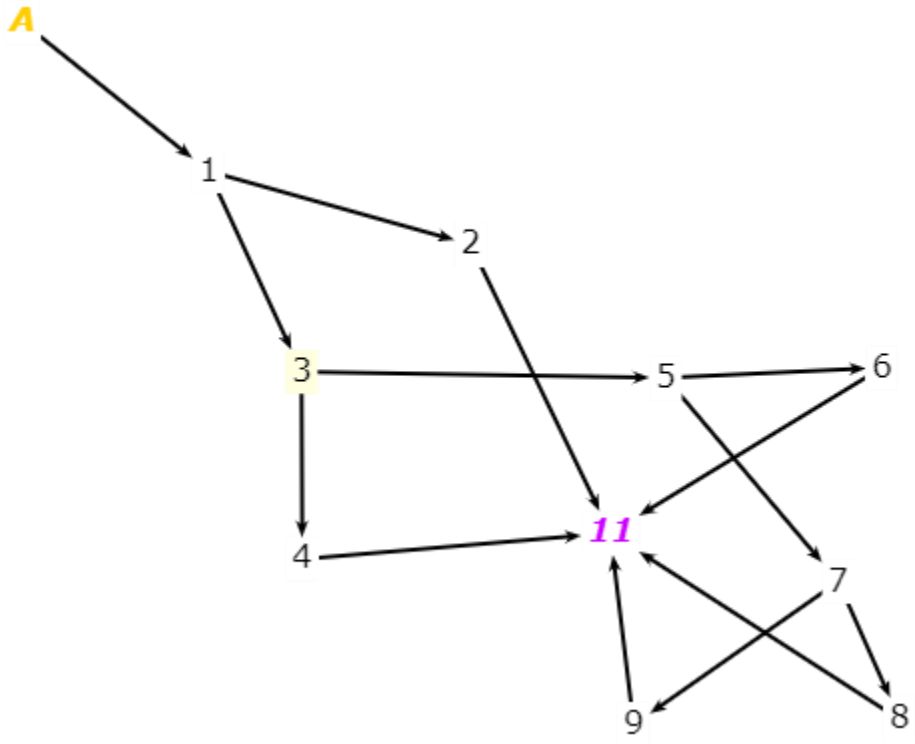
Test Path	S1	S2	S3	Expected Output	Observed Output	Verdict
1	0	0	0	Bad side	Bad side	Pass
2	4	0	5	Bad side	Bad side	Pass
3	4	5	9	No Triangle	No Triangle	Pass
	4	5	10	No Triangle	No Triangle	Pass
4	9	4	5	No Triangle	No Triangle	Pass
	10	4	5	No Triangle	No Triangle	Pass
5	-	-	-	-	-	-
6	5	4	4	Isosceles	Isosceles	Pass
7	5	4	6	Scalene	Scalene	Pass
8	4	5	4	Isosceles	Isosceles	Pass
9	5	5	4	Isosceles	Isosceles	Pass
10	5	5	5	Equilateral	Equilateral	Pass
11	3	5	2	No Triangle	No Triangle	Pass
	3	6	2	No Triangle	No Triangle	Pass
12	4	5	-1	Bad side	Bad side	Pass

Minimized: Yes

Tool Assessment

S. No.	Question	NC	EC	PC	CC	RACC
1	Do you have a test case that represents a valid scalene triangle?	1	1	1	1	1
2	Do you have a test case that represents a valid isosceles triangle?	1	1	1	1	1
3	Do you have a test case that represents a valid equilateral triangle?	1	1	1	1	1
4	Do you have three test case that represent valid isosceles triangle that is you have tried all three permutations of two equal sides?	1	1	1	1	1
5	Do you have a test case in which one side has a zero value?	1	1	1	1	1
6	Do you have a test case in which one side has a negative value?	1	1	1	1	1
7	Do you have a test case with three integers such that the sum of two is equal to the third?	1	1	1	1	1
8	Do you have at least three test cases for question 7 above such that you have tried all permutations of sum of lengths of two sides equal to the length of third side?	1	1	1	1	1
9	Do you have a test case with three integers greater than zero such that the sum of two is less than the third?	1	1	1	1	1
10	Do you have at least three test cases for question 9 such that you have tried all three permutations?	1	1	1	1	1
11	Do you have a test case in which all sides are zero?	1	1	1	1	1
12	Do you have a test case with non-integer values?	0	0	0	0	0
13	Do you have a test case with wrong number of values (two or less or four or more)	0	0	0	0	0
14	For each test case did you specify the expected output along with the input value?	1	1	1	1	1

Graph Coverage Tool



Node Coverage Criteria:

Supports: Yes

Test Paths:

S. No.	Paths	Executable
1	A → 1 → 3 → 5 → 7 → 9 → 11	Yes
2	A → 1 → 3 → 5 → 7 → 8 → 11	Yes
3	A → 1 → 3 → 5 → 6 → 11	Yes
4	A → 1 → 3 → 4 → 11	Yes
5	A → 1 → 2 → 11	Yes

Test Cases:

Test Path	S1	S2	S3	Expected Output	Observed Output	Verdict
1	4	5	6	Scalene	Scalene	Pass
2	4	4	7	Isosceles	Isosceles	Pass
	4	7	4	Isosceles	Isosceles	Pass
	7	4	4	Isosceles	Isosceles	Pass
3	4	4	4	Equilateral	Equilateral	Pass
4	4	4	8	No triangle	No triangle	Pass
	4	8	4	No triangle	No triangle	Pass
	8	4	4	No triangle	No triangle	Pass
	1	1	3	No triangle	No triangle	Pass
	1	3	1	No triangle	No triangle	Pass
	3	1	1	No triangle	No triangle	Pass
5	4	-1	0	Bad side	Bad side	Pass
	0	0	0	Bad side	Bad side	Pass

Minimized: Yes

Edge Coverage Criteria:

Supports: Yes

Test Paths:

S. No.	Paths	Executable
1	A → 1 → 3 → 5 → 7 → 9 → 11	Yes
2	A → 1 → 3 → 5 → 7 → 8 → 11	Yes
3	A → 1 → 3 → 5 → 6 → 11	Yes
4	A → 1 → 3 → 4 → 11	Yes
5	A → 1 → 2 → 11	Yes

Test Cases:

Test Path	S1	S2	S3	Expected Output	Observed Output	Verdict
1	4	5	6	Scalene	Scalene	Pass
2	4	4	7	Isosceles	Isosceles	Pass
	4	7	4	Isosceles	Isosceles	Pass
	7	4	4	Isosceles	Isosceles	Pass
3	4	4	4	Equilateral	Equilateral	Pass
4	4	4	8	No triangle	No triangle	Pass
	4	8	4	No triangle	No triangle	Pass
	8	4	4	No triangle	No triangle	Pass
	1	1	3	No triangle	No triangle	Pass
	1	3	1	No triangle	No triangle	Pass
	3	1	1	No triangle	No triangle	Pass
5	4	-1	0	Bad side	Bad side	Pass
	0	0	0	Bad side	Bad side	Pass

Minimized: Yes

Predicate Coverage Criteria:

As we know from lecture, when predicates come from conditions on edges, predicate coverage is equivalent to edge coverage.

Clause Coverage Criteria:

Supports: No

Restricted Active Clause Coverage:

Supports: No

Tool Assessment

S. No.	Question	NC	EC	PC	CC	RACC
1	Do you have a test case that represents a valid scalene triangle?	1	1	1	0	0
2	Do you have a test case that represents a valid isosceles triangle?	1	1	1	0	0
3	Do you have a test case that represents a valid equilateral triangle?	1	1	1	0	0
4	Do you have three test case that represent valid isosceles triangle that is you have tried all three permutations of two equal sides?	1	1	1	0	0
5	Do you have a test case in which one side has a zero value?	1	1	1	0	0
6	Do you have a test case in which one side has a negative value?	1	1	1	0	0
7	Do you have a test case with three integers such that the sum of two is equal to the third?	1	1	1	0	0
8	Do you have at least three test cases for question 7 above such that you have tried all permutations of sum of lengths of two sides equal to the length of third side?	1	1	1	0	0
9	Do you have a test case with three integers greater than zero such that the sum of two is less than the third?	1	1	1	0	0
10	Do you have at least three test cases for question 9 such that you have tried all three permutations?	1	1	1	0	0
11	Do you have a test case in which all sides are zero?	1	1	1	0	0
12	Do you have a test case with non-integer values?	0	0	0	0	0
13	Do you have a test case with wrong number of values (two or less or four or more)	0	0	0	0	0
14	For each test case did you specify the expected output along with the input value?	1	1	1	0	0

Dataflow Graph Coverage Tool

Node Coverage Criteria:

Supports: No

Edge Coverage Criteria:

Supports: No

Predicate Coverage Criteria:

Supports: No

Clause Coverage Criteria:

Supports: No

Restricted Active Clause Coverage:

Supports: No

Tool Assessment

S. No.	Question	NC	EC	PC	CC	RACC
1	Do you have a test case that represents a valid scalene triangle?	0	0	0	0	0
2	Do you have a test case that represents a valid isosceles triangle?	0	0	0	0	0
3	Do you have a test case that represents a valid equilateral triangle?	0	0	0	0	0
4	Do you have three test case that represent valid isosceles triangle that is you have tried all three permutations of two equal sides?	0	0	0	0	0
5	Do you have a test case in which one side has a zero value?	0	0	0	0	0
6	Do you have a test case in which one side has a negative value?	0	0	0	0	0
7	Do you have a test case with three integers such that the sum of two is equal to the third?	0	0	0	0	0
8	Do you have at least three test cases for question 7 above such that you have tried all permutations of sum of lengths of two sides equal to the length of third side?	0	0	0	0	0
9	Do you have a test case with three integers greater than zero such that the sum of two is less than the third?	0	0	0	0	0
10	Do you have at least three test cases for question 9 such that you have tried all three permutations?	0	0	0	0	0
11	Do you have a test case in which all sides are zero?	0	0	0	0	0
12	Do you have a test case with non-integer values?	0	0	0	0	0
13	Do you have a test case with wrong number of values (two or less or four or more)	0	0	0	0	0
14	For each test case did you specify the expected output along with the input value?	0	0	0	0	0

Logic Coverage Tool

Node Coverage Criteria:

Supports: No

Edge Coverage Criteria:

Supports: No

Predicate Coverage Criteria:

Supports: No

Clause Coverage Criteria:

Supports: No

Restricted Active Clause Coverage:

Supports: Yes

Equilateral Triangle: a & b; *where a: s1 == s2 and b: s2 == s3*

Truth Table:

Row	a	B	P
1	T	T	T
2	T	F	F
3	F	T	F
4	F	F	F

RACC:

Major Clause	Set of possible tests
a	(1,3)
b	(1,2)

Test Cases:

S. No.	S1	S2	S3	Expected Output	Observed Output	Verdict
1	3	3	3	True	True	Pass
2	5	5	8	False	False	Pass
3	0	5	5	False	False	Pass

Isosceles Triangle: !(a & b & c) & (a | b | c); *where a: s1 == s2, b: s2 == s3, c: s1 == s3*

Truth Table:

Row	a	b	c	P
1	T	T	T	F
2	T	T	F	T
3	T	F	T	T
4	T	F	F	T
5	F	T	T	T
6	F	T	F	T
7	F	F	T	T
8	F	F	F	F

RACC:

Major Clause	Set of possible tests
a	(1,5), (4,8)
b	(1,3), (6,8)
c	(1,2), (7,8)

Test Cases:

S. No.	S1	S2	S3	Expected Output	Observed Output	Verdict
1	0	0	0	False	False	Pass
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	3	3	5	True	True	Pass
5	-	-	-	-	-	-
6	5	3	3	True	True	Pass
7	5	3	5	True	True	Pass
8	3	-1	4	False	False	Pass
	-1	3	4	False	False	Pass
	4	-1	3	False	False	Pass

Scalene Triangle: !(a | b | c); *where a: s1 == s2, b: s2 == s3, c: s1 == s3*

Truth Table:

Row	a	b	c	P
1	T	T	T	F
2	T	T	F	F
3	T	F	T	F
4	T	F	F	F
5	F	T	T	F
6	F	T	F	F
7	F	F	T	F
8	F	F	F	T

RACC:

Major Clause	Set of possible tests
a	(4,8)
b	(6,8)
c	(7,8)

Test Cases:

S. No.	S1	S2	S3	Expected Output	Observed Output	Verdict
4	3	3	5	False	False	Pass
6	5	3	3	False	False	Pass
7	5	3	5	False	False	Pass
8	3	4	5	True	True	Pass

Tool Assessment

S. No.	Question	NC	EC	PC	CC	RACC
1	Do you have a test case that represents a valid scalene triangle?	0	0	0	0	1
2	Do you have a test case that represents a valid isosceles triangle?	0	0	0	0	1
3	Do you have a test case that represents a valid equilateral triangle?	0	0	0	0	1
4	Do you have three test case that represent valid isosceles triangle that is you have tried all three permutations of two equal sides?	0	0	0	0	1
5	Do you have a test case in which one side has a zero value?	0	0	0	0	1
6	Do you have a test case in which one side has a negative value?	0	0	0	0	1
7	Do you have a test case with three integers such that the sum of two is equal to the third?	0	0	0	0	1
8	Do you have at least three test cases for question 7 above such that you have tried all permutations of sum of lengths of two sides equal to the length of third side?	0	0	0	0	1
9	Do you have a test case with three integers greater than zero such that the sum of two is less than the third?	0	0	0	0	1
10	Do you have at least three test cases for question 9 such that you have tried all three permutations?	0	0	0	0	1
11	Do you have a test case in which all sides are zero?	0	0	0	0	1
12	Do you have a test case with non-integer values?	0	0	0	0	0
13	Do you have a test case with wrong number of values (two or less or four or more)	0	0	0	0	0
14	For each test case did you specify the expected output along with the input value?	0	0	0	0	1

Conclusion

S. No.	Tool	Points
1	Auto Tester	60/70
2	Graph Coverage Tool	36/70
3	Dataflow Graph Coverage Tool	0/70
4	Logic Coverage Tool	12/70

Auto Tester is the tool with highest points (60/70 overall). It gets 12 out of 14 points for every coverage criterion and 60/70 overall points.