

VU Programm- und Systemverifikation

Assignment 3: Coverage Metrics

Name: _____ Matr. number: _____

Due: May 6, 4pm

Consider the following program fragment and test suite:

```
bool minmax (int i, int j, int k,
             int &least, int &most) {
    least = i;
    most = i;
    if (most < j)
        most = j;
    if (most < k)
        most = k;
    if (least > j)
        least = j;
    if (least > k)
        least = k;
    if (least < most)
        return true;
    if (least == most)
        return false;
}
```

Inputs			Outputs		
i	j	k	least	most	result
1	2	3	1	3	true
2	1	3	1	3	true
2	2	1	1	2	true
0	0	0	0	0	false

Task 1 (3P): Control-Flow-Based Coverage Criteria Indicate (✓) which of the following coverage criteria are satisfied by the test-suite above.

Criterion	satisfied	
	yes	no
path coverage		✓
statement coverage	✓	
branch coverage		✓
decision coverage		✓
condition/decision coverage		✓
MC/DC		✓

Task 2 (7P): Data-Flow-Based Coverage Criteria Which of the following coverage criteria are satisfied by the test-suite above (don't count the parameters of the function as definitions):

Criterion	satisfied	
	yes	no
all-defs	✓	
all-c-uses	✓	
all-p-uses		✓
all-c-uses/some-p-uses	✓	
all-p-uses/some-c-uses		✓
all-uses		✓
all-du-paths		✓

Task 3 (1P): Cyclomatic Complexity What is the cyclomatic complexity of the program?

7

Task 4 (3P): Complete the Test Suite

- If the test-suite from above does not satisfy the coverage criteria listed below, augment it with test-cases such that these criteria are satisfied.
- If full coverage cannot be achieved for one or more of these criteria, explain why.
- If a coverage criterion is already satisfied, briefly explain why this is the case.

all-c-uses

Inputs			Outputs		
i	j	k	least	most	result

all-p-uses/some-c-uses

Inputs			Outputs		
i	j	k	least	most	result

MC/DC

Inputs			Outputs		
i	j	k	least	most	result

- **all-c-uses** is already satisfied
- **all-p-uses** cannot be satisfied, since **least** $\neq$ **most** is only reachable if all definitions in the conditional statements are bypassed.
- **MC/DC** cannot be satisfied, since **least** $\neq$ **most** can never evaluate to true

Task 5 (1P): Modified Condition/Decision Coverage Provide sufficiently many test-cases to guarantee modified condition/decision coverage for the following program fragment:

```
bool foo(int x, int y) {
    return ((x < y) || (y % 2 >= 1));
}
```

Input		Output
x	y	result
1	2	true
5	3	true
1	0	false

Please hand in your assignment via TUWEL (as a single PDF file) by May 6, 2015, 4pm.