

Problem Sheet 10: Testing

Sample Solutions

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1 Branch and Path Coverage

- i. (a) 4.
(b) 6.
- ii. (a) Yes, e.g. `function(4,6)` and `function(6,4)`.
(b) Yes, e.g. `x := 1`, `x := 0`, and `x := -1`.
- iii. (a) 3.
(b) 10.
- iv. (a) `z := true ~> result := "b"`.
(b) `y := x + x [~> y := y + 2]n` for $0 \leq n \leq 6$.
- v. (a) For full path coverage we add the test `function(1,2)`.
(b) For full path coverage we add the tests: `x := 2`, `x := 3`, ... `x := 8`.

2 Logic Coverage

- i. (a) `x < y` and `z && x + y == 10`.
(b) `x > 0`, `y < 15`, and `x = 0`.
- ii. Yes: we can use the same tests as we used for branch coverage.
- iii. (a) `x < y`, `z`, and `x + y == 10`.
(b) `x > 0`, `y < 15`, and `x = 0`.
- iv. Yes in both cases.
 - (a) For full clause coverage we can use the tests `function(6,4)` and `function(1,2)`.
 - (b) For full clause coverage we can use the tests `x := 1`, `x := 0`, and `x := -1`.
- v. Predicate coverage implies branch coverage (in fact, the definitions are equivalent). Clause coverage, however, does not imply branch coverage. Take for example the predicate:

$$x > 0 \vee y > 0.$$

With the tests $(x \mapsto 0, y \mapsto 1)$ and $(x \mapsto 1, y \mapsto 0)$ we achieve clause coverage. However, these tests do not achieve predicate coverage (since the compound formula in both cases evaluates to true) and hence do not achieve branch coverage.

*Solution sheet adapted from an earlier version by Stephan van Staden.