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Softwaretechnik

`http://proglang.informatik.uni-freiburg.de/teaching/swt/2013/`

Exercise Sheet 9

Exercise 1

The paper ”DART: Directed Automated Random Testing” [1] [2] written by Patrice Godefroid, Nils Klarlund, and Koushik Sen presents a tool for automatically testing software.

(i) Read the *DART* paper.

(ii) Apply *DART* on method *medianOf3*.

Compute a set of tuples of input values (x, y, z) that covers all paths of *medianOf3*. Each tuple (x, y, z) is a test case which covers one path of *medianOf3*. Provide the concrete execution, the symbolic execution and the path constraints.

(iii) For each generated test case, determine *your* expected return value of *medianOf3* (i.e. the test oracle is you). Is method *medianOf3* faulty? If so, name the test case generated in (ii), that reveals the bug, if possible.

(iv) Is it guaranteed for *DART* to reveal the bug in this particular example? Justify your answer.

(v) Assume a program P contains loops or function calls (which return non-deterministic values). Is *DART* able to deal with those issues? If not, what are your suggestions?

```
int medianOf3(int x, int y, int z) {
  int m;
  m = z;
  if ( y < z ) {
    if ( x < y ) {
      m = y;
    } else if ( x < z ) {
      m = y;
    }
  } else {
    if ( x > y ) {
      m = y;
    } else if ( x > z ) {
      m = x;
    }
  }
  return m;
}
```

[1] Paper: `http://research.microsoft.com/en-us/um/people/pg/public_psfiles/pldi2005.pdf`

[2] Talk: `http://research.microsoft.com/en-us/um/people/pg/public_psfiles/talk-pldi2005.pdf`

Exercise 2

Consider the following method, which is supposed to return the index of the first element that equals the specfied integer value or -1 if the array does not contain the given integer:

```java
1 public int search(int[] array, int target) {
2   int pos = array.length;
3   while (pos >= 0) {
4     if (array[pos] == target)
5       return pos;
6     --pos;
7   }
8   return -1;
9 }
```

A call to *search* with the input parameters $array = \{1, 2, 3\}$ and $target = 3$ throws an `ArrayIndexOutOfBoundsException` on line 4.

1. For each statement S of the method
   (a) Calculate the set D_S of all statements S_D such that S is data dependent on S_D.
   (b) Calculate the set C_S of all statements S_C such that S is control dependent on S_C.
2. Apply the algorithm for the systematic discovery of defects from the lecture in order to track down the defect in *search*. Where is the origin of the defect?