

Software Quality Assurance (WS 20/21)

Problem Set 6

Problem 1: Theory

- Briefly explain the difference between partial and total correctness.
- Does the Hoare calculus prove partial or total correctness?
- Give suitable post conditions for the following statements or assertions, taking into account the preconditions.

- $x = \sqrt{y}$; precondition: $y \geq 0 \wedge y \in \mathbb{R}$
- `int a[] = sort(b[]);`
precondition: `sizeof(a[]) = sizeof(b[]) $\wedge \forall i, n \in \mathbb{N}$ " with " $0 \leq i \leq n$ "`
holds " `b[i] $\in \mathbb{Z}$`

Problem 2: Symbolic Execution Testing

Fill the tables by performing a symbolic execution test for the following program, then conduct the terms which represent the behavior of the program.

```
void test_me (int x, int y){
    int z = 2 *y;
    if (z==x) {
        x= 30+y;
    } else {
        x= 30-y;
    }
}
```

			PC	Variable Name
				Symbolic Value

			PC	Variable Name
				Symbolic Value

Problem 3: Hoare Calculus

Verify the following programs using the Hoare calculus. For each step, state the axiom you used.

a)

```
void swap(int x, int y){  
    x = x + y;  
    y = x - y;  
    x = x - y;  
}
```

b)

```
int quad(int n){  
    int i, k, y;  
    i = 0;  
    k = -1;  
    y = 0;  
    while (i < n){  
        i = i + 1;  
        k = k + 2;  
        y = y + k;  
    }  
    return y;  
}
```

Problem 4: Termination Proof

Given are two jars, a game jar filled with white and black beans and a storage jar filled with a (theoretically) unlimited amount of black beans. A player changes the contents of the jars by a sequence of moves. Each move proceeds as follows:

1. Blindly draw two beans from the game jar.
2. If they are the same colour, throw both of them away and put a bean from the storage jar into the game jar.
3. Otherwise, throw the black bean away and put the white one back into the game jar.

The procedure ends when there is only one bean left in the game jar.

a) Prove the termination of the game.

b) If the game ends, what colour is the last bean in the game box? Give reasons for your answer.