

## Exercise sheet 1

### Chapter 1: Hoare Logic

#### Exercise: Complete Hoare Triples

Complete the following triples in a meaningful/correct way. Use the primed notation whenever appropriate. You do NOT need to formally prove correctness for loops and if conditions, use intuition for your answers and explain your answer shortly.

1.  $\{true\} \ y = 25 \ \{???\}$
2.  $\{???\} \ y = 6 \ \{y \leq x\}$
3.  $\{x = 2\} \ ??? \ \{x = -2\}$
4.  $\{int \ x \wedge int \ y\} \ x = 16; y = 2; while(x > 3)\{x = x/y\} \ \{???\}$
5.  $\{???\} \ if \ (x \text{ is even})\{y = 2x\} \ else \ \{x = y\} \ \{???\}$
6.  $\{x = 5 \wedge int \ y\} \ x = x - 2; y = x; x = y - x; \ \{???\}$

6 points

#### Exercise: Weird Hoare Triples

Write a short program P (pseudo code is fine) to these Hoare triples and explain why you think your choice is correct.

1.  $\{int \ x \wedge int \ y\} \ P \ \{true\}$
2.  $\{int \ x \wedge int \ y\} \ P \ \{false\}$

4 points

#### Exercise: Formal Proof of a Hoare Triple: if clause

Formally prove the correctness of the following Hoare triple:

```
{int a ∧ int b ∧ b > 0}
if (a < 0)
{a = 2a}
else {a = b}
{ b ≥ a }
```

3 points

**Exercise: Formal Proof of a Hoare Triple: while loop**

Formally prove the correctness of the following Hoare triple:

$\{\text{int } n \wedge n > 0 \wedge \text{int } x \wedge x > 0\}$

```
i=0;  
power=1;  
while (i<n){  
  power = power*x  
  i = i+1  
}
```

$\{ \text{power} = x^n \}$

*7 points*