

# CS263. Homework Assignment 4

## (Solutions due February 25)

February 18, 2010

**Exercise 1:** Prove using Hoare rules the following property: For any boolean command  $b$ , if we start the command `while  $b$  do  $x := x + 2$`  in a state in which  $x$  is even, and if the command terminates, it terminates in a state in which  $x$  is even.

**Exercise 2:** Consider the following alternate Hoare rule for `while`:

$$\frac{\vdash \{A\} c \{b \Rightarrow A \wedge \neg b \Rightarrow B\}}{\vdash \{b \Rightarrow A \wedge \neg b \Rightarrow B\} \text{while } b \text{ do } c \{B\}}$$

Show that the system of axioms remains complete if we replace the old rule for `while` with this one. You must show that any derivation that uses the old rule for `while` can be written with this rule instead.

**Exercise 3:** Consider the following alternate Hoare rule for `while`

$$\frac{\vdash \{A \wedge b\} c \{A\}}{\vdash \{A\} \text{while } b \text{ do } c \{A\}}$$

This rule is not complete. Give a counterexample and a short justification.

**Exercise 4:** Consider now another Hoare rule for `while`:

$$\frac{\vdash \{A\} c \{A\}}{\vdash \{A\} \text{while } b \text{ do } c \{A \wedge \neg b\}}$$

This rule is also incomplete. Give a counterexample and a short justification.