

## Homework Assignment #7

### Due Time/Date

N/A.

### Note

This assignment will not be counted toward your final grade of this course.

### Problems

- (50 %) Prove the partial correctness of the following program using the Owicki-Gries method.

$$\begin{array}{c}
 \{true\} \\
 acc := 0; \\
 Q_0, Q_1 := false, false; \\
 \left[ \begin{array}{l}
 Q_0 := true; \qquad \qquad Q_1 := true; \\
 T := 0; \qquad \qquad T := 1; \\
 \mathbf{await} \neg Q_1 \vee (T \neq 0); \quad \parallel \quad \mathbf{await} \neg Q_0 \vee (T \neq 1); \\
 s_0 := acc; \qquad \qquad s_1 := acc; \\
 acc := s_0 + 1; \qquad \qquad acc := s_1 + 1; \\
 Q_0 := false; \qquad \qquad Q_1 := false;
 \end{array} \right] \\
 \{acc = 2\}
 \end{array}$$

- (20 %) Prove the following derived rule (theorem) in UNITY.

$$\frac{p \mapsto q \vee r \quad r \mapsto s}{p \mapsto q \vee s}$$

You may use the following theorem (finite disjunction):

$$\frac{p \mapsto q \quad p' \mapsto q'}{p \vee p' \mapsto q \vee q'}$$

- (30 %) If the leads-to operator in UNITY were defined without the disjunction rule, the finite disjunction theorem would still hold.

$$\frac{p \mapsto q \quad p' \mapsto q'}{p \vee p' \mapsto q \vee q'}$$

Prove the theorem.

Hint: First prove, using induction, that

$$\frac{p \mapsto q}{p \vee r \mapsto q \vee r}$$