Homework Assignment #5

Note

This assignment is due 2:20PM Thursday, December 29, 2011. Please write or type your answers on A4 (or similar size) paper. Put your completed homework on the instructor's desk before the class starts. For late submissions, please drop them in Yih-Kuen Tsay's mail box on the first floor of Management Building II. A late submission will be penalized by 20% for each working day overdue. You may discuss the problems with others, but copying answers is strictly forbidden.

Problems

1. (50 %) Prove the partial correctness of the following program using the Owicki-Gries method.

$$
\begin{array}{l}
\{true\} \\
acc := 0; \\
Q_0, Q_1 := false, false; \\
\left[\begin{array}{ll|ll}
Q_0 := true; & & Q_1 := true; \\
T := 0; & & T := 1; \\
\textbf{await } \neg Q_1 \vee (T \neq 0); & \| & \textbf{await } \neg Q_0 \vee (T \neq 1); \\
s_0 := acc; & & s_1 := acc; \\
acc := s_0 + 1; & & acc := s_1 + 1; \\
Q_0 := false; & & Q_1 := false;
\end{array}\right] \\
\{acc = 2\}
\end{array}
$$

2. (20 %) Prove the following derived rule (theorem) in UNITY.

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

   You may use the following theorem (finite disjunction):

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

3. (30 %) If the leads-to operator in UNITY were defined without the disjunction rule, the finite disjunction theorem would still hold.

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

   Prove the theorem.

   Hint: First prove, using induction, that

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