Homework 2 — CS 819 C — Spring 2002
February 5, 2002 — due February 12

Problem 1

The following is an annotated total correctness specification for a program for computing the greatest common divisor (gcd) of two nonnegative integers. Give the verification conditions, i.e. the valid assertions that occur in a proof of this specification using the rules for annotated specifications (pages 89-90 of part 3 of the class notes dated January 30). Note that **rem** stands for "remainder".

$$
\begin{array}{l}
[\mathsf{a} \geq 0 \wedge \mathsf{b} \geq 0] \\
\mathsf{c} := \mathsf{a} \,;\, \mathsf{d} := \mathsf{b} \,; \\
[\mathsf{c} \geq 0 \wedge \mathsf{d} \geq 0 \wedge \gcd(\mathsf{c}, \mathsf{d}) = \gcd(\mathsf{a}, \mathsf{b})] \\
\textbf{while } [\textbf{vrnt}\colon \mathsf{d}]\ \mathsf{d} > 0 \textbf{ do} \\
\quad (\mathsf{t} := \mathsf{c} \,;\, \mathsf{c} := \mathsf{d} \,;\, \mathsf{d} := \mathsf{t} \textbf{ rem } \mathsf{d}) \\
[\mathsf{c} = \gcd(\mathsf{a}, \mathsf{b})].
\end{array}
$$

Problem 2

Derive the following inference rules describing a sequence of two mutations:

$$\{(e_1 \mapsto -) \ * \ (e_2 \mapsto -)\}\ [e_1] := e'_1 \,;\, [e_2] := e'_2\ \{(e_1 \mapsto e'_1) \ * \ (e_2 \mapsto e'_2)\}$$

$$\{(e_1 \mapsto -) \wedge (e_2 \mapsto -)\}\ [e_1] := e'_1 \,;\, [e_2] := e'_2\ \{(e_1 \mapsto e'_2) \wedge (e_2 \mapsto e'_2)\}.$$