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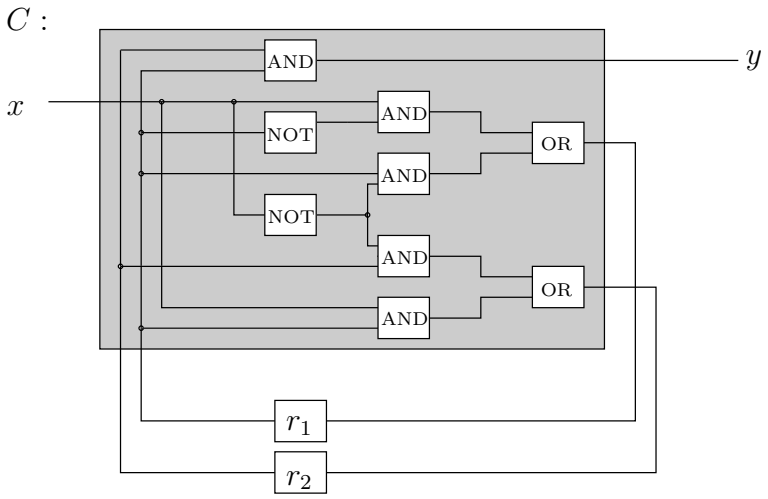
Problem Set 1

Verification

Please write the names of all group members on the solutions you hand in.

Problem 1

Consider the following sequential hardware circuit:



Give the transition system representation T of the circuit C.

Problem 2

Program TRY-MUX1 of Figure 1 is suggested as a tentative solution to the mutual exclusion problem.

A good solution to the mutual exclusion problem is expected to satisfy the requirements of mutual exclusion and starvation freedom, that is, every process wanting to enter the critical section is eventually able to do so, without waiting ad infinitum.

$$\textbf{local } y_1, y_2 : \textbf{integer where } \; y_1 = 0, y_2 = 0$$

$$P_1 :: \left[\begin{array}{l} l_0 : \textbf{loop forever do} \\ \quad \left[\begin{array}{l} l_1 : \textbf{noncritical} \\ l_2 : \textbf{wait until } y_2 = 0 \\ l_3 : y_1 := 1 \\ l_4 : \textbf{critical} \\ l_5 : y_1 := 0 \end{array}\right] \end{array}\right] \;\; || \;\; P_2 :: \left[\begin{array}{l} m_0 : \textbf{loop forever do} \\ \quad \left[\begin{array}{l} m_1 : \textbf{noncritical} \\ m_2 : \textbf{wait until } y_1 = 0 \\ m_3 : y_2 := 1 \\ m_4 : \textbf{critical} \\ m_5 : y_2 := 0 \end{array}\right] \end{array}\right]$$

Figure 1: Program TRY-MUX1: proposed solution.

(a) Define the program graph of one of the two processes.

(b) Determine the transition system for each process.

(c) Construct their parallel composition.

(d) Check whether TRY-MUX1 ensures mutual exclusion.

(e) Check whether TRY-MUX1 ensures starvation freedom.

(f) Answer questions (d) and (e) for a modified version of the program, TRY-MUX2, in which statements l_2 and l_3 are interchanged and so are statements m_2 and m_3.