1. Find Kripke models $M_a$, $M_b$, $M_c$ and $M_d$ (with $AP = \{p, q\}$) such that
   a) $M_a \models Gp$ and $M_a \models G(p \Rightarrow q)$
   b) $M_b \not\models Gp$ and $M_b \models G(p \lor Yq)$
   c) $M_c \models G(p \Rightarrow (q S\neg p))$ and $M_c \models G(p \Rightarrow YY\neg p)$
   d) $M_d \not\models G(p S q)$ and $M_d \models GO q$

   (For two formulas $\psi_1, \psi_2$, a finite word $\pi = x_0x_1x_2\ldots x_n \in (2^{AP})^*$, and an index $0 \leq i \leq n$, $\pi^i \models \psi_1 \Rightarrow \psi_2$ holds iff $\pi^i \models (\neg \psi_1) \lor \psi_2$.)

2. Let $\varphi = G(\text{alarm} \Rightarrow O(\text{crash}))$ be a past safety formula over the atomic propositions $AP = \{\text{alarm, crash}\}$. Give a deterministic finite state automaton $\mathcal{S}$ (over the alphabet $2^{AP}$) which accepts the finite words that are counterexamples to the formula $\varphi$.

3. Demo exercise: Model the automaton $\mathcal{S}$ in Promela by (mis-)using the never claim construction to observe the global bool variables alarm and crash, and to execute the Promela statement assert(false) when the automaton $\mathcal{S}$ would accept the sequence observed so far.