1. (30 points) Write an Esterel program that implements the simplified seat-belt example: when the key is turned on, a timer is started. When the timer expires, an alarm beeps for 5 seconds (here for simplification, you can simply use an end_timer event to indicate that 5 seconds have passed), or until the seat belt has been fastened, or until the key has been turned off.

2. (40 points) Write an Esterel program that implements the following problem: as shown in Figure 1, M1 and M2 are two FSMs. x and y are two inputs of M1; e is the output of M1 and input of M2; z is the output of M2. The overall specification is that e is equal to 1 at clock cycle t_i if x and y were carrying the same Boolean value at the previous cycle t_{i-1}. z is equal to 1 at cycle t_i if the output value of e at cycle t_{i-1} is equal to the output value of e at cycle t_{i-1}.

Figure 1: Block diagram for Problem 2
3. (30 points, from Prof. Reinhard von Hanxleden)
   Consider a node with the signature
   
   node N (x: bool) returns (y: bool)
   
   a. Give the clocks for all sub-expressions of
      
      current ( current ( N ( x when c1 ) ) when c2 )
      
      where x, c1, and c2 all run on the basic clock.
   b. Show that in general, this expression is not equal to
      
      current ( current ( N ( x ) when c1 ) when c2 )