Exercise sheet 3

1. Design a deterministic finite state automaton over the alphabet $\Sigma = \{0, 1\}$ that will accept a string if and only if it
   a) is the empty string
   b) iS not the empty string
   c) is precisely the string 111
   d) begins with the substring 111
   e) is the empty string or begins with the substring 111
   f) ends with the substring 111
   g) begins with 0 and ends with 1
   h) contains the substring 111
2. We will be discsussing this in the lecture, but try to think about it yourself first. Suppose we have an automaton that recognizes a language L_1, and another that recognizes a language L_2.
   a) How will you design an automaton that recognizes $L_1 \cup L_2$?
   b) How will you design an automaton that recognizes $L_1 \cap L_2$?
3. For which of the following languages over the alphabet $\Sigma = \{0, 1\}$ do you feel it is impossible to design a deterministic finite state automaton that recognizes it. For each of the rest, design an automaton to recognize it.
   a) $L = \{ss \mid sisastringover\Sigma\}$
   b) The language consisting of precisely those strings that have an even number of 0s and 1s
   c) a language consisting of strings with only 1s and that too a prime number of 1s
   d) The language of all strings with 2 consecutive 0s anywhere in the string
   e) The language consisting of strings with equal number of 0s and 1s
   f) The language consisting of precisesly those strings with more 1s than 0s.

To be completed