Exercise sheet 3

Theory of Computation, IDC204

1. If L_1 and L_2 are both regular languages over an alphabet Σ. If L_1 can be recognized by a finite state automaton A_1 and L_2 can be recognized by a finite state automaton A_2, then show that one can use A_1 and A_2 to design a *non-deterministic* finite state automaton that recognizes,
   (a) $L_1 \cup L_2$
   (b) $L_1 \circ L_2 = \{s_1 s_2 \mid s_1 \in L_1, s_2 \in L_2\}$, i.e., it is obtained by concatenating each string in L_1 with a string in L_2.
   (c) $L_1^* = \{s_1 s_2 \dots s_n \mid s_i \in L_1\}$.
2. Design a *non*-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