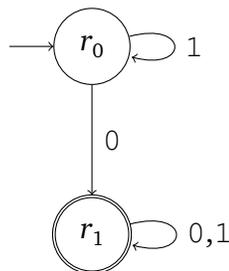
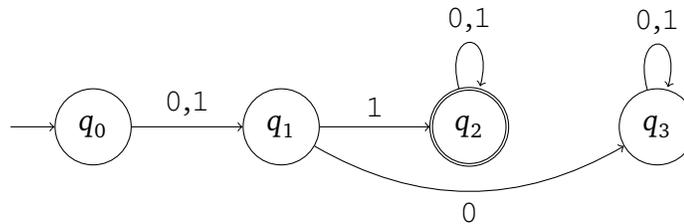
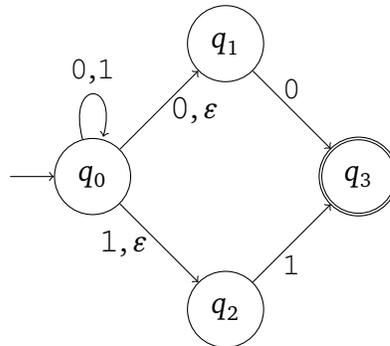


Books, notes, calculators, computers and phones are *not* permitted.

- (16%) Give a DFA for each of the following languages. In both cases, the alphabet is  $\{0, 1\}$ .
  - The language of strings of length at least two that have a 1 as their second symbol. [Exercise 2.3.6(b)]
  - The language of strings that contain less than two 1's (and any number of 0's). [Exercise 2.3.7(d)]
- (12%) What is a DFA? (Give a formal definition.) [Section 2.4]
- (16%) Consider the languages recognized by the two DFA's given below. Use the *pair construction algorithm* to obtain a DFA for the *intersection* of those two languages. Draw the resulting DFA. The alphabet is  $\{0, 1\}$ . [Exercise 2.5.4(a)]



4. (8%) Give an NFA for the language of strings of length at least two that have a 1 in the second-to-last position. The NFA should have no more than three states and five transitions. The alphabet is  $\{0, 1\}$ . [Exercise 3.1.3(c)]
5. (16%) Convert the following NFA into an equivalent DFA. Use the algorithm we learned in class. [Exercise 3.3.4(b)]



6. (16%) Give a regular expression for each of the following languages. In both cases, the alphabet is  $\{0, 1\}$ .
- (a) The language of strings of length at least two that begin with 0 and end in 1. [Exercise 4.3.2(a)]
- (b) The language of strings that contain less than two 1's (and any number of 0's). [Exercise 4.3.4(d)]
7. (16%) Convert the regular expression  $0^*10^*$  into an NFA. Use the algorithm we learned in class. Don't take any shortcuts. [Exercise 4.4.1(c)]