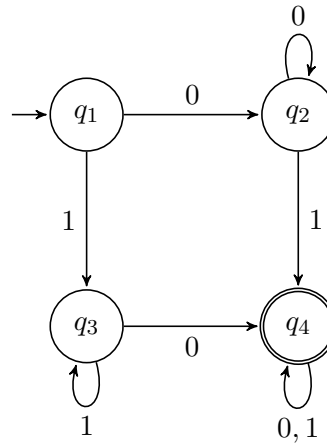
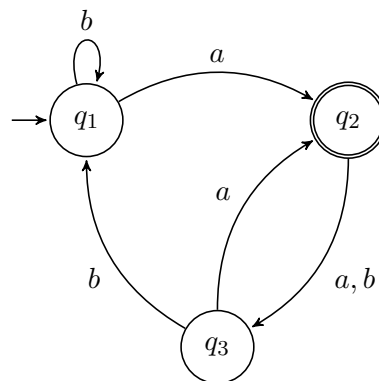


**Directions:** You may work to solve these problems in groups, but all written work must be your own. **Show your work;** See “Guidelines and advice” on the course webpage for more information.

1. Let  $\Sigma = \{0, 1\}$  and let  $M$  be the automaton pictured below.



- (a) List the sequence of states of  $M$  on input 1101. Is  $1101 \in L(M)$ ?
  - (b) Give an English description for  $L(M)$ .
2. Let  $\Sigma = \{a, b\}$ . For each language  $A$  below, construct an automaton  $M$  that recognizes it.
- (a)  $\{w \mid w \text{ has at most 1 } b\}$ .
  - (b)  $\{w \mid w \text{ the number of } a\text{'s in } w \text{ is divisible by 3}\}$
  - (c)  $\{w \mid w \text{ has at most 1 } b \text{ and the number of } a\text{'s is divisible by 3}\}$ .
3. Let  $\Sigma = \{a, b\}$  and let  $M$  be the automaton pictured below (from Sipser 1.1).



- (a) Give a simple English description for  $L(M)$ .
- (b) Two automatas are *equivalent* if their languages are equal. The automaton above has 3 states but is equivalent to an automaton with only 2 states. Construct an automaton with 2 states that is equivalent to  $M$ .