

# Homework 1

CSE 105, Spring 2025  
Due: Monday April 7, 11:59pm

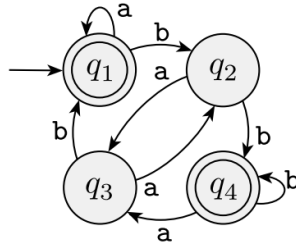
## Instructions:

Upload a single file to Gradescope for each group. All group members' names and PIDs should be on each page of the submission. Your assignments in this class will be evaluated not only on the correctness of your answers, but on your ability to present your ideas clearly and logically. You should always explain how you arrived at your conclusions, using mathematically sound reasoning, where applicable. Whether you use formal proof techniques or write a more informal argument for why something is true, your answers should always be well-supported. Your goal should be to convince the reader that your results and methods are sound.

Read each question carefully. Each question is worth 3 points (total 15 points).

### Problem 1:

The following is a state diagram of a DFA. Answer the following questions about this machine:



- (1) What is the start state?
- (2) What is the set of accept states?
- (3) What sequence of states does the machine go through for input “aabb”?
- (4) Does the machine accept the string “aabbb”?
- (5) Does the machine accept the string  $\varepsilon$  ?

### Problem 2:

The formal description of a DFA  $M$  is  $(\{q_1, q_2, q_3, q_4, q_5\}, \{u, d\}, \delta, q_1, \{q_3\})$ , where  $\delta$  is given by the following table. Give the state diagram of  $M$ .

	u	d
$q_1$	$q_1$	$q_2$
$q_2$	$q_1$	$q_3$
$q_3$	$q_2$	$q_4$
$q_4$	$q_3$	$q_5$
$q_5$	$q_4$	$q_5$

**Problem 3:**

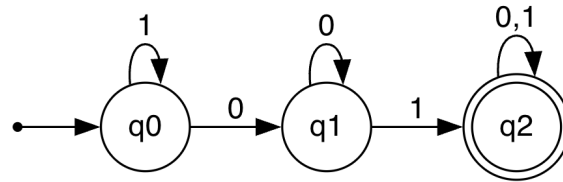
Draw a DFA accepting the following language over the alphabet  $\{0, 1\}$ :  
 $\{w \mid w \text{ contains at least 3 1s}\}$ :

**Problem 4:**

Draw a DFA accepting the following language over the alphabet  $\{0, 1\}$ :  
 $\{w \mid w \text{ does not contain the substring } 110\}$ :

### Problem 5:

Refer to the diagram below and answer the following three questions:



- (1) What is the computation of this machine on input "10010"? Write down the sequence of states processed.
  
- (2) Circle which of the following string(s) would be accepted by the above DFA?
  - (a) 110111
  - (b) 1111
  - (c) 000
  - (d) 1000
  - (e) 1010
  - (f) None of the above
  
- (3) Circle the choice(s) that best describes the language recognized by the above DFA?
  - (a) Set of all strings containing at least one '0' followed later by a '1'
  - (b) Set of all strings with no consecutive '1's
  - (c) Set of all strings over {0,1}
  - (d) Set of all strings that do not contain the substring "10"
  - (e) None of the above