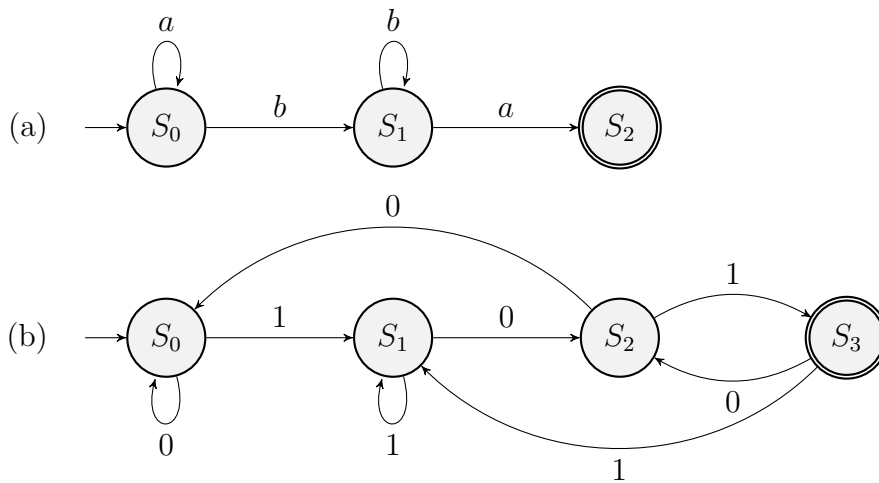


# Foundations of Information Systems

Winter Semester 2025–26, Exercise 5

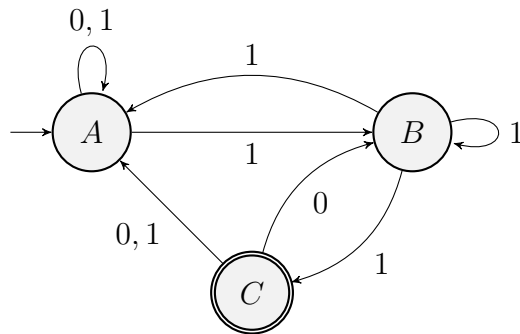
For discussion on Wednesday, November 19, 2025

1. Which strings do the following finite state machines accept?



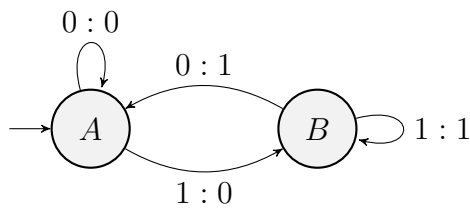
2. Draw a finite state machine that accepts any string from the alphabet  $a, b$  with an even number of  $as$ .
3. Draw a finite state machine that checks if a given 7-bit input corresponds to a number digit (“0”, ..., “9”) encoded in ASCII.
4. Write regular expressions to match the following sets of binary strings. Use the classical regular expression syntax. Then draw the corresponding FSA.
- (a) 0 or 11 or 101,
  - (b) ends with 00,
  - (c) contains at least three 1s,
  - (d) starts and ends with the same character.

5. Consider the following non-deterministic FSA:



- (a) Convert the non-deterministic into an equivalent deterministic FSA.
- (b) Write out a corresponding regular expression.

6. Consider the following finite state transducer:



- (a) Describe the function that is performed by this transducer.
  - (b) The transducer can be used as a “multiply-by-two” machine. How do you need to organize input and output of the transducer so that it performs this function correctly?
7. Construct a binary “add-one” transducer. The input number shall be fed into the transducer starting with the least significant binary digit. The output shall be the input plus one, also starting from the least significant digit.