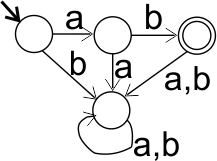
Computer Science 4602

Fall 2020

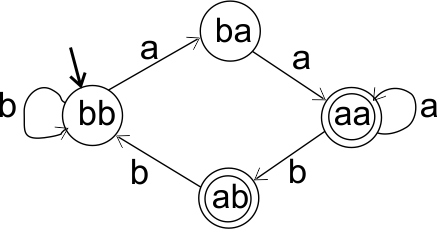
Quiz 2

1. Draw a state transition diagram of a FSM that decides language over alphabet . There is only one string in . Be sure to mark the start state and accepting states. Be sure there is a transition out of every state for every symbol in the alphabet.



2. Draw a state transition diagram of a FSM that decides language *B* = { and the next-to-last symbol in is } Some of the strings in *B* are , , and . Be sure to mark the start state and accepting states.

**Hint.** Have a state for each pair of symbols that might be the last two in a string. The state for strings that end on can serve as a start state.



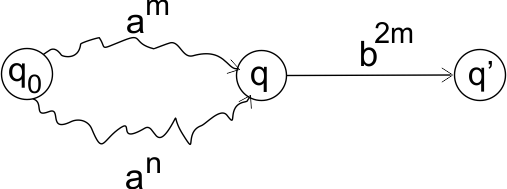
3. Prove that language over alphabet is not regular. Make your proof clear and readable, but not verbose. Do not expect the reader to guess what you are doing.

Theorem. C is not regular.

Proof. By contradiction. Assume that C is regular. Let M be a FSM that solves C.

Perform an experiment where we run M on strings of the form and record, for each, the state that M reaches on that string. Because M has finitely many states, we must eventually find two strings and that cause M to end on the same state q.

Let q’ be the state that M reaches if it is started in state q and reads . Because and both take M to state q, strings and both take M to state q’. Those observations are captured in the following picture.



Since , q’ must be an accepting state. Since , q’ must be a rejecting state. But q’ cannot be both an acception state and a rejecting state. That is a contradiction.