

## Week1 friday

**Review:** Determine whether each statement below about regular expressions over the alphabet  $\{a, b, c\}$  is true or false:

True or False:  $a \in L( (a \cup b) \cup c )$

True or False:  $ab \in L( (a \cup b)^* )$

True or False:  $ba \in L( a^*b^* )$

True or False:  $\varepsilon \in L(a \cup b \cup c)$

True or False:  $\varepsilon \in L( (a \cup b)^* )$

True or False:  $\varepsilon \in L( a^*b^* )$

**From the pre-class reading, pages 34-36:** A deterministic finite automaton (DFA) is specified by  $M = (Q, \Sigma, \delta, q_0, F)$ . This 5-tuple is called the **formal definition** of the DFA. The DFA can also be represented by its state diagram: with nodes for the state, labelled edges specifying the transition function, and decorations on nodes denoting the start and accept states.

Finite set of states  $Q$  can be labelled by any collection of distinct names. Often we use default state labels  $q_0, q_1, \dots$

The alphabet  $\Sigma$  determines the possible inputs to the automaton. Each input to the automaton is a string over  $\Sigma$  and the automaton “processes” the input one symbol (or character) at a time.

The transition function  $\delta$  gives the next state of the DFA based on the current state of machine and the next input symbol.

The start state  $q_0$  is an element of  $Q$ . Each computation of the machine starts at the start state.

The accept (final) states  $F$  form a subset of the states of the DFA,  $F \subseteq Q$ . These states are used to flag if the machine accepts or rejects an input string.

The computation of a machine on an input string is a sequence of states in the machine, starting with the start state, determined by transitions of the machine as it reads successive input symbols.

The DFA  $M$  accepts the given input string exactly when the computation of  $M$  on the input string ends in an accept state.  $M$  rejects the given input string exactly when the computation of  $M$  on the input string ends in a nonaccept state, that is, a state that is not in  $F$ .

The language of  $M$ ,  $L(M)$ , is defined as the set of all strings that are each accepted by the machine  $M$ . Each string that is rejected by  $M$  is not in  $L(M)$ . The language of  $M$  is also called the language recognized by  $M$ .

What is **finite** about all deterministic finite automata? (Select all that apply)

- ☐ The size of the machine (number of states, number of arrows)
- ☐ The number of strings that are accepted by the machine
- ☐ The length of each computation of the machine



The formal definition of this DFA is

Classify each string  $a, aa, ab, ba, bb, \varepsilon$  as accepted by the DFA or rejected by the DFA.

*Why are these the only two options?*

The language recognized by this DFA is



The language recognized by this DFA is



The language recognized by this DFA is