Week 2 Wednesday Review Quiz

Q1 Iterated transition function

1 Point

For some proofs it is useful to define the iterated transition function of a finite automaton. Given a finite automaton $(Q, \Sigma, \delta, q_0, F)$ the iterated transition function δ^* has domain $Q \times \Sigma^*$ and codomain Q and, on input (q, w), outputs the state that the machine is in when starting in state q and processing the entire string w character-by-character according to the transition function δ.

Since the string w is built up recursively, we will define the iterated transition function recursively. Choose the correct option to fill in this definition:

The basis case is for $w = \varepsilon$ and we define

$\delta^*((q, \varepsilon))$ =

- ○ ε
- ○ Σ
- ○ q
- ○ q_0
- ○ F

The recursive step is when $w = ua$ for $u \in \Sigma^*$ and $a \in \Sigma$, and we define

$\delta^*((q, w))$ =

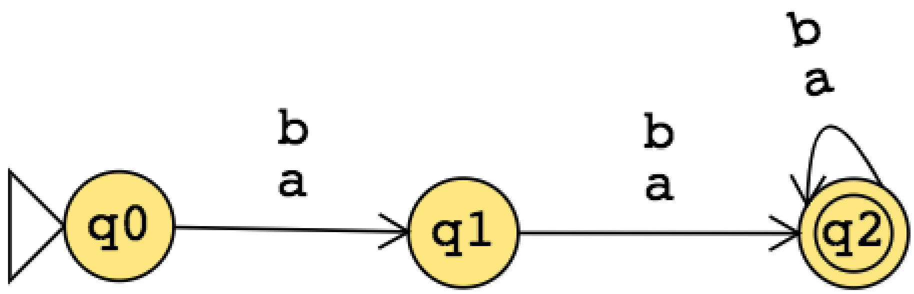
- ○ $\delta((\delta^*((q, u)), a))$
- ○ $\delta((\delta((q, u)), a))$

Save Answer

Q2 Iterated transition function example

2 Points

Let's consider the finite automaton whose state diagram is below. Notice that we can deduce the alphabet from the diagram: the arrow labels are the symbols in the alphabet so $\Sigma = \{a, b\}$. Let's refer to the transition function of this automaton by δ.



Q2.1 (a)

1 Point

What is $\delta((q0, a))$?

- ○ $q0$
- ○ $q1$
- ○ $q2$
- ○ a
- ○ b
- ○ Undefined

What is $\delta((q0, abb))$?

- ○ $q0$
- ○ $q1$
- ○ $q2$
- ○ a
- ○ b
- ○ Undefined

Save Answer

Q2.2 (c)
1 Point

What is $\delta^*((q0, a))$?

- ○ $q0$
- ○ $q1$
- ○ $q2$
- ○ a
- ○ b
- ○ Undefined

What is $\delta^*((q0, abb))$?

- ○ $q0$
- ○ $q1$
- ○ $q2$
- ○ a
- ○ b
- ○ Undefined

Save Answer

Q3 General constructions

3 Points

Fix the alphabet $\Sigma = \{a, b\}$. For each positive integer n, define L_n to be the language over Σ given by $L_n = \{w \in \Sigma^* \mid |w| \text{ is an integer multiple of } n\}$

Q3.1 Example

1 Point

Select all and only the languages below in which $abbaab$ is an element.

- ☐ L_1
- ☐ L_2
- ☐ L_3
- ☐ L_4
- ☐ L_5
- ☐ L_6
- ☐ L_7
- ☐ L_8
- ☐ L_9
- ☐ L_{10}
- ☐ L_{11}
- ☐ L_{12}

Save Answer

Q3.2 Automata and $$L_n$$

1 Point

True or false: for each n, there is some finite automaton that recognizes L_n.

◯ True

◯ False

Save Answer

Q3.3 A related language

1 Point

True or false: There is a finite automaton that recognizes the set of all strings over $\{a, b\}$ with odd length.

◯ True

◯ False

Save Answer

Q4 DFA construction
2 Points

Consider an arbitrary finite automaton $M = (Q, \{a, b\}, \delta, q_0, F)$ and let's call the language recognized by this finite automaton L.

We can define a new finite automaton which recognizes the collection of strings that result from taking each string in L and replacing each a in the string with 0 and each b in the string with 1. For example, if $L = \{a, aab\}$, then this process would produce the new language $\{0, 001\}$.

Informally: the construction is to keep the states and arrows more or less the same, but change the labels so that the label a on an arrow is replaced by the label 0 and the label b on an arrow is replaced by the label 1.

Fill in the formal definition below;

The new machine is $M' = (Q', \Sigma', \delta', q', F')$ where

$Q' =$

- ○ Q
- ○ $\overline{Q}$, aka Q^c, aka the complement of Q
- ○ $Q \times Q$

$\Sigma' =$

- ○ $\{a, b\}$
- ○ $\{0, 1\}$
- ○ $\{0, 1, a, b\}$

$\delta' : Q' \times \Sigma' \to Q'$ is defined by $\delta'((q, 0)) = \delta((q, a))$ and $\delta'((q, 1)) = \delta((q, b))$ for each $q \in Q$.

$q' =$

- 0
- 1
- a
- b
- q
- q_0

$F' =$

- F
- $\overline{F}$, aka F^c, aka the complement of F
- $F \times F$

Save Answer

Q5 Closure
2 Points

A set X is said to be **closed** under an operation OP if, for any elements in X, applying OP to them gives an element in X. For example, the set of integers is closed under multiplication because if we take any two integers, their product is also an integer.

For each of the sentences below, (1) first determine if it is a closure claim, and, if it is, then (2) determine if the sentence is true or false.

Concatenating two strings over the alphabet Σ gives a string over the alphabet Σ

- ○ Not a closure claim.
- ○ Is a closure claim, but false.
- ○ Is a closure claim, and true.

The intersection of two infinite sets of integers is an infinite set of integers.

- ○ Not a closure claim.
- ○ Is a closure claim, but false.
- ○ Is a closure claim, and true.

Save Answer

Q6 Feedback
0 Points

Any feedback or questions about today's material or comments you'd like to share? (Optional; not for credit)

Save Answer

Week 2 Friday Review Quiz

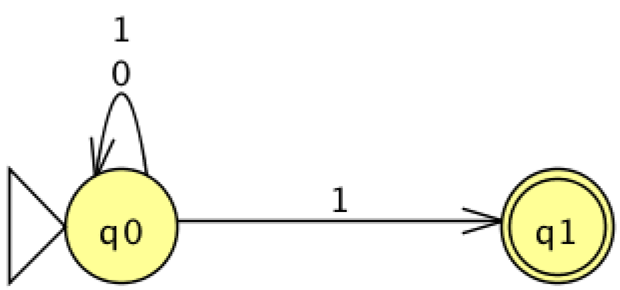
Student Name

Search students by name or email...

Q1 Strings accepted by NFA

2 Points

Select all (and only) the strings of length 3 that are accepted by the NFA over the alphabet $\{0, 1\}$ with state diagram:



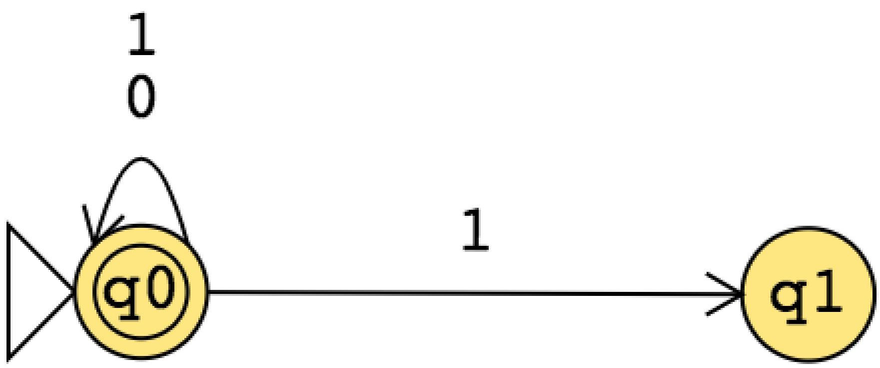
- [ ] 000
- [ ] 001
- [ ] 010
- [ ] 011
- [ ] 100
- [ ] 101
- [ ] 110
- [ ] 111

Save Answer

Q2 Strings accepted by NFA

2 Points

Select all (and only) the strings of length 3 that are accepted by the NFA over the alphabet $\{0, 1\}$ with state diagram:



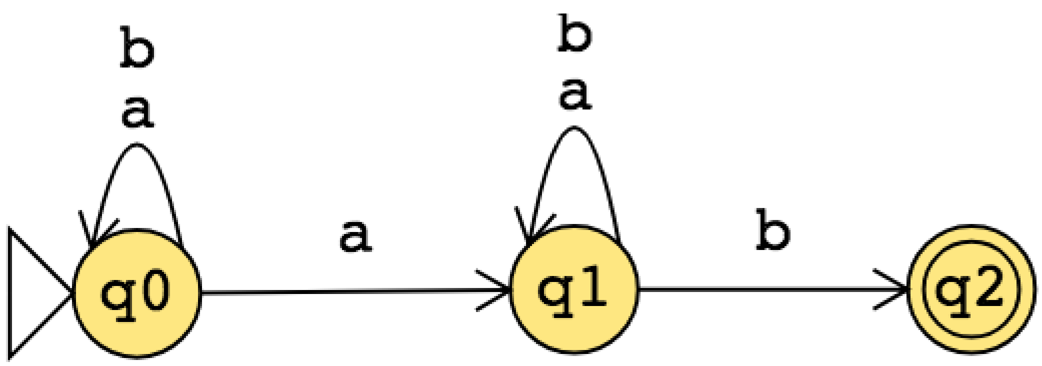
- [ ] 000
- [ ] 001
- [ ] 010
- [ ] 011
- [ ] 100
- [ ] 101
- [ ] 110
- [ ] 111

Save Answer

Q3 NFA and regular expressions

6 Points

Consider the NFA over the alphabet $\{a, b\}$ with state diagram:



Q3.1 Language recognized by NFA

3 Points

Pick the regular expression that describes the language of this NFA.

- ○ $(a \cup b)^*ab$
- ○ $(a \cup b)^*ab(a \cup b)^*$
- ○ $(a \cup b)^*ab(a \cup b)^*b$
- ○ $(a \cup b)^*a(a \cup b)^*b$
- ○ $(a \cup b)^*a(a \cup b)b$
- ○ None of the above

Save Answer

Q3.2 Languages described by regular expressions
3 Points

Select all and only regular expressions that describe a subset of the language recognized by the NFA.

- [ ] $(a \cup b)^* ab$
- [ ] $(a \cup b)^* ab(a \cup b)^*$
- [ ] $(a \cup b)^* ab(a \cup b)^* b$
- [ ] $(a \cup b)^* a(a \cup b)^* b$
- [ ] $(a \cup b)^* a(a \cup b) b$
- [ ] None of the above

Save Answer

Q4 Feedback
0 Points

Any feedback or questions about today's material or comments you'd like to share? (Optional; not for credit)

Save Answer

Save All Answers

Submit & View Submission ›