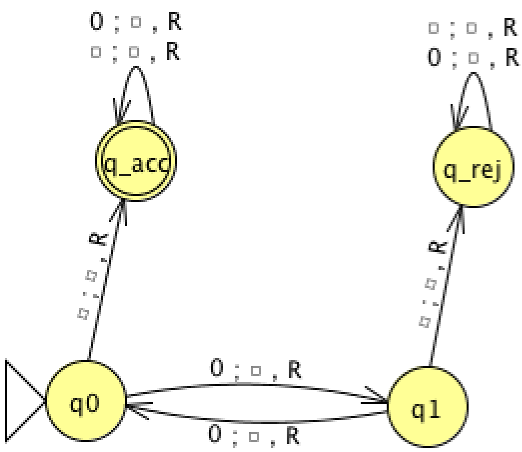
Week 6 Monday Review Quiz

Q1 TM state diagram

2 Points

Which strings over $\{0\}$ are accepted by the Turing machine with the state diagram below? (Select all that apply)



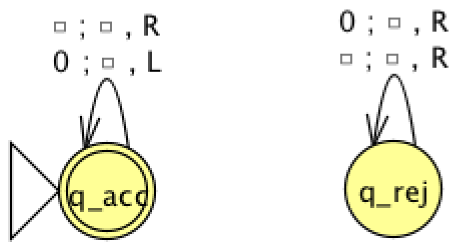
- ☐ Empty string
- ☐ 0
- ☐ 00
- ☐ 000
- ☐ 0000
- ☐ _00 (where the _ denotes a blank symbol)
- ☐ Empty set

Save Answer

Q2 TM state diagram and formal definition

4 Points

Consider the TM with the following state diagram.



We will consider the formal definition of this TM $(Q, \Sigma, \Gamma, \delta, q0, qaccept, qreject)$

Q2.1 (a)

1 Point

What is Σ ?

- $\{0\}$
- $\{0, \square\}$
- $\{0, \square, L, R\}$

What is Γ ?

- $\{0\}$
- $\{0, \square\}$
- $\{0, \square, L, R\}$

Save Answer

Q2.2 (b)
1 Point

What is $q0$?

- ○ q_acc
- ○ q_rej
- ○ None of the above

Save Answer

Q2.3 (c)
1 Point

What is $\delta((q_{acc}, 0))$?

- ○ $0; \square, L$
- ○ $(q_{acc}, \square, L)$
- ○ $\{(q_{acc}, \square, L)\}$

Save Answer

Q2.4 (d)
1 Point

What is the language recognized by this TM?

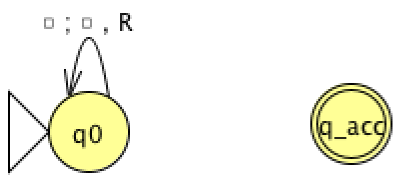
- ○ $\emptyset$
- ○ $\{\varepsilon\}$
- ○ $\{0\}$
- ○ $\{0\}^*$
- ○ $\{0, \square\}^*$

Save Answer

Q3
3 Points

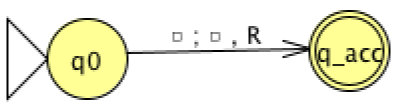
Consider the following state diagrams of four Turing machines over the input alphabet $\{0, 1\}$. (We use the convention that q_{rej} may sometimes be omitted from the diagram and that all missing transitions are directed to it.)

M_1

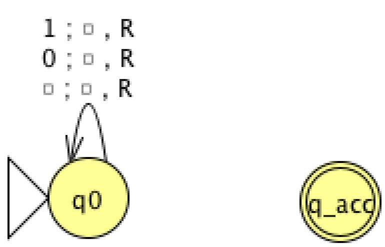


M_2

M_3



M_4



Q3.1 (a)

1 Point

The implementation-level definition below agrees with which of the machines whose state diagrams are above?

"On input w:

1. If w is the empty string, accept.
2. Otherwise, reject."

- ○ M_1
- ○ M_2
- ○ M_3
- ○ M_4
- ○ None of the above.

Save Answer

Q3.2 (b)

1 Point

The implementation level definition below agrees with which of the machines whose state diagrams are above?

"On input w:

1. If w is the empty string, accept.
2. Otherwise, sweep through the tape from left to right, erasing all input characters, until you reach the end of w, and accept."

- ○ M_1
- ○ M_2
- ○ M_3
- ○ M_4
- ○ None of the above.

Save Answer

Q3.3 (c)

1 Point

The implementation level definition below agrees with which of the machines whose state diagrams are above?

"On input w:

1. Sweep through the tape from left to right, looking for first nonblank symbol.
2. When current cell has a 0 or 1, reject."

- ○ M_1
- ○ M_2
- ○ M_3
- ○ M_4
- ○ None of the above.

Save Answer

Q4 Regular languages and TMs

1 Point

Select all and only the correct choices.

- ☐ Suppose you have a state diagram of a DFA recognizing a language L. To get a state diagram of a Turing machine recognizing L, we can always use the same diagram but replace arrows labelled x with arrows labelled $x \to R$.
- ☐ Suppose you have a state diagram of a DFA recognizing a language L. To get a state diagram of a Turing machine recognizing L, we add two special states (qacc and qrej), modify the arrows of the labels to program the Turing machine to read the input from left to right, and add transitions from accept states in the DFA to qacc when we read the blank symbol and transitions from non-accept states in the DFA to qrej when we read the blank symbol.

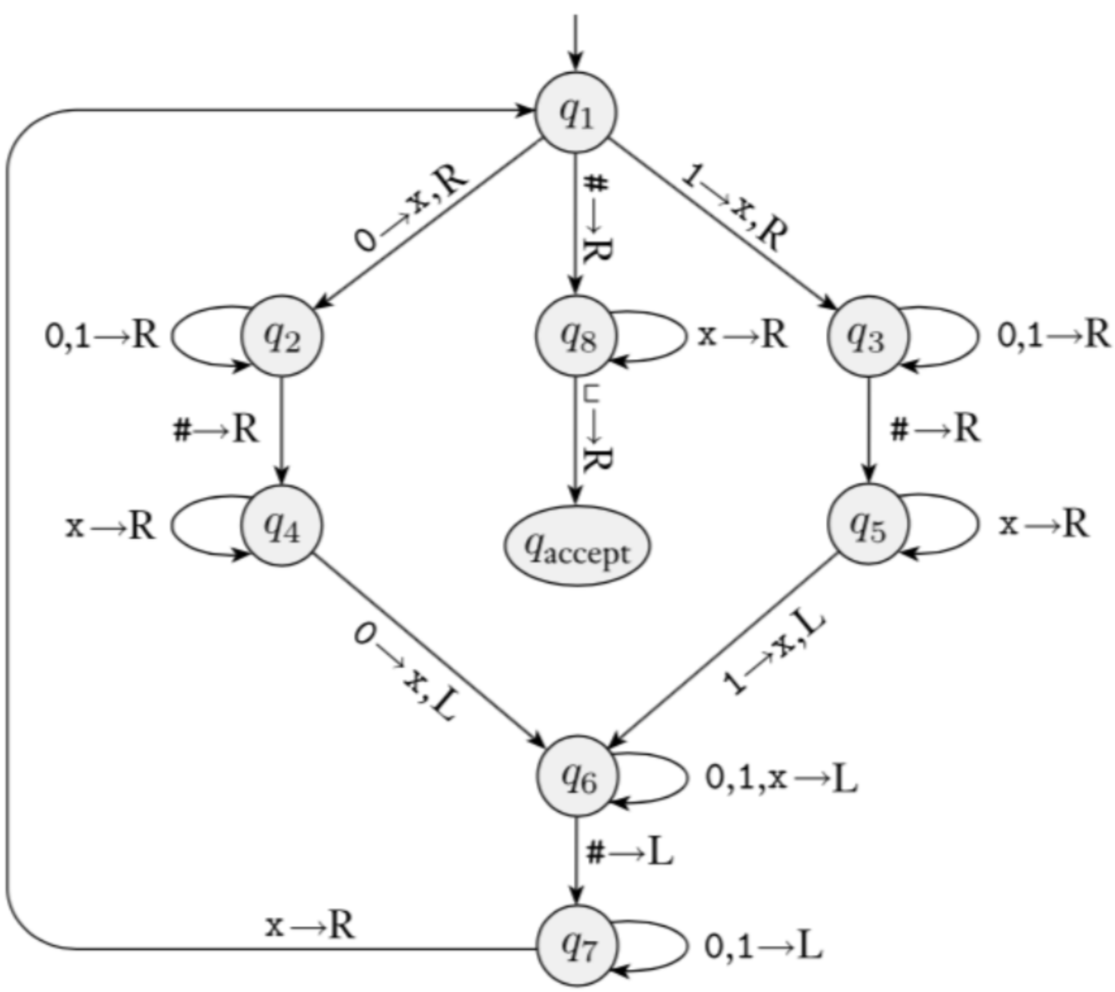
Save Answer

Week 6 Wednesday Review Quiz

Q1 A complicated Turing machine

3 Points

Sipser Figure 3.10



Q1.1 (a)

1 Point

What happens at the start of the computation of this Turing machine on the string 10?

- ◯ The Turing machine starts at q_1, reads the 1, overwrites it with an x, moves the read/write head to the R and transitions to q_3.
- ◯ The Turing machine doesn't have a computation on this input string.
- ◯ The Turing machine has more than one possible computation on this string.

Save Answer

Q1.2 (b)

1 Point

What happens in the second step of the computation of this Turing machine on the string 10?

- ◯ The Turing machine is in q_3, reads a 0 and overwrites it with a 1, moves the read/write head to the R and loops back to to q_3.
- ◯ The Turing machine is in q_3, reads a 0 and overwrites it with a 0 (resulting in no change to the cell contents), moves the read/write head to the R and loops back to to q_3.

Save Answer

Q1.3 (c)
1 Point

What happens at the start of
the computation of this Turing machine on the empty string?

- ○ The Turing machine reads a # writes a #, moves the read/write head to the R and transitions to q8
- ○ The Turing machine reads a blank, writes a blank, moves the read/write head to the R and transitions to qreject, then halts.
- ○ The Turing machine doesn't have a computation on this input string.
- ○ The Turing machine has more than one possible computation on this string.

Save Answer

Q2 Building new TMs with subroutines
7 Points

Suppose M_1 and M_2 are Turing machines. Consider the Turing machines given by the high-level descriptions:

"M = On input w,

1. Run M_1 on input w. If M_1 accepts w, accept. If M_1 rejects w, go to 2.
2. Run M_2 on input w. If M_2 accepts w, accept. If M_2 rejects w, reject."

"M' = On input w,

1. Run M_1 on input w. If M_1 rejects w, reject. If M_1 accepts w, go to 2.
2. Run M_2 on input w. If M_2 rejects w, reject. If M_2 accepts w, accept."

For each of the following claims, answer Always true if the statement is true for all possible M_1 and M_2; answer Always false if the statement is false for all possible M_1 and M_2; and answer Neither otherwise.

Q2.1 (a)
1 Point

True / False: For all choices of M_1 and M_2, if M_1 and M_2 are both deciders then M is a decider.

- ○ True
- ○ False

Save Answer

Q2.2 (b)
2 Points

If $w \in L(M_1)$ then $w \in L(M)$.

- ○ Always true
- ○ Always false
- ○ Neither

If $w \in L(M_2)$ then $w \in L(M)$.

- ○ Always true
- ○ Always false
- ○ Neither

Save Answer

Q2.3 (c)

1 Point

If $w \notin L(M_1)$ then $w \notin L(M)$.

- ◯ Always true
- ◯ Always false
- ◯ Neither

If $w \notin L(M_2)$ then $w \notin L(M)$.

- ◯ Always true
- ◯ Always false
- ◯ Neither

Save Answer

Q2.4 (d)

1 Point

True / False: For all choices of M_1 and M_2, if M_1 and M_2 are both deciders then M' is a decider.

- ◯ True
- ◯ False

Save Answer

Q2.5 (e)
1 Point

If $w \in L(M_1)$ then $w \in L(M')$.

- ◯ Always true
- ◯ Always false
- ◯ Neither

If $w \in L(M_2)$ then $w \in L(M')$.

- ◯ Always true
- ◯ Always false
- ◯ Neither

Save Answer

Q2.6 (f)
1 Point

If $w \notin L(M_1)$ then $w \notin L(M')$.

- ◯ Always true
- ◯ Always false
- ◯ Neither

If $w \notin L(M_2)$ then $w \notin L(M')$.

- ◯ Always true
- ◯ Always false
- ◯ Neither

Save Answer

Week 6 Friday Review Quiz

Q1 Implementation level definition of TMs

2 Points

What is allowed when giving an implementation-level description of a Turing machine? (Select all and only that apply)

- [ ] Give the seven-tuple defining a Turing machine
- [ ] Build new machines from existing machines using previously shown results (e.g. "Construct an NFA B such that $L(B) = \overline{L(A)}$")
- [ ] Mention the tape or its contents (e.g. "Scan the tape from left to right until a blank is seen.")
- [ ] Use other Turing machines as subroutines (e.g. "Run N on w")
- [ ] Mention the tape head (e.g. "Return the tape head to the left end of the tape.")
- [ ] Mention the states of the machine (e.g. "Swap the accept and reject states.")
- [ ] Use previously shown conversions and constructions (e.g. "Convert regular expression R to an NFA N")

Save Answer

Q2 High level description of TMs
2 Points

What is allowed when giving a high-level description of a Turing machine? (Select all and only that apply)

- [ ] Give the seven-tuple defining a Turing machine
- [ ] Build new machines from existing machines using previously shown results (e.g. "Construct an NFA B such that $L(B) = \overline{L(A)}$")
- [ ] Mention the tape or its contents (e.g. "Scan the tape from left to right until a blank is seen.")
- [ ] Use other Turing machines as subroutines (e.g. "Run N on w")
- [ ] Mention the tape head (e.g. "Return the tape head to the left end of the tape.")
- [ ] Mention the states of the machine (e.g. "Swap the accept and reject states.")
- [ ] Use previously shown conversions and constructions (e.g. "Convert regular expression R to an NFA N")

Save Answer

Q3 Turing machine vocabulary

2 Points

Which of the following sentences make sense? (Some are true and some are false -- select all and only those that "type check" correctly, regardless of whether they are true or false).

- [ ] A language is a decider if it always halts.
- [ ] The union of two deciders is a decider.
- [ ] A language is decidable if and only if it is recognizable.
- [ ] There is a Turing machine that isn't decidable.
- [ ] There is a recognizable language that isn't decided by any Turing machine.

Save Answer

Q4 Closure

2 Points

Select all and only correct statements.

- [ ] The class of decidable languages is closed under union.
- [ ] The class of recognizable languages is closed under union.
- [ ] The class of decidable languages is closed under complementation.

Save Answer

Q5 Church-Turing Thesis

2 Points

Select all and only true statements below.

- [ ] The Church-Turing thesis says that the intuitive notion of algorithms exactly equals Turing machine algorithms.
- [ ] To describe low-level programming of Turing machines, we use formal definitions (and, potentially state diagrams)
- [ ] To describe memory management and implementing data access with data structures, we use implementation-level description.
- [ ] The input to a Turing machine is always a string.
- [ ] The format of the input to a Turing machine can be checked to interpret this string as representing structured data (like the formal definition of a DFA, another Turing machine, etc.)

Save Answer

Q6 Feedback

0 Points

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

Save Answer

Save All Answers

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