# Homework quiz 13

**Due** May 7 at 11:59pm **Points** 10 **Questions** 4 **Available** until May 7 at 11:59pm
**Time Limit** None **Allowed Attempts** Unlimited

# Instructions

This "quiz" is your graded homework for the week. Some of it can be done based solely on the materials found on Canvas, while other parts may require lecture material.

I suggest you consume the Canvas material as early as possible and attempt as many problems as you can, and then return to finish after lecture and/or office hours fills in any gaps in your understanding.

You are welcome to take the quiz alone or with others. If you do work with others, it is important that answers are not simply shared but that everyone involved works to understand the solution and could do similar problems alone in the future.

The quiz is untimed and may be taken multiple times. Your highest score achieved before the deadline is the one that will get recorded.

Take the Quiz Again

## Attempt History

| | Attempt | Time | Score |
|---|---|---|---|
| **KEPT** | Attempt 4 | 33 minutes | 10 out of 10 |
| **LATEST** | Attempt 4 | 33 minutes | 10 out of 10 |
| | Attempt 3 | less than 1 minute | 0 out of 10 |
| | Attempt 2 | 42 minutes | 7 out of 10 |
| | Attempt 1 | 5,936 minutes | 3.5 out of 10 |

| Attempt | Time | Score |
| --- | --- | --- |
| | | |

ⓘ Correct answers are hidden.

Score for this attempt: **10** out of 10

Submitted May 6 at 3:49pm

This attempt took 33 minutes.

## Question 1

**2.5 / 2.5 pts**

A Turing machine that deletes all initial 1 characters from the beginning of the input and leaves the head over the next character can be written with just two states and two transitions. Here's a few examples of its behavior.

```
Before   After
1100     00     // Delete any initial 1s; head at first non-1
^        ^
00       00     // Delete any initial 1s; head at first non-1
^        ^
B        B      // Delete any initial 1s; head at first non-1
^        ^
```

Fill in the blanks to make a TM that achieves this task.

q0 [ 1 ] [ B ] q1

q1 [ B ] [ R ] q0

**Answer 1:**

1

**Answer 2:**

B

**Answer 3:**

B

**Answer 4:**

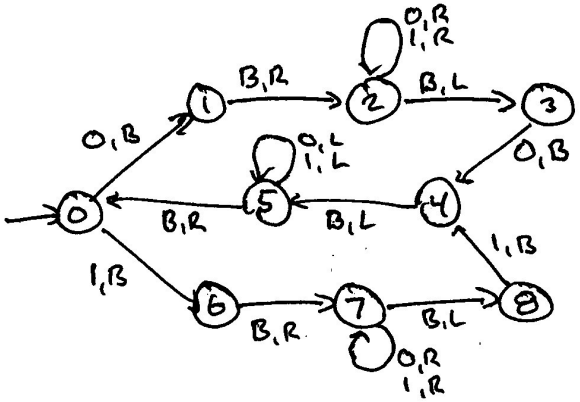
R

## Question 2

**2.5 / 2.5 pts**

Below is a Turing machine that consumes a palindrome made of 0s and 1s and leaves the tape blank. For example, on the following inputs, the output is a blank tape.

```
Before   After
0110
^        ^
010
^        ^
```




If the input to this machine is 0110, what state does the machine end in? (Answer as a single digit integer.) 0

If the input to this machine is 010, what state does the machine end in? (Answer as a single digit integer.) 8

If you wanted to output a 1 in the case that the input was an even length palindrome, you could achieve that be adding one more transition arrow (pointing to a new state 9). Specify the transition: q0 B 1 q9.

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**Answer 1:**

0

---

**Answer 2:**

8

---

**Answer 3:**

q0

**Answer 4:**

B

**Answer 5:**

1

## Question 3

**2.5 / 2.5 pts**

Here is an almost complete Turing machine. It moves the first bit of input to the end of the input. Here are a few examples.

```
Before  After
B       B
^       ^
1       1
^       ^
10      01
^       ^
100     001
^       ^
11000   10001
^       ^
```

Note that the machine handles length 0 and 1 inputs too.

q0 1 B q1
q0 0 B q5
q1 B R q2
q2 0 R q2
q2 1 R q2

q2 B [1] q3

q3 0 L q3

q3 1 L q3

q3 [B] R q4

q5 B R q6

q6 0 R q6

q6 [1] R q6

q6 B [0] q3

Fill in the missing parts of each instruction.

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**Answer 1:**

1

---

**Answer 2:**

B

---

**Answer 3:**

1

---

**Answer 4:**

0

## Question 4

2.5 / 2.5 pts

Trace the first three steps of the Turing machine in the previous question giving the following initial configuration by showing the successive configurations. List one configuration per line with a single space separating each part of the configuration. Recall that the parts of the configuration are in the following order: current-state current-head tape-to-left tape-to-right.

Use "e" for ε and use it only in the "tape-to-left" or "tape-to-right" positions when there is nothing but blanks in those directions. Otherwise list all characters explicitly (and use B for a blank character when needed).

initially q0 1 e 00

Step 1 q1 B e 00

Step 2 q2 0 e 0

Step 3 q2 0 0 e

**Answer 1:**

q1 B e 00

**Answer 2:**

q2 0 e 0

**Answer 3:**

q2 0 0 e

Quiz Score: **10** out of 10