

Exercise 7.4.

For each of the following languages, draw a transition diagram for a Turing machine that accepts that language.

a. $AnBn = \{a^i b^i \mid i \geq 0\}$

b. $\{a^i b^j \mid i < j\}$

c. $\{a^i b^j \mid i \leq j\}$

d. $\{a^i b^j \mid i \neq j\}$

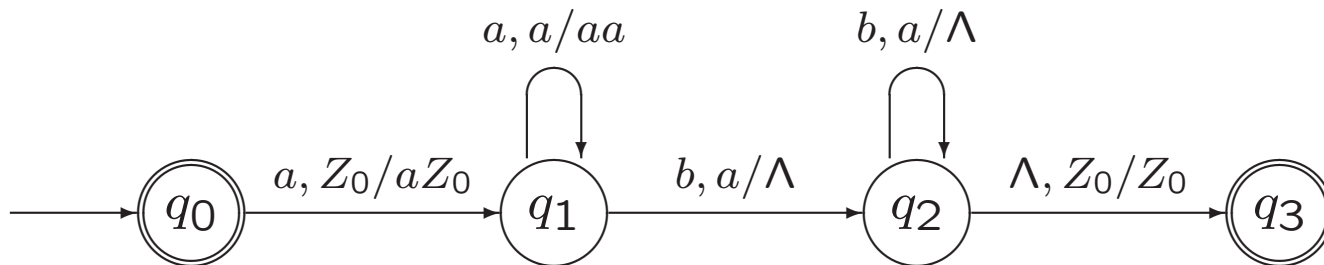
Exercise 7.4.

For each of the following languages, draw a transition diagram for a Turing machine that accepts that language.

a. $AnBn = \{a^i b^i \mid i \geq 0\}$

We could also use the portion of the tape to the right of the input, to simulate the stack of a deterministic pushdown automaton. (Works for any deterministic PDA!)

Draw a transition diagram for a Turing machine that does so for the following PDA:



Exercise.

Draw a transition diagram for a Turing machine accepting

$$AnBnCn = \{a^i b^i c^i \mid i \geq 0\}$$

Exercise 7.5.

For each part below, draw a transition diagram for a TM that accepts $A \text{Eq} B = \{x \in \{a, b\}^* \mid n_a(x) = n_b(x)\}$ by using the approach that is described.

- a.** Search the string left-to-right for an a . As soon as one is found, replace it by X , return to the left end, and search for b . Replace it by X . Return to the left end and repeat these steps until one of the two searches is unsuccessful.
- b.** Begin at the left and search for either an a or a b . When one is found, replace it by X and continue to the right searching for the opposite symbol. When it is found, replace it by X and move back to the left end. Repeat these steps until one of the two searches is unsuccessful.

Exercise 7.6.

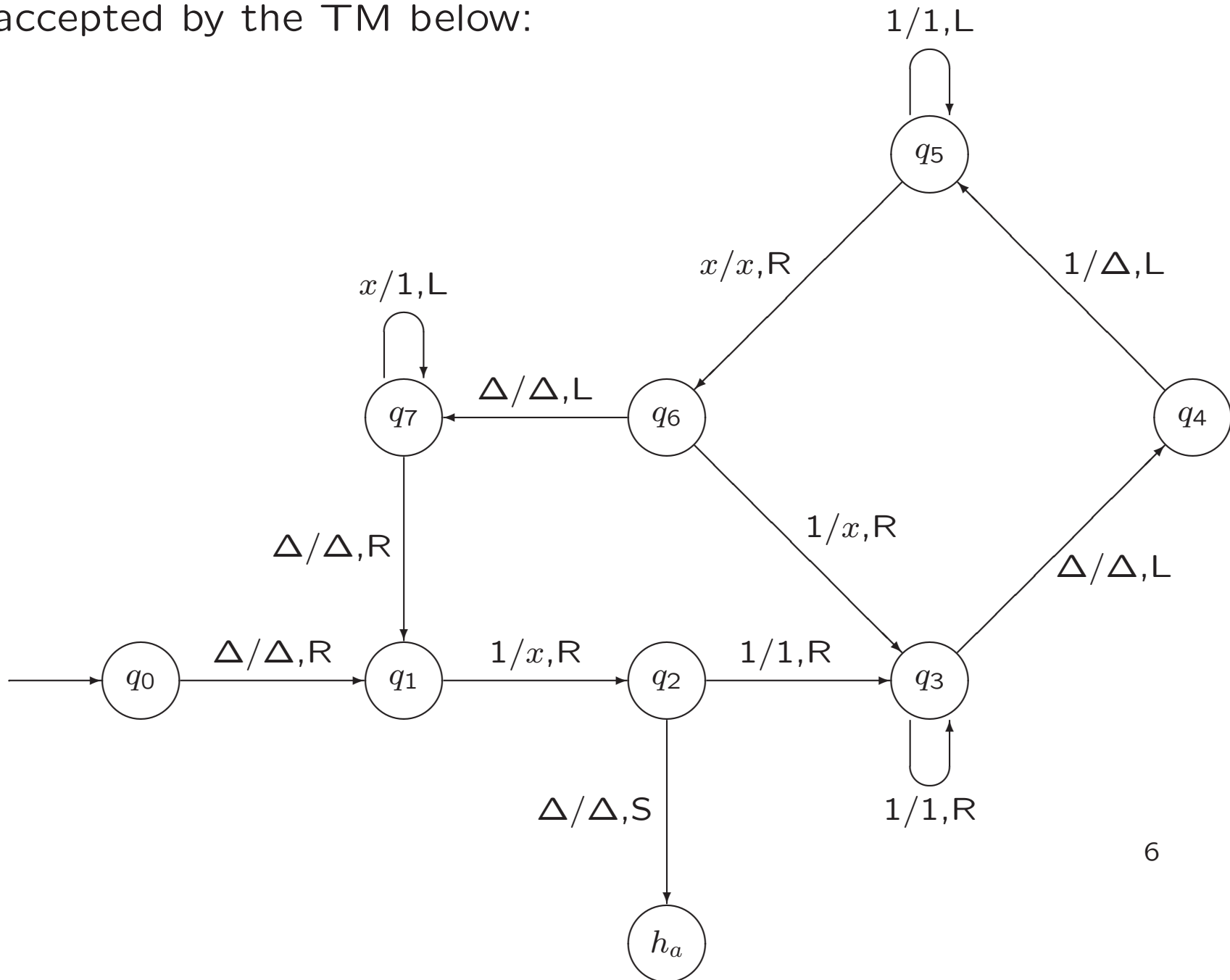
Draw a transition diagram for a TM accepting *Pal*, the language of palindromes over $\{a, b\}$, using the following approach.

Look at the leftmost symbol of the current string, erase it but remember it, move to the rightmost symbol and see if it matches the one on the left; if so, erase it and go back to the left end of the remaining string.

Repeat these steps until either the symbols are exhausted or the two symbols on the ends don't match.

Exercise 7.9.

Describe the language (a subset of $\{1\}^*$)
accepted by the TM below:



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Exercise.

Let the language $L_1 \subseteq \{a, b\}^*$ be defined by

$$L_1 = \{a^i b^j a^{2i} \mid i, j \geq 0 \text{ and } i \leq j < 2i\}$$

- a.** Give the first four elements in the canonical (shortlex) order of L_1 .
- b.** Draw a Turing machine T_1 , such that $L(T_1) = L_1$.

Hint: check first if the letters of the input are in the right order.