Today! — Examples of Turing Machines

— Conventions regarding TM

diagrams

Specific languages

① $\{ w \in \{a,b\} \mid$ last letter of w is "a" $\}$

② PALINDROME $_{\{a,b\}}$

DFA: $\delta : Q \times \Sigma \to Q$ $q \xrightarrow{a} q'$

TM:

$\delta : Q \times \Gamma \to Q \times \Gamma \times \{L, R\}$ $q \xrightarrow{a \to b, L} q'$

Final Exam: Dec 11, 3:30pm

Extreme weather $\Longrightarrow$
   follow UBC modified date/time

$=$

HW 7 posted

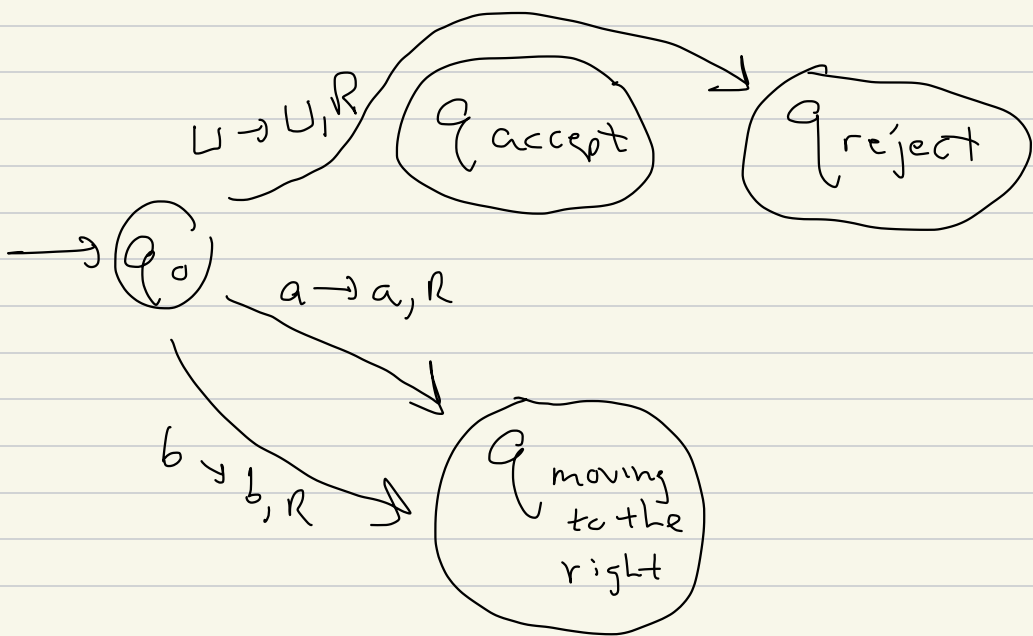no HW due week of
            Oct 30 — Nov 3
                        $\uparrow$
                    midterm

① $\{w \in \{a, b\} \mid \text{last letter of } w \text{ is "a"}\}$

| | a | b | b | a | ␣ | ␣ | ␣ | - - - |

Alg: Move right to the end
of the input; then see if
last symbol/letter is "a" or "b"

⊔ → ⊔, R   q accept   q reject

→ (q₀)   a → a, R
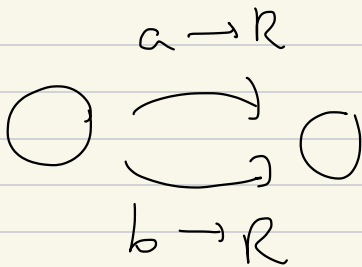
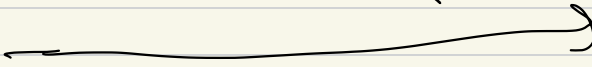   b → b, R   q moving to the right

Shorthand :

$$a \longrightarrow a, R$$

shorthand :

$$a \longrightarrow R$$

shorthand

$$a \longrightarrow R$$
$$b \longrightarrow R$$

$$a, b \longrightarrow R$$
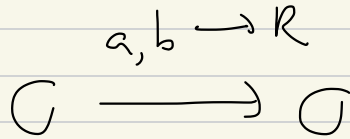
not in textbook [Sip]

First TM

$\sqcup \to$ R

q accept q reject

$\to$ q_0

$a, b \to R$

We could merge

q moving to the right

$a \to R$

$b \to R$

q move L once

$a, b \to R$

$\sqcup \to L$
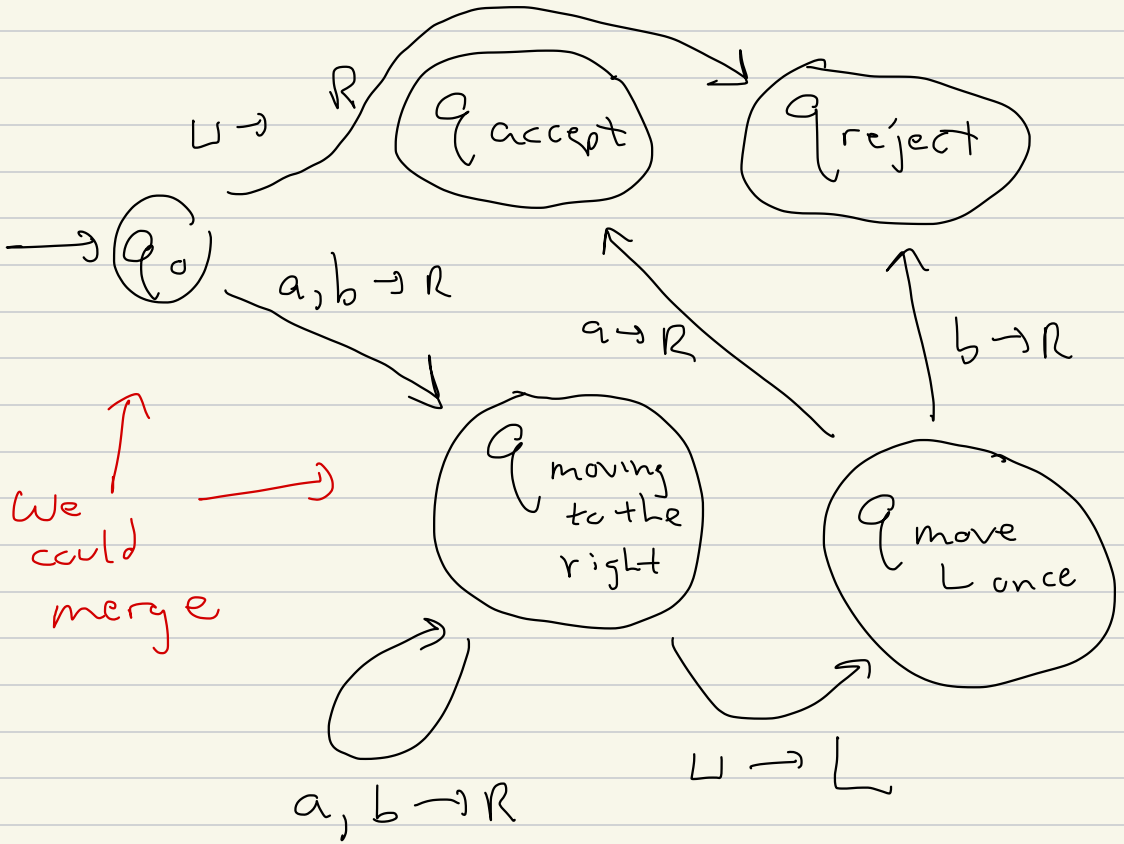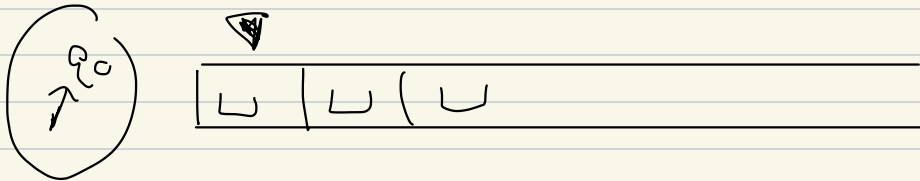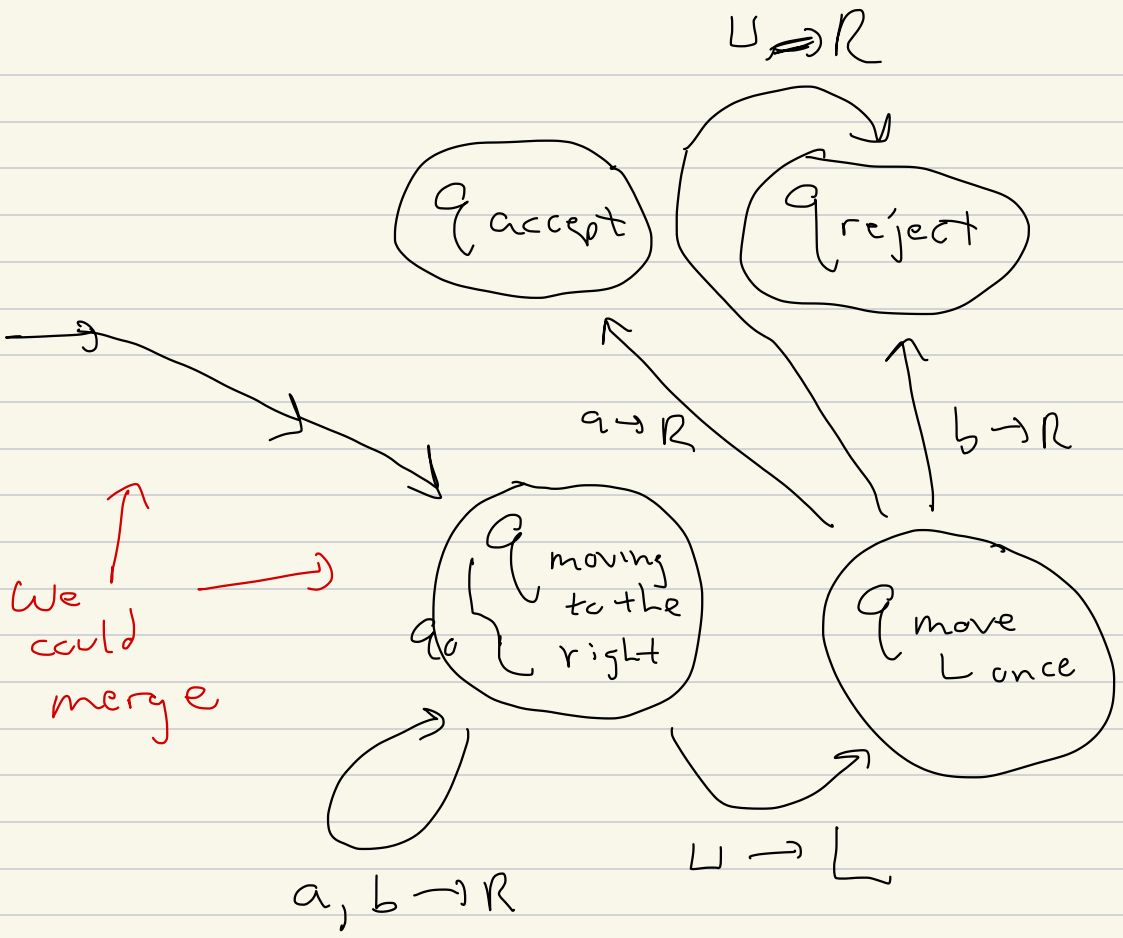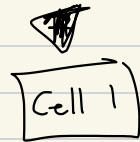
Shorthand: If a tape symbol cannot be read, it's OK not to write it in diagram, despite

$$\delta : Q \times \Gamma \longrightarrow Q \times \Gamma \times \{L, R\}$$

$\sqcup \to R$

q_{accept}

q_{reject}

$q_{moving\ to\ the\ right}$

q_0

$q_{move\ L\ once}$

$a \to R$

$b \to R$

We could merge

$a, b \to R$

$\sqcup \to L$

q_0

| $\sqcup$ | $\sqcup$ | $\sqcup$ |

input is ε

Cell 1

Convention: Left $\sqcup$ with
doesn't move

PALINDROME$_\Sigma$

$$\overset{def}{=} \left\{ w \in \Sigma^* \;\middle|\; w^{rev} = w \right\}$$

where

$$\left(\sigma_1 \ldots \sigma_n \right)^{rev} = \sigma_n \sigma_{n-1} \ldots \sigma_1$$

A̶M̶A̶N̶A̶ ̶P̶L̶A̶N̶A̶ ̶C̶A̶N̶A̶L̶ ̶P̶A̶N̶A̶M̶A̶

RACECAR $\longleftarrow$ $\uparrow$

$$w^{rev} = w$$

$$w \in PALINDROME, \qquad w^2, \; w^3$$

| a | b | b | a | ⊔ | ⊔ | ... |

| a | b | b | b | ⊔ | ⊔ | ~ ~ |

| a b |

| ⊅ | b |

marked with "#"

$$\Gamma = \{ a, b, ⊔, \# \}$$

$\sqcup \rightarrow R$

q accept

q reject

q_0

$a \rightarrow \#, R$
$b \rightarrow \#, R$

MISTAKE...

OR

$a, b \rightarrow \#, R$

$\mathcal{E} \in PALIDROME$

$\sqcup, R$

q_{accept}

q_{reject}

$\rightarrow q_0$

$a \rightarrow \#, R$

$by \#R$

q move R
saw "a"
at first

$a, b \rightarrow R$

q move R
saw "b"

$\sqcup \rightarrow L$

$a, b \rightarrow R$
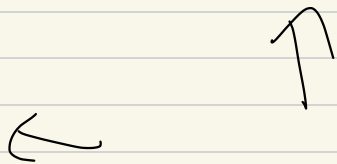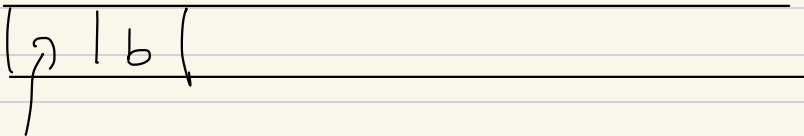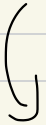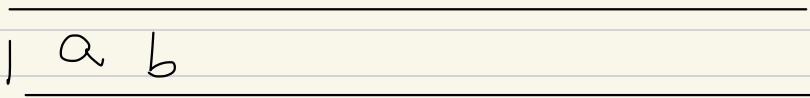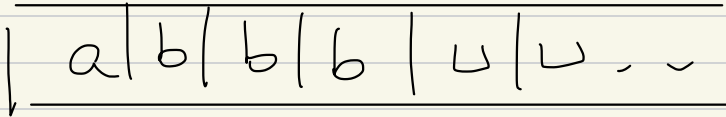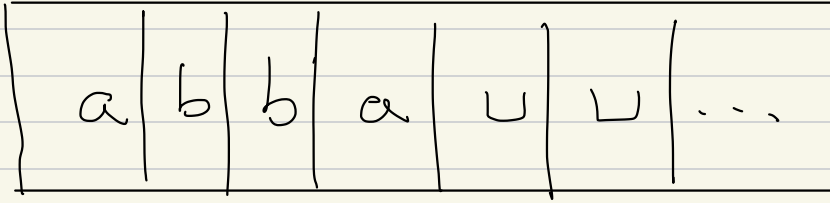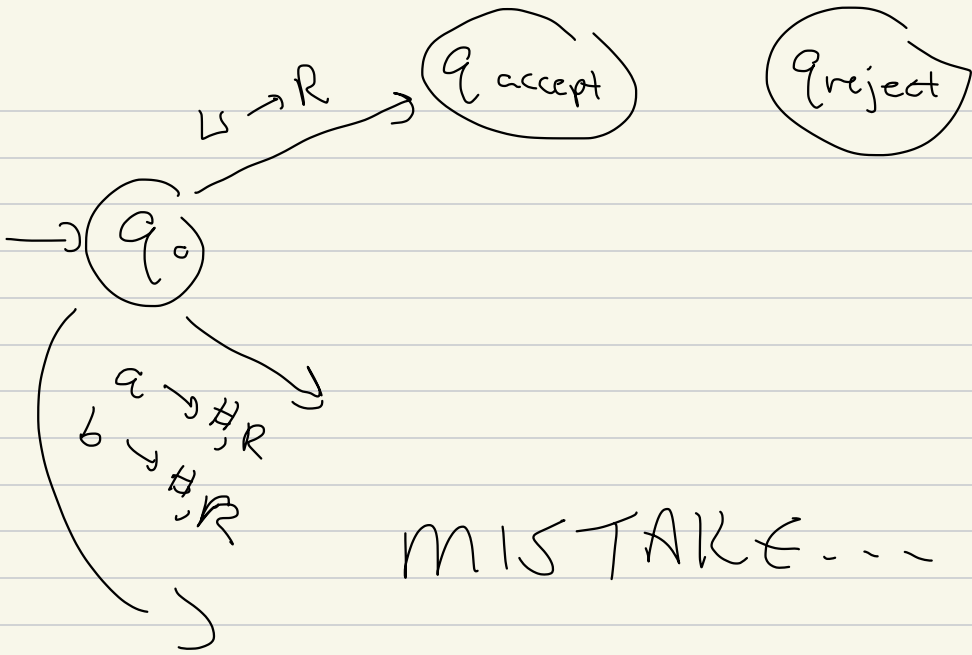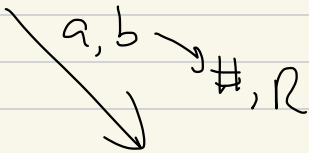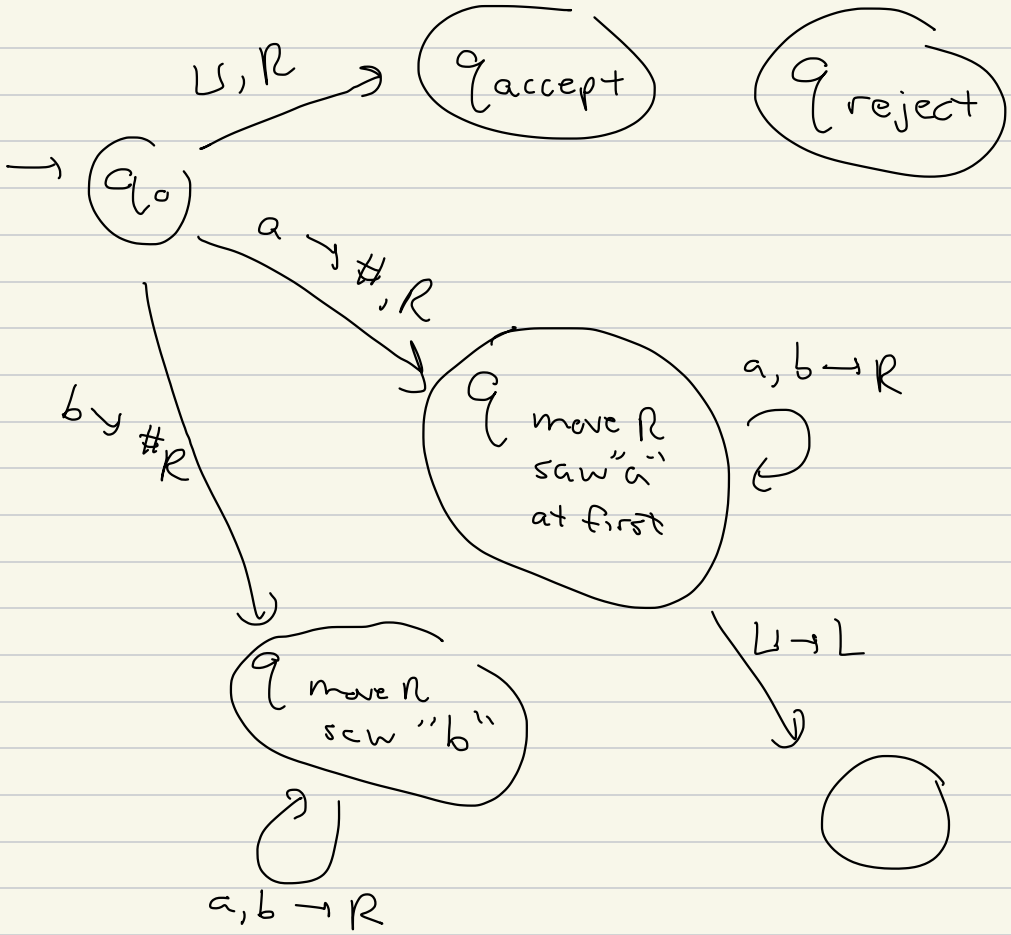
To be continued...

a   b   b   a

♯   b   b   a   Ц

9 sroove R
sew r.

♯   b   b   ♯

}

♯ ♯ ♯ ♯

length 5
abba
♯ b b b ♯
♯ ♯ (b) ♯ ♯