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I pledge my honor that I have abided by the Stevens Honor System

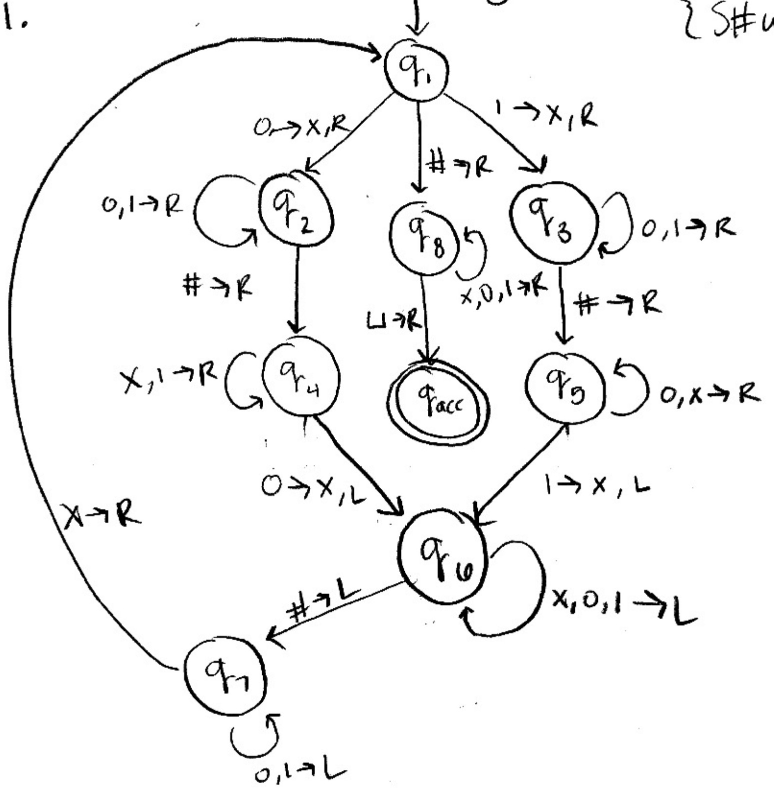
Homework 4

Construction of a Turing Machine

1.

$\{ S\#w \mid S \text{ is a subsequence of } w \}$

$w \in \{0,1\}^*$



2. "01#001"

$q_1\,01\#001$

$x\,q_2\,1\#001$

$x1\,q_2\,\#001$

$x1\#\,q_4\,001$

$x1\,q_6\,\#x01$

$x\,q_7\,1\#x01$

$q_7\,x1\#x01$

$x\,q_1\,1\#x01$

$xx\,q_3\,\#x01$

$xx\#\,q_5\,x01$

$xx\#x\,q_5\,01$

$xx\#x0\,q_5\,1$

$xx\#x0\,q_6\,x$

$xx\#\,q_6\,x0x$

$xx\,q_6\,\#x0x$

$x\,q_7\,x\#x0x$

$xx\,q_1\,\#x0x$

$xx\#\,q_8\,x0x$

$xx\#x\,q_8\,0x$

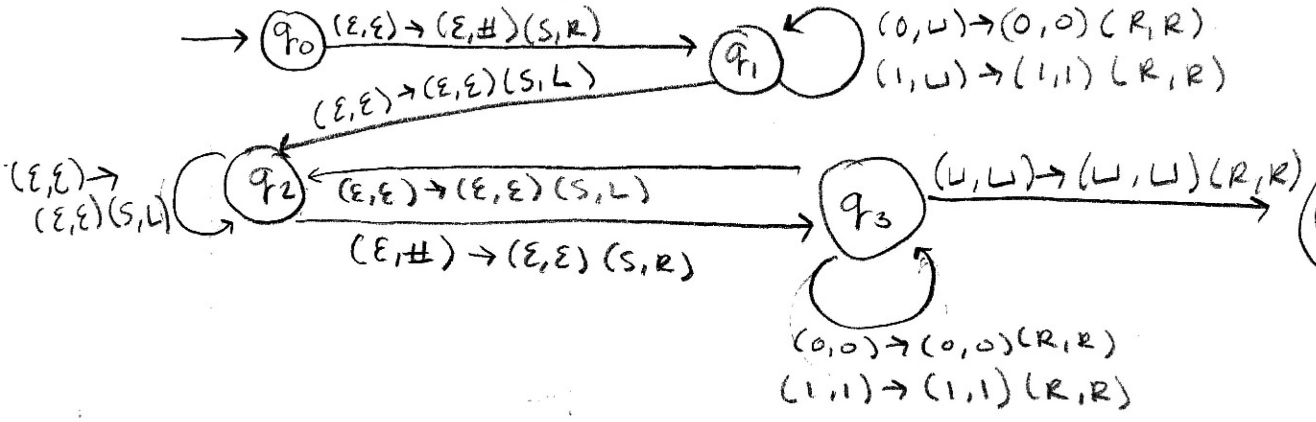
$xx\#x0\,q_8\,x$

$xx\#x0x\,q_8$

$xx\#x0x\sqcup\,q_{acc}.$

Proving Turing-Decidability

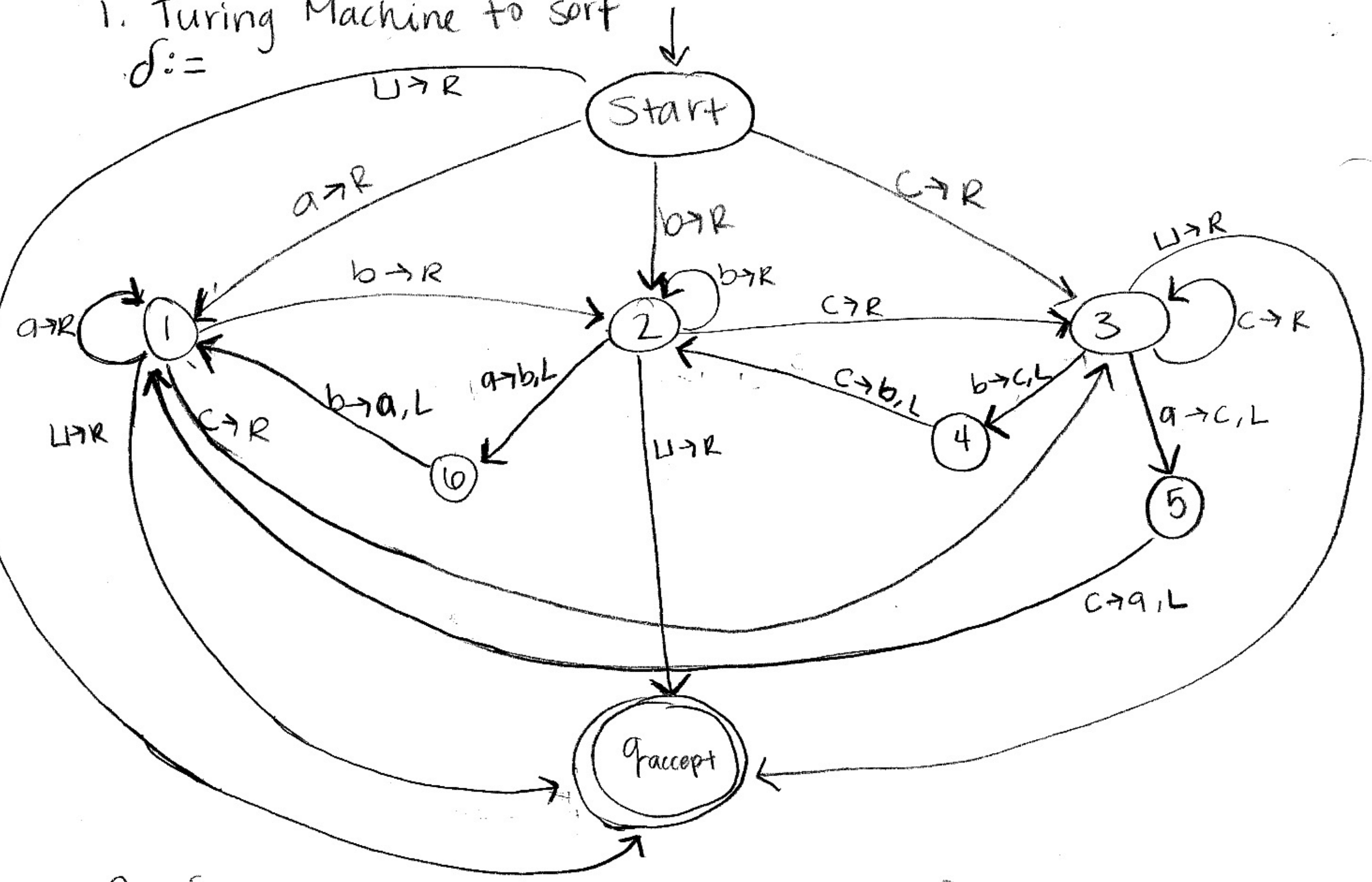
1. $\{s^n \mid s \in \Sigma^*\}$ $\Sigma := \{0,1\}$



Computing non-decision problems w/ TM

1. Turing Machine to sort

$\delta :=$



$Q := \{Start, 1, 2, 3, 4, 5, 6, q_{accept}, q_{reject}\}$

$\Sigma := \{a, b, c\}$

$\Gamma := \{a, b, c, \sqcup\}$

$q_{start} :=$ Start

$q_{accept} := q_{accept}$

$q_{reject} := q_{reject}$

Musings on Finiteness of DFAs

1. a. DFA w/ infinite States:

   Because a TM is countably infinite, and a DFA that has infinitely many states is uncountably infinite, a DIA (Deterministic Infinite Automaton) will accept more languages than the TM, however it could take infinitly longer to compute.

   b. If the size of the alphabet was infinite but the number of states was finite, the new DFA would still accept less languages than a TM because there are less possible ways to make it through the DFA. A TM still has more states than the DFA.