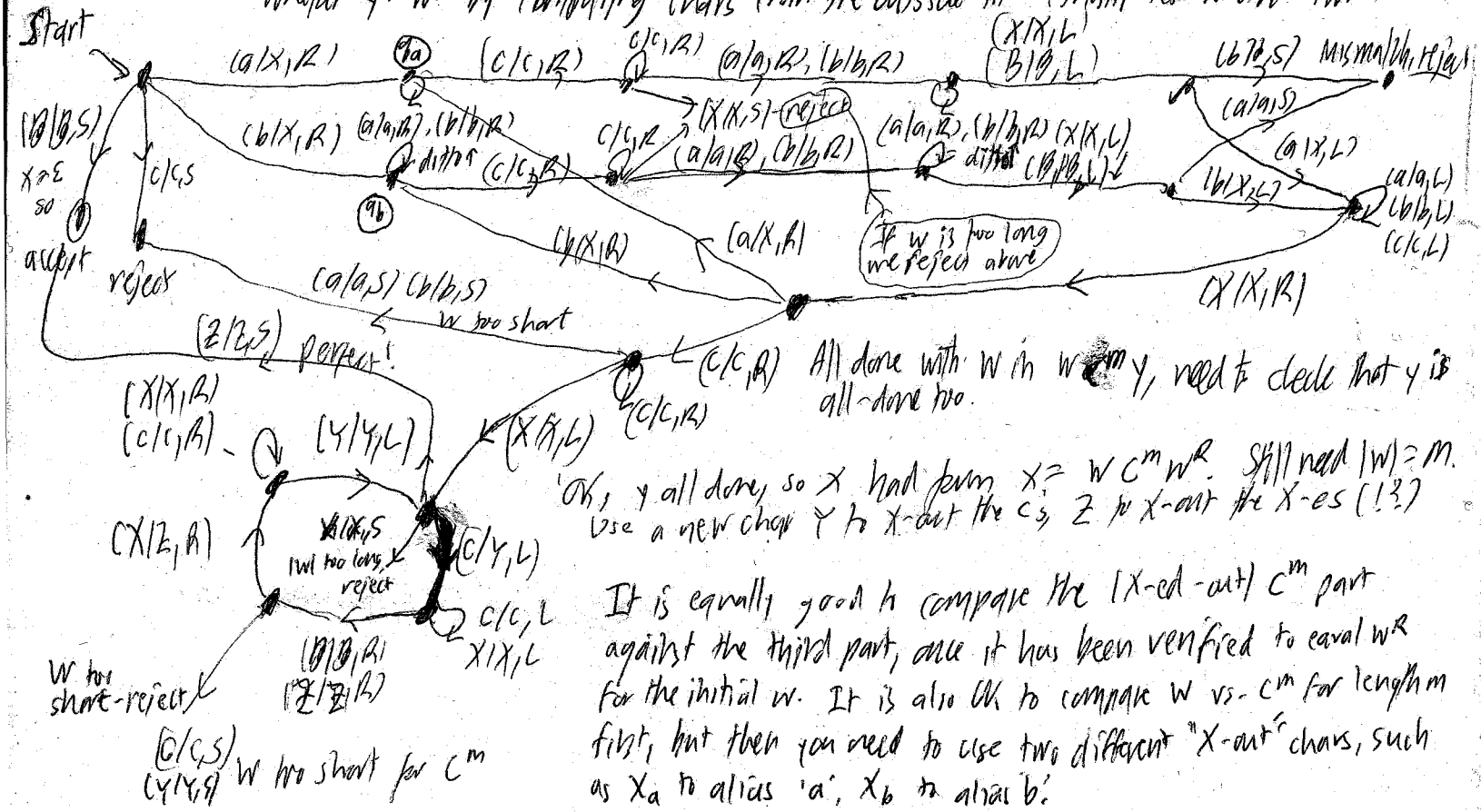
CSE 396 Part 8 Problem Set 9 Answer Key Spring 2010

4 (a) Define $A = \{wc^m w^R : w \in \{a,b\}^*, |w| = m\}$. Here $\Sigma = \{a,b,c\}$, and $\varepsilon \in A$ since $m=0$ is allowed. Design a 1-tape TM M s.t. $L(M) = A$. $A = \{\varepsilon, 0c0, 1c1, 00c00, 01c10, 10c01, 11c11, \ldots\}$

Strategy: First test whether the input x is in $(a+b)^* c^* (a+b)^*$, i.e. has the form $wc^m y$, $w, y \in \{a,b\}^*$. Then test whether $y = w^R$ by comparing chars from the outside in. Finally test whether $|w| = m$.



It is equally good to compare the (X-ed-out) c^m part against the third part, once it has been verified to equal w^R for the initial w. It is also OK to compare w vs. c^m for length m first, but then you need to use two different "X-out" chars, such as X_a to alias 'a', X_b to alias 'b'.