ECS 120: Theory of Computation

Midterm Exam
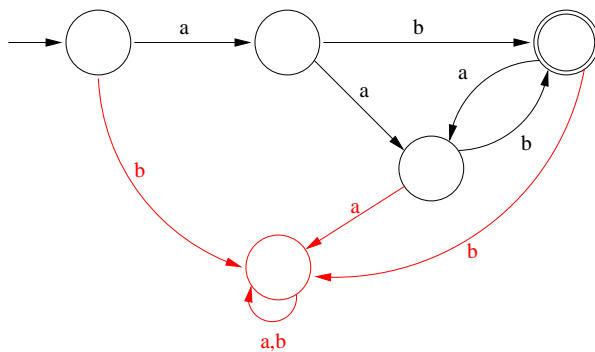
Date: 5/15/06

[Problem 1.]

[a.]

$\delta^*(q_0, aab) = \{q_2, q_3\}$

[b.]

[c.]

$S \to aA$
$A \to aB|bC$
$B \to bC$
$C \to aB$
$C \to \lambda$

[Problem 2.]

$(a + b)[(a + b)(a + b)]^*$

[Problem 3.]

[a.]

Prove that L is not regular using the pumping lemma. Given m, let $w = a^{m!}bbc^{2m!}$. w can be decomposed into xyz, such that $|xy| \leq m$ and $y \neq \lambda$. Thus, $y = a^k$, where $1 \leq k \leq m$ and xy^iz contains $m! + (i-1)k$ of a's. We want to pump the string i times so that $xy^iz \notin L$. When $i = \frac{m!}{k} + 1$, we get $a^{2m!}bbc^{2m!} \notin L$.

[b.]

$S \to aSc|bbC|bbbC|bbbbC$
$C \to c|cC$

[Problem 4.]

Yes. Since L_1 and L_2 are regular, by closure under union, intersection, and concatenation (Theorem 4.1), $(L_1 \cup L_2)(L_1 \cap L_2)$ is also regular.

[Problem 5.]

$u = a, Z; 111Z$
$v = \lambda, Z; Z$