CS 3530: Assignment 1d

Fall 2014

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Problems

Problem 1.60 (10 points)

Problem

Let $\Sigma = \{a, b\}$. For each $k \geq 1$, let C_k be the language consisting of all strings that contain an a exactly k places from the right-hand end. Thus $C_k = \Sigma^* a \Sigma^{k-1}$. Describe an NFA with $k + 1$ states that recognizes C_k, both in terms of a state diagram and a formal description.

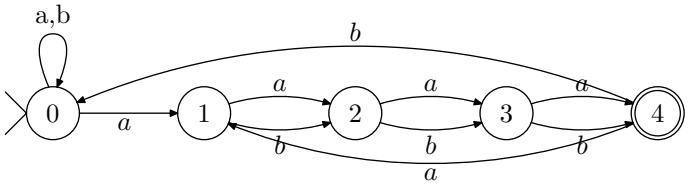
Solution Description

N = (Q, Σ, δ, q_0, F)
Q = {0, 1, ... , k}
Σ = {A, B}
q_0 = {0}
F = {k}
δ =

$\delta(q_k, A) = q_{k+1}$ for all k-1 > 0
$\delta(q_k, A) = q_1$ for k_{max}
$\delta(q_0, A) = q_0$

$\delta(q_k, B) = q_{k+1}$ for all k-1 > 1
$\delta(q_k, B) = q_0$ for k_{max}
$\delta(q_0, B) = q_0$

Solution Diagram



Problem 1.62 (10 points)

Problem

Let $\Sigma = \{a, b\}$. For each $k \geq 1$, let D_k be the language consisting of all strings that have at least one a among the last k symbols. Thus $D_k = \Sigma^* a(\Sigma \cup \varepsilon)^{k-1}$. Describe a DFA with at most $k + 1$ states that recognizes D_k, both in terms of a state diagram and a formal description.

Solution Description

D = (Q, Σ, δ, q_0, F)
Q = {0, 1, ... , k}
Σ = {A, B}
q_0 = {0}
F = $\{1, ..., k\}$
δ =

$\delta(q_k, A) = q_{k+1}$ for all k-1 > 0
$\delta(q_k, A) = q_k$ for k_{max}

$\delta(q_k, B) = q_{k+1}$ for all k-1 > 1
$\delta(q_k, B) = q_0$ for k_{max}
$\delta(q_0, B) = q_0$

Solution Diagram