CSE 105
THEORY OF COMPUTATION

Spring 2018 Exam 1review class

Today's learning goals

- Summarize key concepts, ideas, themes from Chapter 1.
- Approach your exam studying with confidence.
- Identify areas to focus on while studying for the exam.

Reminders

- Seat map & study guide on Piazza.
  - Review session tonight will go over practice questions.
- Please arrive early & put backpacks near front of room.
- Index card with handwritten notes ok.

Roadmap of examples

A. Regular language: design
B. Transforming machines
C. Proving nonregularity

Given L, prove it is regular

Construction

Strategy 1: Construct DFA

Strategy 2: Construct NFA

Strategy 3: Construct regular expression

Proof of correctness

WTS 1 if w is in L then w is accepted by ….

WTS 2 if w is not in L then w is rejected by …

L= { w in {0,1}* | w has exactly one 0 and an even number of 1s}

Regular expression:

NFA:

L= { w in {0,1}* | w has exactly one 0 and an even number of 1s}

DFA, directly:

DFA, via construction:

Alternate regular expressions?

A. (011)* U (101)* U (110)*
B. (11)*0(11)*
C. (ε U 1)(11)* 0 (ε U 1)(11)*
D. All of the above
E. None of the above

New model

Define a "TFA" given by a state diagram that has **at** most one outgoing arrow from each state labelled by each alphabet symbol. Formally, as (Q, Σ, R, q0, F) where R is a subset of Q x Σ x Q such that each pair of q in Q and x in Σ appear at most once in the first & second components of a tuple in R.

Claim: Any TFA is equivalent to a DFA

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Claim: Any TFA is equivalent to a DFA

Proof: Given (Q, Σ, R, q0, F), build

A. (Q, Σ, **δ**, q0, F) where **δ** maps (q,x) to q' if (q,x,q') is in R, and to q otherwise.
B. (Q, Σ, **δ**, q0, {q0}) where **δ** maps (q,x) to q' if (q,x,q') is in R, and to q0 otherwise.
C. (Q U { q_{new} }, Σ, **δ**, q0, {q_{new}}) where **δ** maps (q,x) to q' if (q,x,q') is in R, and to q_{new} otherwise (assuming q_{new} is not in Q)
D. (Q U { q_{new} }, Σ, **δ**, q0, F) where **δ** maps (q,x) to q' if (q,x,q') is in R, and to q_{new} otherwise (assuming q_{new} is not in Q)
E. None of the above

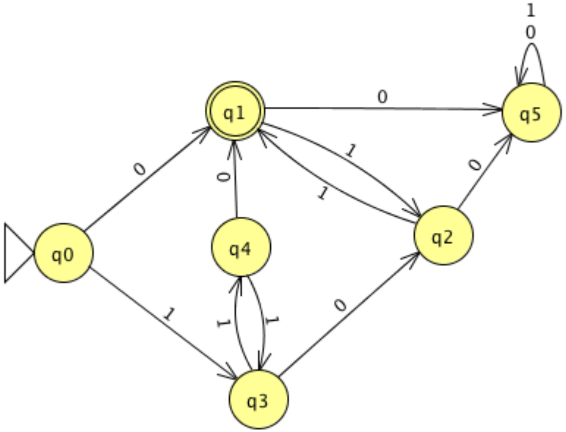
Claim: If L is regular, so is L^R

Claim: The set $\{0^j1^k \mid j,k \geq 0 \text{ and } k \geq j\}$ is not regular.

(Using) Pumping Lemma

Theorem: L = $\{0^j1^k \mid j,k \geq 0 \text{ and } k \geq j\}$ is not regular.

Proof (by contradiction): Assume, towards a contradiction, that L is regular. Then by the Pumping Lemma, there is a pumping length, p, for L. Choose s to be the string _________. The Pumping Lemma guarantees that s can be divided into parts s=xyz such that $|xy| \leq p$, $|y|>0$, and for any $i\geq 0$, xy^iz is in L. But, if we let i=_____, we get the string _______ which is not in L, a contradiction. Thus L is not regular.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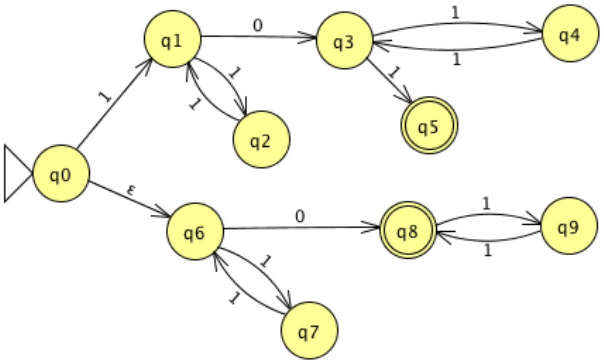
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