COMPSCI/SFWRENG 2FA3

Discrete Mathematics with Applications II

Winter 2020

Assignment 7

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Assignment 7 consists of two problems. You must write your solutions to the problems using LaTeX.

Please submit Assignment 7 as two files, `Assignment_7_YourMacID.tex` and `Assignment_7_YourMacID.pdf`, to the Assignment 7 folder on Avenue under Assessments/Assignments. *YourMacID* must be your personal MacID (written without capitalization). The `Assignment_7_YourMacID.tex` file is a copy of the LaTeX source file for this assignment (`Assignment_7.tex` found on Avenue under Contents/Assignments) with your solution entered after each problem. The `Assignment_7_YourMacID.pdf` is the PDF output produced by executing

```
pdflatex Assignment_7_YourMacID
```

This assignment is due **Sunday, March 15, 2020 before midnight.** You are allow to submit the assignment multiple times, but only the last submission will be marked. **Late submissions and files that are not named exactly as specified above will not be accepted!** It is suggested that you submit your preliminary `Assignment_7_YourMacID.tex` and `Assignment_7_YourMacID.pdf` files well before the deadline so that your mark is not zero if, e.g., your computer fails at 11:50 PM on March 15.

Although you are allowed to receive help from the instructional staff and other students, your submission must be your own work. Copying will be treated as academic dishonesty! If any of the ideas used in your submission were obtained from other students or sources outside of the lectures and tutorials, you must acknowledge where or from whom these ideas were obtained.

Problems

1. [**10 points**] Let Σ be the set of lower and uppercase letters in the Roman alphabet plus the hyphen symbol "-". Let a *simple English word* be a nonempty string $x \in \Sigma^*$ such that:

   a. An uppercase letter can only occur as the first symbol in x.

   b. A hyphen cannot occur as either the first or the last symbol in x.

   c. Two hyphens cannot occur in a row.

Write a regular expression that matches the set of simple English words (as defined above).

Jatin — Chowdhaj — March 15th, 2020

Put your regular expression here.

<div align="center">

* * *
Start Answer
* * *

</div>

The set of characters is the *Roman Alphabet*, uppercase and lowercase, and the hypen. I will be using the following sets:

- $a, b, c, d, ..., z$
  Note: This the set of lowercase letters from a to z. It will be abbreviated as: $a + ... + z$.

- $A, B, C, D, ..., Z$
  Note: This the set of uppercase letters from A to Z. It will be abbreviated as: $A + ... + Z$.

- $-$
  Note: This is a hypen, which will be represented as: "**-**".

- ϵ
  Note: This is epsilon and will be used to represent the empty string: """

Our language, Σ is defined as: $\Sigma = [a + ... + z + A + ... + Z + \text{"} - \text{"} + \epsilon]$

Also, I will be assuming that a word is any number of characters that is ≥ 1. This means that the letter a is a word.

Also, this goes without say, a single hyphen is not a word.

The regular expression is:
$(A + ... + Z + \epsilon)\big((a + ... + z)(\epsilon + \text{"} - \text{"})\big)^*(a + ... + z)^+$

<div align="center">

* * *
End Answer
* * *

</div>

2

2. [**10 points**] Construct an NFA (possibly with ϵ-transitions) that is equivalent to the regular expression
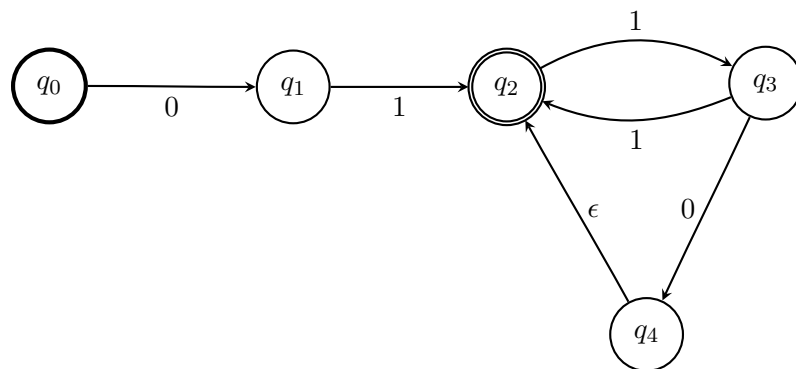
$$01((10)^* + 11)^*.$$

Present the NFA as both a transition table (with a column for ϵ transitions) and a transition diagram.

Jatin — Chowdhaj — March 15th, 2020
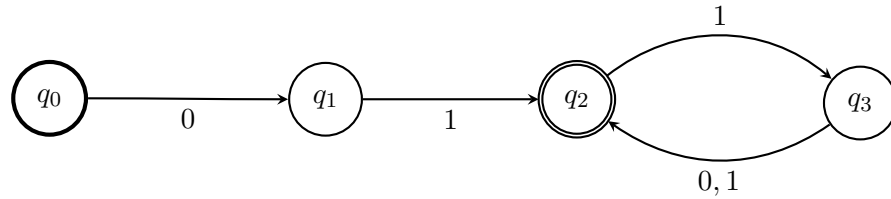
Put your transition diagram here.

Put your transition table here.

<div align="center">* * *</div>
<div align="center">**Start Answer**</div>
<div align="center">* * *</div>

	Σ	0	1	ϵ
	Q			
start $\to$	$q0$	$\{q1\}$	$\{\}$	$\{\}$
	$q1$	$\{\}$	$\{q2\}$	$\{\}$
final $\to$	$q2$	$\{\}$	$\{q3\}$	$\{\}$
	$q3$	$\{q4\}$	$\{q2\}$	$\{\}$
	$q4$	$\{\}$	$\{\}$	$\{q2\}$

Question #2 says, "possibly with ε-transitions". I don't know if that means I need to include another NFA with no ε-transitions. Nonetheless, here it is. They're both legit.

Σ Q	0	1
start → $q0$	$\{q1\}$	$\{\}$
$q1$	$\{\}$	$\{q2\}$
final → $q2$	$\{\}$	$\{q3\}$
$q3$	$\{q2\}$	$\{q2\}$

* * *
End Answer
* * *