

COMPSCI/SFWRENG 2FA3
Discrete Mathematics with Applications II
Winter 2020

Assignment 9

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Revised: March 21, 2020

Assignment 9 consists of two problems. You must write your solutions to the problems using LaTeX.

Please submit Assignment 9 as two files, `Assignment_9_YourMacID.tex` and `Assignment_9_YourMacID.pdf`, to the Assignment 9 folder on Avenue under Assessments/Assignments. *YourMacID* must be your personal MacID (written without capitalization). The `Assignment_9_YourMacID.tex` file is a copy of the LaTeX source file for this assignment (`Assignment_9.tex` found on Avenue under Contents/Assignments) with your solution entered after each problem. The `Assignment_9_YourMacID.pdf` is the PDF output produced by executing

```
pdflatex Assignment_9_YourMacID
```

This assignment is due **Sunday, March 29, 2020 before midnight**. You are allowed 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_9_YourMacID.tex` and `Assignment_9_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 29.

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] Construct a regular grammar that generates the language matched by the regular expression $(000^* + 111^*)^*$.

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Date: March 29, 2020

Let $G = (\{S, A, B\}, \{0, 1\}, P, S)$ be the regular grammar where P contains the following productions:

$S \rightarrow \epsilon \mid 00A \mid 11B$

$A \rightarrow 0A \mid \epsilon \mid E$

$B \rightarrow 1B \mid \epsilon \mid E$

2. [10 points] Let $\Sigma = \{a, b\}$ and $L = \{x \in \Sigma^* \mid x \neq \text{rev}(x)\}$. Construct a simple grammar for L as well as grammars in Chomsky and Greibach normal form for L .

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Simple Grammar:

Let $G = (\{S, A, B\}, \{a, b\}, P, S)$ be a simple grammar where P contains the following productions:

$S \rightarrow ab \mid ba \mid aEb \mid bEa \mid aSa \mid bSb$

$E \rightarrow aE \mid bE \mid a \mid b$

Chomsky Normal Form:

Let $G = (\{S, A, B, C, D, E, F, G\}, \{a, b\}, P, S)$ be a grammar in CNF form where P contains the following productions:

$S \rightarrow AB \mid BA \mid AC \mid BD \mid AF \mid BG$

$C \rightarrow CB$

$D \rightarrow DA$

$F \rightarrow SA$

$G \rightarrow SB$

$E \rightarrow AE \mid BE \mid A \mid B$

$A \rightarrow a$

$B \rightarrow b$

Greibach Normal Form:

Let $G = (\{S, A, B, E\}, \{a, b\}, P, S)$ be a grammar in GNF form where P contains the following productions:

$S \rightarrow aB \mid bA \mid aEB \mid bEA \mid aSA \mid bSB$

$E \rightarrow aE \mid bE \mid a \mid b$

$A \rightarrow a$

$B \rightarrow b$