

Formal Languages & Automata Theory

Quiz 2

March 25, 2019

Name: _____

Given the following grammar G_1 :

$$E \longrightarrow E + T \mid T$$

$$T \longrightarrow T \times F \mid F$$

$$F \longrightarrow (E) \mid a$$

1. Give the parse tree for G_1 for:

$$a + a$$

2. Give the parse tree for G_1 for:

$$((a))$$

3. Given grammar G_2

$$\begin{aligned}R &\longrightarrow XRX \mid S \\S &\longrightarrow aTb \mid bTa \\T &\longrightarrow XTX \mid X \mid \varepsilon \\X &\longrightarrow a \mid b\end{aligned}$$

- a. What are the variables of G_2 ?
- b. What are the terminals of G_2 ?
- c. What is the start variable of G_2 ?
- d. Give three strings in G_2 .

4. Give one leftmost derivation of G_2 .

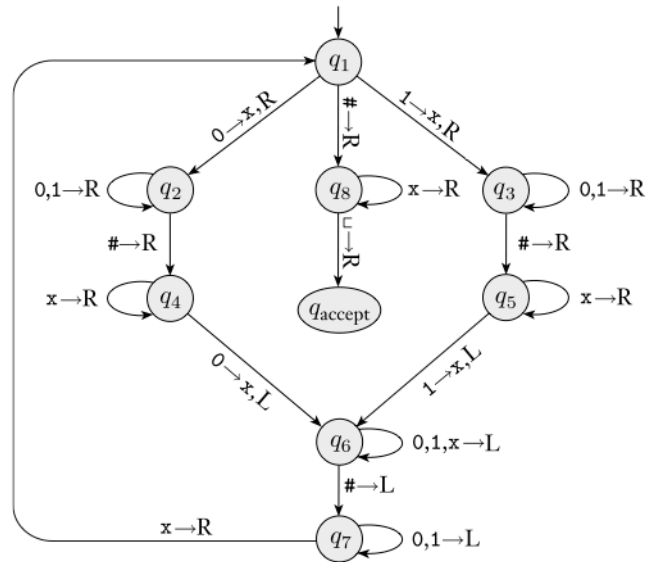
5. Choose the letter which sorts the classes of languages from the smallest to the largest class:

- a. Regular Languages, Context-Free Languages, Decidable Languages, Turing-Recognizable Languages
- b. Regular Languages, Context-Free Languages, Turing-Recognizable Languages, Decidable Languages
- c. Context-Free Languages, Regular Languages, Turing-Recognizable Languages, Decidable Languages
- d. Context-Free Languages, Regular Languages, Decidable Languages, Turing-Recognizable Languages
- e. Decidable Languages, Turing-Recognizable Languages, Context-Free Languages, Regular Languages

6. Which statement about the recognition power of various Turing Machine variants is true? Read all answers before choosing.
- a. the standard Turing Machine recognizes more languages than the other variants
 - b. a multi-tape Turing Machine recognizes more languages than the other variants
 - c. a non-deterministic Turing Machine recognizes more languages than the other variants
 - d. multi-tape Turing machines **and** deterministic recognize more languages than the standard Turing Machine
 - e. **All** of the above Turing Machine variants recognize the same class of languages
7. (2 pts) Draw the state diagram for a PDA that recognizes the following language:

$$A = \{ww^R | w \in \{0, 1\}^*\}$$

8. (2 Points) Given the following Turing Machine:

Figure 1: Turing Machine T_1

If the machine has a configuration of:

 $q_1 01 \# 01$

List the next four configurations of T_1 :