



# National University of Modern Languages, Islamabad

Faculty of Engineering and Computer Science

Department of Computer Science

## Second Assignment

BS CS (6) Morning/Evening Fall-2022

Automata Theory

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Assignment Submission Date: 12-10-2022

Points: 10

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Instruction:

- Copied from any source leads to zero marks
- Hand written assignment is required.

1. For each of the following grammars and strings:

[5 points]

- $S \rightarrow + S S \mid * S S \mid \mathbf{a}$  with string  $+*aaa$ .
- $S \rightarrow S ( S ) S \mid \epsilon$  with string  $(( ))$ .
- $S \rightarrow S + S \mid SS \mid (S) \mid S^* \mid \mathbf{a}$  with string  $(a+a)*a$ .
- $S \rightarrow (L) \mid \mathbf{a}$  and  $L \rightarrow L, S \mid S$  with string  $((a, a), a, (a))$ .

Answer the following questions:

- Give a leftmost derivation for the string.
  - Give a rightmost derivation for the string.
  - Give a parse tree for the string.
  - Is the grammar ambiguous or unambiguous? Justify your answer.
  - Describe the language generated by this grammar.
2. Consider the grammar  $S \rightarrow aS \mid aSbS \mid \epsilon$ . Describe (in English) the language generated by this grammar? Show that the grammar is ambiguous. [3 Points]
3. Design CFG for the following language: [2 Points]
- The set of all strings of 0s and 1s in which 011 does not appear as a substring.