

Department of Computer Science & IT
The Islamia University of Bahawalpur

MCS – 3rd - Final Term

Final term – 12 June 2017

Teacher: Dr. Nadeem Akhtar

Subject: Theory of Automata and Formal Languages (CSIT-21304)

Time: 90 min.

(Marks: 50)

Q1. Short questions

- a) Differentiate between Regular Language and Context-Free Language. Give examples.
- b) Define Push-Down Automata (PDA).
- c) Construct CFG for the language: $\{0^n@1^n \mid n \geq 0\} \cup \{1^n@0^n \mid n \geq 0\}$. Derive the string 1111@0000 from the constructed CFG.
- d) Construct Context Free Grammar representing the following regular expressions: ab^*a

(5 + 5 + 5 + 5 = 20)

Q2. Consider the following Context-Free Grammar

$\langle \text{EXPR} \rangle \rightarrow \langle \text{EXPR} \rangle + \langle \text{TERM} \rangle \mid \langle \text{TERM} \rangle$
 $\langle \text{TERM} \rangle \rightarrow \langle \text{TERM} \rangle \times \langle \text{FACTOR} \rangle \mid \langle \text{TERM} \rangle / \langle \text{FACTOR} \rangle \mid \langle \text{FACTOR} \rangle$
 $\langle \text{FACTOR} \rangle \rightarrow (\langle \text{EXPR} \rangle) \mid a \mid b$

Formally describe the above grammar.

Using the above grammar construct parse trees of the following expressions:

- (1) $a / (a + b)$
- (2) $(b + a) + (b / a \times a)$

(5 + 5 = 10)

Q3. Describe the languages denoted by the following Regular expressions. Construct Finite Automata for the following language

(Note: The alphabet $\Sigma = \{0, 1\}$)

- a) $(0 \cup 10 \cup 11) \Sigma^*$
- b) $1^*(01^+ \cup 11)^*$
- c) $0\Sigma^*0 \cup 1\Sigma^*1 \cup 0 \cup 1$

(3 + 3.5 + 3.5 = 10)

Q4. Consider the language:

$\{b^n a^n \mid n \geq 0\}$

- a) Construct a Push-Down Automata that recognizes the above language.
- b) Formally describe the constructed Push-Down Automata.

(5 + 5 = 10)