



National University of Modern Languages, Islamabad

Faculty of Engineering and Computer Science

Department of Computer Science

Third Assignment

BS CS (6) Morning/Evening Fall-2022

Automata Theory

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Points: 10

Instruction:

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

QNO1. Let $\Sigma = \{ \text{int}, +, *, (,) \}$ and consider the language $\text{ARITH} = \{ w \in \Sigma^* \mid w \text{ is a legal arithmetic expression} \}$

QNO2. Consider the pushdown automaton

$$M = (K, \Sigma, \Gamma, \Delta, s, F)$$

where

$$K = \{s, f\},$$

$$F = \{f\},$$

$$\Sigma = \{0, 1\},$$

$$\Gamma = \{0\},$$

$$\Delta = \{((s, 0, \epsilon), (s, 0)), ((s, 1, \epsilon), (s, 0)), ((s, 1, \epsilon), (f, \epsilon)), ((f, 0, 0), (f, \epsilon)), ((f, 1, 0), (f, \epsilon))\}.$$

- Draw Pushdown Automata
 - Trace all possible sequences of transitions of M on input 010.
 - Show that $010, 00, 011 \notin L(M)$, but $100, 101, 10000 \in L(M)$.
 - Describe $L(M)$ in English
- QNO3. Construct pushdown automata that accept each of the following:
- $L = \{w \in \{0, 1\}^* : w \text{ has twice as many 0's as 1's}\}.$
 - $L = \{uawb : u \text{ and } w \in \{0, 1\}^* \text{ and } |u| = |w|\}$

QNO4. Consider the following language:

$$L = \{0^m 1^n : m \leq n \leq 2m\}.$$

- Draw CFG the language
- Construct the PDA.

QNO5. Consider the following language:

- Construct a TM machine for checking the palindrome of the string of odd length.
- Construct TM for the addition function for the unary number system
- Construct a TM for subtraction of two unary numbers $f(a-b) = c$ where a is always greater than b .