University of Central Punjab
Theory of Automata
Spring 2023 – Midterm
All Sections

Allowed Time: 90 minutes
Note: Manage your time during solution of Questions. Total Questions are 5

Problem 1: (2,8)

a. Give at least 6 strings in ascending order of string length of the following language
b. Design a DFA of the following language.

$$L = \{w \in \{a,b\}^* \mid w \text{ contains the substring aba and bb not necessarily together}\}$$

Problem 2: (5+5)
Design an NFA of the following language with at most 4 states

a. Design NFA without NULL transition of the following language with at most 4 states

$$0(101 + 10)^*$$

b. Design an NFA of the following language with at most 4 states

$$L = \{w \in \{0,1\}^* \mid w \text{ starts with } 01 \text{ or } 10 \text{ but does not end at } 11\}$$

Problem 3: (10)
Covert the following NFA into DFA. (Start State 1 and Final State 3)

	δ(q,a)	δ(q,b)
→1	{1,2,3,4,5}	{4,5}
2	{3}	{5}
3*	Φ	{2}
4	{5}	{4}
5	Φ	Φ

Problem 4: (4,6)

	δ(q,a)	δ(q,b)	δ(q,ϵ)
→ 1	{1}	Φ	{2,4}
2	{3}	{5}	Φ
3	Φ	{2}	Φ
4	{4,5}	Φ	Φ
5*	Φ	Φ	{1}

Consider the above Finite Automata answer the following. Start State is 1 and Final State is 5.

a) Compute ϵ-Closure (NULL CLOSURE) of all states
b) Draw tree of string babab.

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Problem 5: (5 + 5)

a. Give the Regular Expression of the language with set of strings that contains odd number of 0's or odd number 1's.
b. Give a Regular Expression of the language which contains substrings either aa or aba or both but ends at b.