Question Paper

Exam Date & Time: 04-Jul-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEMESTER B.TECH. DEGREE EXAMINATIONS - JUNE/JULY 2023
SUBJECT: CSE 2254/CSE-2254 - FORMAL LANGUAGES AND AUTOMATA THEORY
(COMPUTER SCIENCE AND ENGINEERING - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING / COMPUTER SCIENCE / COMPUTER SCIENCE AND ENGINEERING - CYBER SECURITY)
(MAKEUP)

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

1A)	Design a deterministic and non-deterministic finite automaton (dfa and nfa) which accept a string containing "ion" at the end of a string in a string of {a-z}, e.g., "imagination" but not "image". Mention the quintuple representation of both dfa and nfa you designed.	(4)
1B)	Consider the language L={$(10)^n$: n≥0}. Prove that Deterministic Finite Automata (DFA) is equivalent to non-Deterministic Finite Automata (NFA) on the language L.	(4)
1C)	The language, L={$a^n b^n c^n$: n≥1} is a context sensitive language. Design context sensitive grammar for the language.	(2)
2A)	The Grammar G, with productions. S → S_1B, S_1 → aS_1b, bB → bbbB, aS_1b → aa, B →λ Identify whether this is unrestricted grammar or not. Supplement your answer with proper technical justifications.	(2)
2B)	Generate the regular expressions for the sets given below. i) {a^n: n is divisible by 2 or 3 or n=5} ii) {a^2. a^5, a^8, . . .} iii) The set of all strings on {a,b} terminated by either 'a' or 'abb'	(3)
2C)	Identify the languages given below is regular or not and support your answer with proper justifications. i) L= {$a^n b^m c^k$: n, m, k≥0} ii) L={$a^i b^{2j}$: i, j ≥0} iii) L= {a^n: n is prime} iv) L= {www^R: w∈{a,b}* } v) L= {a^n: n≥100}	(5)
3A)	Check whether the grammar S→aSbS | bSaS | λ is ambiguous or not for the sentence "abab" , by deriving two distinct parse trees.	(3)
3B)	Simplify the Grammar given below and convert to Chomsky Normal Form S→aBBa |aB| aD|CC B→aBD|D|λ	(3)

$C \rightarrow aCC|bCC$
$D \rightarrow ab|cd|B$.

3C)	Show that language $L=\{a^n b^n c^n \mid n>=1\}$ is not CFG using pumping lemma.	(4)
4A)	Construct a PDA for the CFG G= ({S, A, B}, {0,1}, S, {$S \rightarrow 0A$, $A \rightarrow 0AB|1$, $B \rightarrow 1$}) and show the sequence of moves for the string "000111".	(3)
4B)	Construct NPDA for the language $L=\{w \in \{a,b\}^* : n_a(w) = n_b(w)\}$.	(3)
4C)	Construct DPDA for the language $L= \{a^n b^{2n} c^n d^{2n} \mid n>=1\}$.	(4)
5A)	Design a Turing Machine using the state transition diagram to reverse a given sring w {0,1}+ such that the input tape will contains final state followed by reversed string.	(4)
5B)	Design a Transducer using state transition diagram to compute the sum or differenc of two positive integers, X and Y. The integers are represented in the Turing machine with equal number of 1's separated by 0.	(4)
5C)	Construct a Grammar to generate a language $L= \{a^n b^n c^m \mid n,m \geq 1\}$.	(2)

-----End-----