Question Paper

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.   (2)
$S \rightarrow S_1 B$,
$S_1 \rightarrow aS_1 b$,
$bB \rightarrow bbbB$,
$aS_1 b \rightarrow aa$,
$B \rightarrow \lambda$
Identify whether this is unrestricted grammar or not. Supplement your answer with proper technical justifications.

2B) Generate the regular expressions for the sets given below.   (3)
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'

2C) Identify the languages given below is regular or not and support your answer with proper justifications.   (5)
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}

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   (3)
S→aBBa |aB| aD|CC
B→aBD|D|λ

C → aCC|bCC
D → ab |cd |B.

3C) Show that language L={$a^nb^nc^n$ | n>=1} is not CFG using pumping lemma. (4)

4A) Construct a PDA for the CFG G= ({S, A, B}, {0,1}, S, {S→0A, A→0AB |1, B→1}) and show the sequence of moves for the string "000111". (3)

4B) Construct NPDA for the language L={wЄ {a,b}* :n_a(w) =n_b(w)}. (3)

4C) Construct DPDA for the language L= {a^nb^{2n} c^nd^{2n} | 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= {$a^nb^nc^m$|n,m≥1}. (2)

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