NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI – 620015
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.Tech (CSE) - Cycle Test 2 – January – May 2024
CSPC41– Formal languages and Automata Theory

Semester: IV **Max Marks: 20**
Curriculum: NITTUGCSE21 **Time: 1 hour**
Date of Exam: 3rd April 2024

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1. Check whether the following Grammar is ambiguous or not. (2)

   $S \rightarrow wSS$
   $S \rightarrow a$
   $S \rightarrow b$

   Where 'w' is some string over {a,b} and S is the start symbol.

2. Convert the following grammar to Chomsky Normal form where S is the start symbol. (CO2)

   (4)

   $S \rightarrow aSASb \mid Saa \mid AA$
   $A \rightarrow caA \mid Ac \mid \varepsilon$
   $B \rightarrow bca$

3. Define a Context free grammar for the following language: (CO2) (2)
   - $L = \{a^n b^m \mid n,m \geq 1, n \neq m\}$
   - The set of odd length strings over {a,b}* with middle symbol 1

4. Show that if L is a CFL and $\varepsilon \notin L$, then there is a PDA M accepting L by final state such that M has at most two states and makes no ε moves. (CO5) (2)

5. Define a DPDA. Design a DPDA that accepts by final state for the following language. (CO2) (5)

   $\{a^n b^m c^{m+n} \mid m, n > 0\}$

6. Design a Turing machine for the following:
   - $L = \{a^n b^{2n} \mid n, \geq 1\}$ (2)
   - To reverse a string 'w'. Example: The tape contains #w# and the output should be $\#w^R\#$, where w – {a,b}* (3)

--- Best Wishes ---