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Automata Theory and Computability
Quiz 2 (2024)

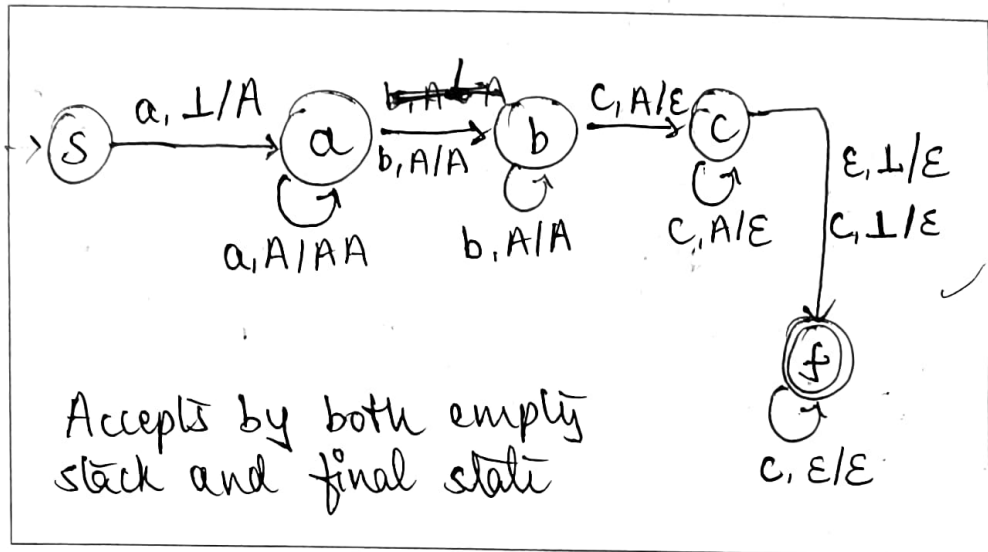
Time: 30 minutes. Total marks 25.

Instructions: Write your answers neatly and to the point in the space provided below each question. If necessary write your answers in rough first. Do not attach rough sheets.

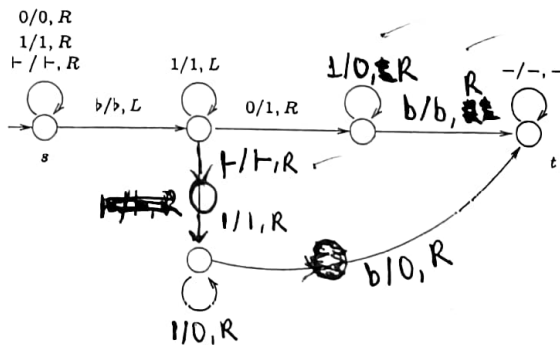
1. Give the diagrammatic representation of a PDA that accepts the language $\{a^l b^m c^n \mid 1 \leq l \leq n \text{ and } 0 \leq m\}$. (10)

You reject
aaBcc?

8
8



2. The Turing machine below is meant to compute the next string in lexicographic ordering. Thus, given a binary string $w \in \{0,1\}^*$, it outputs the succeeding string in the lexicographic ordering. Recall that in lexicographic ordering strings of length i appear before strings of length $i+1$, and all strings of same length are ordered by the usual dictionary ordering. For example given the string "11011" as input, the Turing machine should halt in state 't' with the string "11100" on its tape. Complete the description of the TM below by adding transitions where required. (10)



8

lex
1111 → 10000
not 11000!

3. If a language L over the alphabet $\{a, b\}$ is recursive, what can you say about its complement (i.e. $\{a, b\}^* - L$)? Justify your answer. (5)

5
If a language is recursive, we have a Turing machine that halts on all its inputs. It accepts for strings in L and rejects otherwise. ✓

The complement of L is also recursive. We use the same Turing machine but ~~it~~ exchange its accept & reject states. Now every string not in L (i.e. in L^c) is accepted. ✓ or -