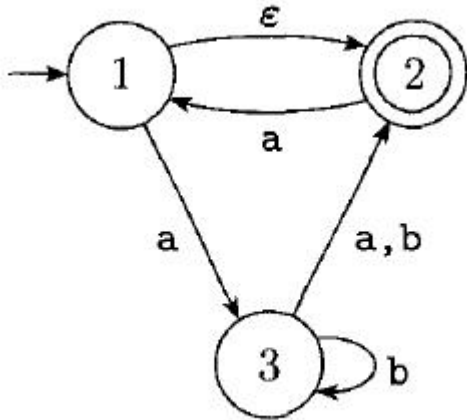


Exam

Introduction to Theory of Computation

1. Convert the following non-deterministic FA into a deterministic FA.



2. Use the Pumping Lemma to show that the following language is not regular: $A = \{www : w \in \{0,1\}^*\}$

3. Convert the following CFG into its Chomsky Normal form:
- $$A \rightarrow BAB \mid B \mid \varepsilon$$
- $$B \rightarrow 00 \mid \varepsilon$$

4. (1) Give **implementation-level** description of Turing machines that decides the following language over the alphabet $\{0,1\}$: $\{w : w \text{ contains twice as many 0's as 1's}\}$.
(2) What is the difference between Turing-recognizability and decidability? Give one example which is Turing-recognizable but not decidable?

5. (1) Give the definitions of the three classes P, NP and NP-completeness;
(2) Describe the containment relationships among these three classes and briefly justify these relationships;
(3) Provide at least three problems that are in P;
(4) Provide at least three problems that are NP-complete.