

Practice for the CS456 Final Examination: Part III

1. Let L be any \mathcal{NP} -complete language. Prove that there is an algorithm for deciding the membership problem for L which has polynomial space complexity.
2. Enumeration questions.
 - (i) Prove that every recursive language can be enumerated in canonical order by some machine.
 - (ii) Prove that every language that can be enumerated in canonical order by some machine is recursive.
 - (iii) Prove that every language accepted by a machine is recursively enumerable.
 - (iv) Prove that every recursively enumerable language is accepted by some machine.
3. DCFL questions.
 - (i) Give two deterministic context-free languages whose union is not a DCFL.
 - (ii) Give two deterministic context-free languages whose intersection is not a DCFL.
4. \mathcal{P} \mathcal{NP} questions.
 - (i) Give two \mathcal{NP} -complete languages whose intersection is known to be \mathcal{P} .
 - (ii) Give two \mathcal{NP} -complete languages whose union is known to be \mathcal{P} .
5. Let \mathcal{N} be the natural numbers, that is, the positive integers. Define a function $f : \mathcal{N} \rightarrow \mathcal{N}$ which is not recursive.