Computational Complexity
Exam (Theory Test)
5.02.2020

.....
your name & index number

For each question, give answer: YES, NO, or NOT KNOWN. The third possibility means that the current state of knowledge allows for both possibilities. Correct answer gives 1 pt, incorrect answer gives -0.5 pt.

1. Does there exist an undecidable language L and a deterministic Turing machine that (in an infinite loop) outputs all words from L?

   .....
2. Is there an algorithm that given a Turing machine M and a number $k \in \mathbb{N}$ answers whether for every input the machine M stops after at most k steps?

   .....
3. Is there an NP-complete (w.r.t. polynomial-time reductions) language containing only finitely many words?

   .....
4. Does SAT $\in$ coNP?

   .....
5. Is NTIME(n^2) closed under logarithmic-space reductions?

   .....
6. Is L closed under polynomial-time reductions?

   .....
7. Is it true that either P = NP, or there is a language $L \in \mathsf{NP} \setminus \mathsf{P}$ that is not NP-complete?

   .....
8. Is it true that if P = PSPACE then EXPTIME = EXPSPACE?

   .....
9. Does $\mathsf{AC}^0 = \mathsf{AC}^5$?

   .....
10. Does QBF $\in$ uniform-NC^1 (where QBF = "quantified Boolean formula")?

    .....
11. Does P/poly $\subseteq$ PSPACE?

    .....
12. Is RP closed under polynomial-time reductions?

    .....
13. Does BPP $\cap$ coBPP $\subseteq$ NP?

    .....
14. Current best polynomial approximation algorithm for VERTEX-COVER gives 2-approximation. Does there exist a PTAS (polynomial time approximation scheme) for VERTEX-COVER?

    .....
15. Current best algorithm for k-clique works in $O(n^{0.8k})$ time. Is k-clique (with parameter k) in **FPT**?

    .....
16. Does NPSPACE $\cap$ coNPSPACE = IP?

    .....