

FIRST OPEN TIME EXAMINATION

CS301

Full marks – 10

6th October, 2013

General Instructions

- Kindly invest an honest effort in writing the proofs. Remember that the onus is on you to convince other's of your proof.
- Kindly be honest with yourself.
- DON'T PANIC.

Academic Instructions

- Each question carries 10 marks.
 - You are required to answer one question only. Anything more will amount to bonus.
 - Whatever be the complexity class, you can use the *Karp* reduction.
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1. (Arora Barak, 2.30) A language is called *unary* if every string in it is of the form 1^i (the string of i ones) for some $i > 0$. Show that if there exists an NP-complete unary language then $P=NP$.

Hint: *If there is a n^c time reduction from 3SAT to a unary language L , then this reduction can only map size n instances of 3SAT to some string of the form 1^i where $i \leq n^c$. Use this observation to obtain a polynomial-time algorithm for SAT using the downward self reducibility argument.*

2. (Arora Barak, 2.32) Prove that if every *unary* NP-language is in P then $EXP=NEXP$.