

MID SEMESTER EXAMINATION
CS301

Full marks – 32

26th October, 2013

Instructions

DON'T PANIC.

1. (2 marks) Copy the following text at the very beginning of your answer script and sign below it.

I PROMISE NOT TO COMMIT ANY ACADEMIC DISHONESTY.

2. (10 marks) Prove that 2SAT is in the complexity class P i.e., given any expression in 2CNF, you can decide whether it has a satisfying assignment in polynomial time.
3. (10 marks) Let $S, T : \mathbb{N} \rightarrow \mathbb{N}$ be two time-constructible functions. If

$$S^2(n) = o(T(n)),$$

then prove that

$$\text{DTIME}(S(n)) \subsetneq \text{DTIME}(T(n)).$$

4. (10 marks) Assuming $P \neq NP$, prove that there exists a language which is in $NP \setminus P$ and not NP-complete.
5. (10 marks (bonus)) Prove that the following language is not a candidate for the previous question

$$\left\{ \Psi 01^{|\Psi|^{|\Psi|}} \mid \Psi \in \text{SAT} \right\}.$$