

FIRST OPEN TIME EXAMINATION

CS301

Full marks – 30

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.
- The questions are simple enough. So kindly be honest with yourself
- DON'T PANIC.

Academic Instructions

- Each question carries 10 marks.
 - All questions are compulsory. Bonus questions will be coming in the future sessions.
 - Whatever be the complexity class, you can use the *Karp* reduction.
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1. Given that $S : \mathbb{N} \rightarrow \mathbb{N}$ is a *polynomial*, construct a language that is $\text{DTIME}(S(n))$ -Complete.
2. Prove that the following language is NP-complete –
DOUBLE – SAT = $\{ \Psi \mid \Psi \text{ is a Boolean formula with at least two satisfying assignments} \}$.
3. Let us define the complexity class DP by

$$\text{DP} = \{ L \mid \exists M, N \in \text{NP} \text{ such that } L = M \setminus N \}.$$

Show that C , defined as,

$$C = \{ \langle G_1, k_1, G_2, k_2 \rangle \mid G_1 \text{ has a } k_1\text{-clique and } G_2 \text{ does not have any } k_2\text{-clique} \}$$

is DP-Complete.