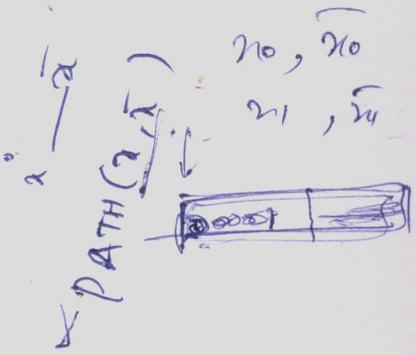

Midsem : CC2019

28 Feb 2019

Instruction

Answer as much as you can. Maximum you can score is 100. All questions carry equal marks.

1 Problems

1. A language is unary if every string in it of the form 1^i for some integer i. Show that if any unary language is NP-complete, then P=NP.
2. Suppose that $L_1, L_2 \in NP \cap coNP$. Define the following language $L_1 \oplus L_2 = \{x : x \text{ is in exactly in } L_1 or L_2\}$. Show that $L_1 \oplus L_2$ is in $NP \cap coNP$.
3. Prove that $DSAPCE(n) \neq NP$ [1].
4. Show that $2SAT$ is in NL.
5. Show that if $3SAT \leq_p \overline{3SAT}$, then $PH = NP$.
6. A language L is SPARSE if there exist a polynomial p such that for each n, the number of strings of length n in L is at most $p(n)$. Argue that $L \in P/poly$.

[1] Hint: Use padding argument. Although we do not know whether one is contained in the other.