Quiz 8

$SPACE(s(n)) = \{L : \text{There is a TM that decides } L \text{ in space} \leq O(s(n))\}$.

$NSPACE(s(n)) = \{L : \text{There is an NTM that decides } L \text{ in space} \leq O(s(n))\}$.

(1) Show that the following language is PSPACE-hard.

$SPACETMSAT = \{\langle M, w, 1^s \rangle : M \text{ is a decider that accepts } w \text{ and } M \text{ requires space} \leq s\}$.

Is it in PSPACE? [5+3]

(2) Recall that $NL = NSPACE(\log n)$.

Show that $NL \subseteq P$. [4]

(3) Define $coNPSPACE = \{L : L^c \in NPSPACE\}$.

Show that $PSPACE = NPSPACE = coNPSPACE$ [5+3]

$PSPACE = \bigcup_{k \in \mathbb{N}} SPACE(n^k)$ $\quad$ $NPSPACE = \bigcup_{k \in \mathbb{N}} NSPACE(n^k)$.