

# COMP531 - Assignment 1

Due January 27th

## Question 1

Show that if  $L$  is recognized by a TM that is  $O(S(n))$  space bounded with  $S(n) \geq \log(n)$  (which does not necessarily halt), then we can assume that  $L$  is recognized by a TM of space complexity  $S(n)$  that always halts.

## Question 2

Show that the language  $L = \{a^n b^n : n \geq 0\}$  can be recognized on a single tape machine in time  $O(n \log n)$ . Show that for one tape this is the best possible.

## Question 3

Show that any language recognized by a TM in space  $o(\log \log(n))$  must be regular.

## Question 4

Find a non-regular language that you can recognize in  $DSPACE(\log \log(n))$

## Question 5

In the context of the proof that there is no optimal time bound, we used the assumption that you can pad the encoding of a TM with an arbitrary number of 1's. Explain why you need this assumption, and where it is used in the proof.