CS5230
Tutorial 4

1. Show that $DTIME(2^{n^2})$ is a proper superset of $DSPACE(n)$.

2. Show that DTIME(2^n) is a proper subset of DTIME($2^n * \lceil (n)^{2/3} \rceil$).

3. Show Gap theorem for deterministic space and non-deterministic time/space. Please try to do it as a corollary of theorems done in class, rather than re-proving it using the technique for gap theorem for time.

4. Suppose $\mathbf{M}$ is a deterministic one-tape TM which accepts $\{wcw^R : w \in \{a,b\}^*\}$. Then show that $\mathbf{M}$ is $\Omega(n^2)$ time bounded (Note that for time-bounded TMs, one-tape TM means that the only tape is the input tape, which is readable/writable). Here w^R denotes the reverse of string w.

   Hint: Consider the behaviour of $\mathbf{M}$ on inputs of the form $wa^mca^mw^R$, where w is of length m. Consider the crossing sequences of the machine in the portion a^mc. [Here, ignore the content of the tape, and just consider the states of the TM in the crossing sequence]. Divide in two appropriate cases based on whether for some w of length m the crossing sequence are all "large".