

## CS281 Spring 2011: Homework 4

Due Friday, May 13th

1. **(10 points)**

Using the Padding Lemma show that

$$NSpace(n^8) \subsetneq NSpace(n^9)$$

2. **(10 Points)**

Suppose there is an NP Complete problem that takes time  $O(n^{\log_2 n})$ . Note that this function lies between the polynomials and the exponentials, and is in neither class of functions. What could we say about the running time of any problem in  $\mathcal{NP}$ ?

3. **(20 Points)**

Show that the class of languages  $\mathcal{P}$  is closed under the following operations:

- a) Reversal
- b) Concatenation
- c) Kleene Star
- d) Complementation

**Note.** The operations are defined in previous homeworks.