Exercises for Computability and Complexity, Spring 2019, Sheet 2

Please return in class on Tuesday Feb 19

Exercise 1 Show that $L = \{w \in \{1\}^* \mid |w| \text{ is a power of } 2\} \in \mathbf{TIME}(O(n \log n))$, by describing in words (and maybe sketches of interesting configurations) a TM (with possibly several tapes) that does this job.

Exercise 2 (a) Are the functions $f(n) = \exp(n)$ and $g(n) = \exp(2n)$ polynomially related? **(b)** What about $f(n) = \exp(n)$ and $g(n) = \exp(n2)$? Prove your answers.

Challenge problem (***optional***) Let $\Sigma_n = \{1,..., n\}$ and $L_n = \{12...n\}$ (i.e. the language that contains only the word 12...n). Prove or disprove: a single-tape TM deciding L_n must have at least n states.