9.1 Show that addition of two n-bit numbers is in AC^0.

9.2 Show that multiplication of two n-bit numbers is in AC^1.

9.3 Show that multiplication of two n-bit numbers is in NC^1.

9.4 The majority function of n bits outputs 1 iff at least half of its inputs are equal to 1. Show that the majority function is in NC^1.

9.5 The input to the bit sorting problem is a sequence $x_1, \ldots, x_n$. where each $x_i \in \{0,1\}$. The goal is to output the same bits in the sorted order. Show that this problem is in NC^1.

Problems for homework **Due: December 4, 2018**

9.6 The function $\mathrm{IP}(x,y)$ computes the inner product of vectors $x, y \in \{0,1\}^n$ over the field $\mathbb{F}_2$. Show that $\mathrm{IP} \in \mathsf{NC}^1$.

9.7 The function $\mathrm{GT}(x,y)$ for $x, y \in \{0,1\}^n$ is equal to 1 iff $x \geq y$ (x and y are considered as integers in binary representation). Show that $\mathrm{GT} \in \mathsf{AC}^0$.

9.8 Extra The input to the sorting problem is a sequence $a_1, \ldots, a_n$. where each $a_i \in \{0,1\}^n$ is considered as an integer in binary representation. The goal is to output the same bits in the sorted order. Show that this problem is in NC^1.