1. Exercise 7.4 in text.
2. Exercise 7.5 in text.
3. Exercise 7.11 in text.
4. Recall that for a positive integer $n$, $\text{len}(n)$ denotes the length of $n$ written as a binary string (with no leading zeros).
   Let $n_1, \ldots, n_k$ be positive integers. Show that
   
   \[
   \sum_{i=1}^{k} \text{len}(n_i) - k \leq \text{len}\left(\prod_{i=1}^{k} n_i\right) \leq \sum_{i=1}^{k} \text{len}(n_i).
   \]

5. Assume that positive integers $a$ and $b$ can be multiplied in time $O(\text{len}(a)\text{len}(b))$. Design and analyze an algorithm that takes as input positive integers $n_1, \ldots, n_k$, with each $n_i > 1$, and computes the product $n := \prod_{i=1}^{k} n_i$ in time $O(\text{len}(n)^2)$.

6. Show that given a prime $p$, an element $\alpha \in \mathbb{Z}_p$, and an exponent $e \geq p$, we can compute $\alpha^e \in \mathbb{Z}_p$ in time $O(\text{len}(e)\text{len}(p) + \text{len}(p)^3)$.
   For this problem, you may use any algorithms and running time estimates discussed in class.