1. The input is $d$ sequences of elements such that each sequence is already sorted, and there is a total of $n$ elements. Design an $O(n \log d)$ algorithm to merge all the sequences into one sorted sequence.

2. Let $G = (V,E)$ be a connected weighted undirected graph, and let $T$ be an MCST of $G$. Suppose that we now add a new vertex $v$ to $G$, together with weighted edges from $v$ to vertices of $G$. Design a linear-time algorithm to find a new MCST that includes $v$.

3. You are given a collection of $n$ bolts of different widths and $n$ corresponding nuts. You are allowed to try a nut and bolt together, from which you can determine whether the nut is larger than the bolt, smaller than the bolt, or matches the bolt exactly. However there is no way to compare two nuts together or two bolts together. The problem is to match each bolt to its nut. Design an algorithm for this problem with average case efficiency of $\Theta(n \log n)$.

4. Determine the complexity of a recursive algorithm whose running time is given by $T(n) = T(n-1) + b*n$ and $T(1) = c$;