Problem 1. Is Insertion sort stable? Why or why not?

Problem 2. Design a strategy that makes any sorting algorithm stable. How much additional time, asymptotically, does it add to the algorithm?

Problem 3. Design an algorithm to sort $n$ integers in the range 0 to $n^3 - 1$ in linear time.

Problem 4. We are given $n$ points in the unit circle, $p_i = (x_i, y_i)$, such that $0 < x_i^2 + y_i^2 \leq 1$ for $i = 1, 2, \ldots, n$. Suppose that the points are uniformly distributed; that is, the probability of finding a point in any region of the circle is proportional to the area of that region. Design an algorithm with an average-case running time of $\theta(n)$ to sort the $n$ points by their distances $d_i = \sqrt{x_i^2 + y_i^2}$ from the origin.