

HOMEWORK 1 – Q2

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2. Suppose that you bought a bag of n bolts with nuts screwed on them. Your 5 year old nephew unscrewed all the nuts from the bolts and put both the nuts and the bolts back into the bag. The bolts are all of similar quite large size but are actually of meant different diameters, differing only by at most a few millimeters, so the only way to see if a nut fits a bolt is to try to screw it on and determine if the nut is too small, if it fits or if it is too large. Design an algorithm for matching each bolt with a nut of fitting size which runs in the expected time $O(n \log n)$. (20 points)

Solution: This is done by a “double QuickSort” as follows. Pick a nut and use it as a pivot to split the bolts into two group: too large, and too small. Then pick the bolt which the nut was a fit and use it to screw all the other nuts, splitting them in two group: too large, and too small. Continue this process with the first group bolts, and first group of nuts and then also the second group of bolts and second group of nuts.