

Q2

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Answer:

We take one bolt to split the nuts into three parts which are small, fitting and too large, and then use the matching nut to split the bolts like splitting the nuts, Iterate it. Now we can simply do the same process with either the large parts of bolts and nuts or small parts of bolts and nuts. For example, we pay attention to the large parts of bolts and nuts, we take out one of the bolts in the large part and then split the nuts from large part into other new three parts which are small, fitting and large. We will not stop doing the process until all the bolts and nuts matched. Essentially, this algorithm is that takes one bolt or nut as pivot and then uses it to separate the rest of nuts or bolts into two parts, like the quick sort does. Hence this algorithm takes $O(n \log n)$.