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CS 590 Homework Assignment 7: Sorting and Selection Application Exercises

Due Date: March 20, 2022

Problem 8.5.24:

The efficient Algorithm to solve this problem is randomized quick sort algorithm.

Take any nut at random and using it to partition the bolts into two groups. One group has diameter smaller than the chosen nut and the other group has the diameter larger than the chosen nut.
This results in finding out one matched nut-bolt pair, say, (a, b), where a is in A and b is in B.

Next, use the bolt and partition the nuts into two groups. One group has diameter smaller than the bolt and the other group has diameter larger than the bolt.

Now, you can find that there are 2 piles of nuts and 2 piles of bolts. Every nut contains a matched bolt and every bolt contains a matched nut. The size of a pile of nuts with

smaller threads is equal to the size of a pile of bolts with smaller threads. The size of a pile of nuts with larger threads is equal to the size of a pile of bolts with larger threads.

Repeat this process for every matched set of nuts and bolts.

The number of comparisons in the first round is n + (n-1), so the time complexity in the first round is O(n). The number of comparisons in the second round is at most n, so the time complexity in the second round is at most O(n). The number of comparisons to divide the nuts and bolts into two different sets in each time is 2*(3/4)*(n), so the time complexity for that is at most O(log(n)). **Therefore, the total time complexity for this algorithm is O(nlog(n)), meaning that the running time of this algorithm is O(nlog(n)).**