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1. Sort five numbers by using maximumly 7 comparisons.

Assume there are 5 different numbers a, b, c, d, e

Step 1: Compare any two of these numbers such as a and b, and assume we get a<b.

Step 2: Compare another two numbers such as c and d, and assume we get c<d.

Step 3: Compare the bigger numbers we have gotten from step 1 and step 2. In this case, we compare b and d, assume b<d.

Now we have two relations which are a<b<d, and c<d

Step 4: Based on the binary search algorithm, compare e and b, no matter e>b or e<b, we can get the relation among a, b, d, e within 2 steps. We need to compare e and b, then compare e and a, or e and d. Assume we get a<b<e<d.

Step 5: Based on the binary search algorithm, and we have already known c<d, we can compare c and b first, if c>b, then compare c and e, then we will get a<b<c<e<d or a<b<e<c<d; if c<b, then compare a and e, then we will get c<a<b<e<d or a<c<b<e<d.

So far, we have sorted five numbers by using 7 comparisons. because I assumed 5 numbers are all different, so it is the worst case. Thus, we can say we can sort 5 numbers by using maximumly 7 comparisons.