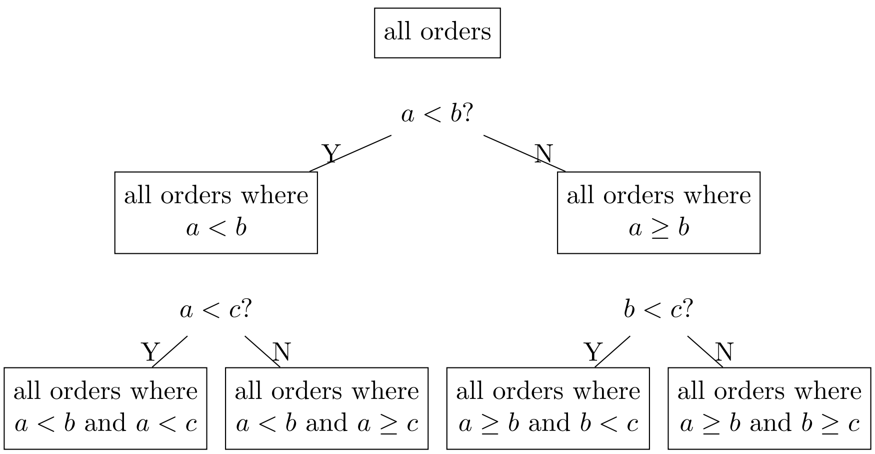
1.

a) There are $\Pi(9) = 9! = 362880$ possible batting orders.

b) If the pitcher has to bat last, then we have only permutations of eight players, and that is $\Pi(8) = 8! = 40320$.

2. We take selection sort for the elements (a, b, c, d). We compare a to the other three elements, swapping the least. Say a is the least. Then we compare b to the other two, and suppose that b is the least. Lastly we compare c to d and suppose c is the least. Thus there are six comparisons that must be performed.

By Equation (4.2), we have that the number of comparisons is at least $\log_2 24$ which must be the higher of 4 and 5. Hence the best possible number of comparisons is 5, and selection sort underperforms.



3. We take merge sort for the elements (a, b, c, d). We split the list into (a, c) and (b, d). We split them again and compare a with c and b with d. The least of both are compared, that is a with b. The greatest of that comparison, say b, is compared with c. Suppose c is the least of that comparison. Then b is compared with d. There are at most five comparisons. The best possible number is five, and thus merge sort is as good as can be done.