1. { 10 points } Given that $2^{k-1} < n \leq 2^k$, prove (using mathematical induction) that the merge sort algorithm applied to the set of $n$ numbers uses at most $f(k) =$ comparisons of the elements of the set.

Fill an appropriate function $f(k) = O(k2^k)$ for which you can prove the estimate. There will be bonus points, if that function is the optimal one.