

Well-orderings of infinite cardinals

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Anyone have a hint on the following problem from Kunen? (This is not homework – it is for my own edification.)

Let R be a well-ordering of an infinite cardinal k . Show (in ZFC) that there exists a subset X of k such that $|X| = k$ and R agrees with the usual ordering (i.e., membership) on X .

Say a set is R -agreeable iff R agrees with the usual ordering on it. I have been able to show the result under the assumption that k is regular (define an R -agreeable set by transfinite recursion), but not in the general case. At first glance, Zorn's lemma does not help: It is possible for there to exist a maximal R -agreeable set whose cardinality is strictly less than k . I have tried starting from the following:

In the case when k is not regular, let m be its cofinality. It is easy to show that there exists nondecreasing cofinal $f: m \rightarrow k$ such that $f(a)$ is a regular cardinal for all a in m .

Since we can find R -agreeable sets of cardinality $f(a)$ for all a in m , I was thinking we might be able to cook up some sort of compactness argument. (This was the source of my recent question about subbases and compactness.) However, I haven't been able to get this to work, either.

Suggestions?

For clarity, here are some definitions which I am not sure are standard.

We use the von Neumann definition for ordinals and cardinals.

Given ordinals a and b , the map $f: a \rightarrow b$ is cofinal iff the range of f has no strict upper bound in b .

The cofinality of an ordinal a , denoted $cf(a)$, is the least ordinal b such that there exists a cofinal map from b to a .

An ordinal a is regular iff $a = cf(a)$.