CS 146: Data Structures and Algorithms (Taylor) **October 24, 2018**

The zombie attack on SJSU is coming. You are trying to gather a team to fit on one floor of MacQuarrie Hall, to battle them. Of course, other teams are being formed elsewhere as well, and each "team captain" is trying to put together a good team as well, but you get to pick your team first.

Due to time constraints, you decide that you will use some simple measures for each potential team member. For all students, you consider their endurance, strength, quickness (speed), intelligence, and knowledge. (Assume that these are available on your school transcript, and have been measured for everybody.) For person a, denote these values as $a.e$, $a.s$, $a.q$, $a.i$, and $a.k$. Person a *dominates* person b if $a.e \geq b.e$, $a.s \geq b.s$, $a.q \geq b.q$, $a.i \geq b.i$, and $a.k \geq b.k$. In this case, I will write $a \geq b$. (They *strictly dominate* if they dominate, and none of the corresponding values are equal. In that case I will write $a > b$.) If a dominates b, you would much rather have a on your team than b: it is all but certain that a will survive longer that b. There are other cases, where neither student dominates the other, where your preference isn't so clear cut. For instance, if $a.q > b.q$, but $b.i > a.i$, depending on which situations arise in the future, don't know if a or b would be better for your team.

You want humanity to survive, and for that, you prefer that some of the "best" (as measured above) will make it. But, you have two different issues: first, you understand that when a zombie catches somebody, it gives everybody else a bit of extra time, as the zombies gather round for Zombie Thanksgiving. So, you want some weaker students (a.k.a. Zombie Bait) on your team to give others a chance to survive. But, you also know that the more students are on a team, the more zombies get attracted to that floor to begin, which is bad for everybody on that floor, so you don't want to just take everybody onto one floor.

As a survival strategy, you decide to pick a team with long "chains" of dominant students: if $a > b$, and $b > c$, this gives us a chain of 3 students, where we know the first will outlast the second, and the second will outlast the third, thus giving the first student a longer time to survive. Your goal is to select, from all students, the longest chain of dominant students, and nobody else. That will maximize the chance of survival for those at the top of the chain. If they can just survive until the end of finals week, they will have survived the apocalypse, because even zombies leave campus after finals. Write as efficient an algorithm as you can to find the longest chain of students *that includes you.* (You don't need to be at the top of the chain, but don't want to put together a team and just wish them well while zombies feast on your delicious brain.)