For the interval scheduling problem in Lecture 6, pick a request with the latest start time is a valid greedy choice. And what it means is that the maximum number of meetings we can schedule for this input is four. And in this example, the maximum number is unique, four. So, to prove the latest start time is a valid greedy choice, we first consider an output, G = $\{g_1, g_2, \ldots, g_k\}$ that this greedy choice results in. And another optimal set of meetings, T = $\{t_1, t_2, \ldots, t_m\}$. Suppose we represent the start time of a meeting as a function, $s(\cdot)$, and finish time as a function, $f(\cdot)$. We assume, without any loss of generality, that the meetings in the two sets are ordered by latest start time. So, since the meetings in the respective sets are not in conflict, it means that they are ordered by latest finish time as well. Also, we know that for sets G and T, $m \geq k$, and we need to prove that $k = m$. And this can be done in two stages.

First, need to show that greedy choice always causes us to "stay ahead" of any optimal choice, which means that: *For every* $i = 1, \ldots, k$, $s(g_i) \geq s(t_i)$. To prove this, use induction on i. For the base case, when $i = 1$, the greedy choice is to pick a meeting with the latest start time. This guarantees that $s(g_1) \geq s(t_1)$. For the step, assume that the assertion is true for $i = 1, \ldots, p - 1$. For $i = p$, we know that $s(g_{p-1}) \geq s(t_{p-1}) \geq f(t_p)$. Thus, the meeting t_p does not conflict with g_{p-1}, and therefore, is available to be chosen after g_{p-1} is chosen. Thus, $s(g_p) \geq s(t_p)$ because we choose the meeting with the latest start time.

Now, need to prove that $k = m$. Now for the purpose of contradiction, we assume that $m > k$. In this case, there exists a meeting t_{k+1} in the set T. But, $s(g_k) \geq s(t_k)$ by the first part of the proof. Thus, the meeting t_{k+1} does not conflict with t_k, and therefore does not conflict with g_k, and is available to be chosen after g_k is chosen. But this contradicts the claim that no more meetings are left that can be chosen after g_k is chosen.

Hence, with these two stages of proof, we have proved that pick a request with the latest start time is a valid greedy choice.