$\mathcal{N} = \{n_i\}_{i=1}^{N}$: population
$\mathcal{T} = \{t_i\}_{i=1}^{T}$: training cases
$e_j(n)$: error on t_j for individual n
Here we define Pareto dominance relations with respect to the training cases.

Definition: n_1 dominates n_2, i.e., $n_1 \prec n_2$, if $e_j(n_1) \leq e_j(n_2)\ \forall j \in \{1, \ldots, N\}$ and $\exists j \in \{1, \ldots, N\}$ for which $e_j(n_1) < e_j(n_2)$.

Theorem 1: Individuals selected by lexicase selection are non-dominated in $\mathcal{N}$ with respect to the training cases $\mathcal{T}$.

Proof: Let $n_1, n_2 \in \mathcal{N}$ be individuals in a population selected by lexicase selection. Suppose $n_1 \prec n_2$. Then $e_j(n_1) \leq e_j(n_2)\ \forall j \in \{1, \ldots, N\}$ and $\exists j \in \{1, \ldots, N\}$ for which $e_j(n_1) < e_j(n_2)$. Therefore n_1 is selected for every case that n_2 is selected, and $\exists t \in \mathcal{T}$ for which n_2 is removed from selection due to n_1. Therefore n_2 cannot be selected by lexicase selection, the supposition is false, and the theorem is true.