On the Existence of Balanced Derivative Computation Task Sets

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In mathematics education research, mathematics task sets involving *mixed practice* include tasks from many different skills on the same assignment. We call a task set *balanced* if each skill is assessed the same number of times. In this paper, we use graph decompositions to construct mixed practice task sets for Calculus I, focusing on *derivative computation tasks*, or tasks of the form "Compute $f'(x)$ of the function $f(x) =$ [elementary function]." A *decomposition* D of a graph $G = (V, E)$ is a collection $\{H_1, H_2, \ldots, H_t\}$ of nonempty subgraphs such that $H_i = G[E_i]$ for some nonempty subset E_i of $E(G)$, and $\{E_1, E_2, \ldots, E_t\}$ is a partition of $E(G)$. We use results on decompositions of the complete directed graph due to Meszka & Skupień and Colbourn, Hoffman, & Rodger to show the existence of balanced task sets for specific numbers of skills.

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