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Permutation Puzzles.

Define a *permutation puzzle* as a partition of $\{1, \dots, n\}$ into blocks, a permutation cycle type that includes the block to which each element belongs, and a “rule” stipulating that the values of the permutation in each block are either ascending or descending. In 2009, J. Steinhardt proved that a such a puzzle has at most one solution. We investigate rules other than ascending and descending. We prove that the number of solutions to any puzzle with only one such rule has a bound depending only on that rule, and we give an algorithm for computing it. We prove that in the special case that all rules are ascending except one, which reverses the order of its first two elements, then the permutation puzzle has at most two solutions. We propose possible generalizations to other classes of rules. (Received September 19, 2010)