A Generalization of Stars and Bars for Placing Identical Items into Identical Bins

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The classical method of stars-and-bars is used to count the number of ways to place identical items into distinct bins, but is not applicable when the bins are also identical. The aim of this research project is to explore alternative methods to find the number of ways to place items into bins, provided that both are identical. When both the items and bins are identical, the common method to count the number of ways is by casework, which is tedious, time consuming, prone to error, and sometimes not even feasible if the numbers of items and bins are large. In this project, new mathematical formulas are established to calculate the number of ways of placing arbitrary number of identical items into arbitrary number of identical bins. Firstly, single closed formulas for the cases of two and three bins are developed for arbitrary number of items. Secondly, a recursive formula for more than three bins is derived for arbitrary number of items. This new recursive formula reduces the number of bins by one in each step until reaching the base case of three bins for which the new closed formula can be applied.

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