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Parking functions with a fixed set of lucky cars

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Abstract. In a parking function, a lucky car is a car that parks in its preferred parking spot, and the parking outcome is the permutation encoding the order in which the cars park on the street. We give a characterization for the set of parking outcomes arising from parking functions with a fixed set of lucky cars. This characterization involves the descent bottom set of a permutation, and we use the characterization to give a formula for the number of parking functions with a fixed set of lucky cars. Our work includes the cases where the number of cars is equal to the number of parking spots and where there are more spots than cars. We also give product formulas for the number of weakly increasing parking functions having a fixed set of lucky cars. When the number of cars equals the number of spots, this is a product of Catalan numbers.

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