The Number of Euler Tours of a Random d-in/d-out Graph

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Abstract

We obtain the expectation and variance of the number of Euler tours of a random d-in/d-out directed graph, for $d \geq 2$. We use this to obtain the asymptotic distribution and prove a concentration result. We are then able to show that a very simple approach for uniform sampling or approximately counting Euler tours yields algorithms running in expected polynomial time for almost every d-in/d-out graph. We make use of the BEST theorem of de Bruijn, van Aardenne-Ehrenfest, Smith and Tutte, which shows that the number of Euler tours of a d-in/d-out graph is the product of the number of arborescences and the term $([(d-1)!]^n)/n$. Therefore most of our work lies in estimating the asymptotic distribution of the number of arborescences of a random d-in/d-out graph.

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