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**One and Two-Dimensional Random Walks with One-Step Memory**

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**Abstract**

Formalized studies of random walks have been conducted dating back to the early 20th century. Since then, well-defined conclusions have been drawn, specifically in the case of one and two dimensional random walks. A key theorem was formulated by George Pólya in 1912. He stated that for a one or two-dimensional lattice random walk in the limit of infinite number of steps, *N*, the probability that the walker will return to its point of origin is unity. However, for any higher dimensional lattice, the probability of a return is less than one. The following work explores Pólya’s theorem for one and two-dimensional random walks that are non-isotropic and have the property of one-step memory, i.e. the probability of moving in any direction is non-symmetric and dependent on the previous step. The memory can introduce a positive bias which creates a tendency to continue movement in the current direction of travel. Alternatively, a negative bias can be introduced which creates a tendency to reverse the direction of travel. Explicit theoretical formulation and numerical analysis have been explored for the one-dimensional case. Finite asymptotic results have been achieved for the two-dimensional case.