

論文 / 著書情報
Article / Book Information

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種別(和文)	論文要旨
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論文要旨

THESIS SUMMARY

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Department of			Academic Degree Requested	Doctor of
学生氏名：	岡田 いず海		指導教員 (主)：	桑田 和正
Student's Name			Academic Advisor(main)	
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要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

In this paper, we study the local time of a random walk and special sites among the random walk range, called late points and favorite points. The local time is a functional of a random walk with time and space parameter. It describes how many times the random walk visits a specified site until a specified time. The notion of local time is very basic and it appears in various fields. For example, Feynman-Kac formula provides us a representation of the solution of (discrete) Schrodinger equation by using a functional of the local time. Indeed, this is a fundamental tool to study Schrodinger equations by means of probability theory, and a detailed study of local time is required to investigate it. Though the research on the local time is a classical topic, many questions related to it are recently propounded and investigated and many of them remaining to be cleared up. In particular, problems concerning the local time in two dimension are most difficult than in other dimensions. Since the simple random walk in two dimension is recurrent, estimates such as asymptotic behavior of hitting probabilities are complex and often exhibits a different nature. The simple random walk is also recurrent in one dimension, but the structure of the state space is much simpler than two dimension and hence many special techniques are available there.

Before entering the description of our main results, we briefly review known results concerning late points and favorite points. About sixty years ago, Erdos and Taylor proposed a problem on asymptotic behavior of the spatial maximum of the local time of a simple random walk in two dimension. Over forty years later, Dembo, Peres, Rosen and Zeitouni solved it and some related problems by developing innovative proofs. Moreover, these methods have been applied also to the study of late points in two dimensional discrete torus.

In main results in this paper, we determine the power exponents for the numbers of pairs of favorite points as Dembo et al. conjectured. It has been shown that the exponents for the numbers of pairs of late points coincide with those of nearly favorite points and high points in the Gaussian free field whose exact values are known. In addition, we estimate the exponents for the numbers of a multipoint set of late points in average and in probability. While there have been observed certain similarities between among three classes of points, our results exhibit a difference. In addition, we consider the question: how many times does a simple random walk revisit the most frequently visited site among the inner boundary points? It is known that in two dimension, the number of visits to the most frequently visited site among all of the points of the random walk range up to time n is asymptotic to the square of $\log n$, while in three dimension, it is of order $\log n$. We prove that the corresponding number for the inner boundary is asymptotic to $c \log n$, where c is a certain constant having a simple probabilistic expression.

Now we state motivations for the present study of entire research of this paper in more details. We wish to understand the structure of the random field of a local time as a configuration of late points and favorite points. In particular, we want to determine the relationship between the special points of a random walk and those of a Gaussian free field (GFF). In fact, there are several results for Gaussian free fields corresponding to ones for favorite points and late points. In addition, We wish to employ detailed information of the geometric structures of late points and favorite points to obtain the diverse large deviation estimates of the local time or high moment of functionals of the local time. Of course, there are corresponding questions for high points also. In general, the limit theorem for random variables has a connection with its large deviation estimates or high moments. We believe that our estimates of the local time helps the study of asymptotic behavior of various functionals of the local time.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

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