Some Statistical Quantities of Random Walk Simulation on the Prime Numbers with the Twin, Cousin and Sexy Prime Numbers

Daisuke Ishii*
Okayama University of Science, Okayama, Japan s@xmath.ous.ac.jp

Yoshiyuki Mori
Okayama University of Science, Okayama, Japan mori@xmath.ous.ac.jp

Ryuichi Sawae
Okayama University of Science, Okayama, Japan sawae@xmath.ous.ac.jp

A natural number is uniquely decomposed into unique prime factors up to order of these factors. Following this fact, for a randomly given natural number n, we can construct a kind of random walk path where coin-tossing steps up and down are performed according to the occurrence of special primes.

Some statistical quantities characterizing this random walk are studied with computer simulation. The displacement functions of the random walker after N steps for $1 \le N \le 10^{16}$ will be simulated on the twin and cousin prime counting function and on the twin and sexy prime counting function.

As for the twin and cousin prime counting function, the mean square fluctuation function $F(l)$ become to behave in perfect power-low dependence $F(l) \sim \sqrt{l}$ representing that the defined random walk is not correlated. Also, we get some statistical results about properties of the random walk on the prime numbers, which are the number of returns to the origin and quality of the random numbers related to this random walk.

Key Words: Random walk, fluctuation function, prime numbers, twin cousin and sexy prime numbers.