

IT461 Assignment 2: Random Walks

- (1) Write a program to verify the probability of eventual return in 1-d, 2-d and 3-d random walk.
- (2) Write a program to estimate $P(M_{100} \geq 25)$ where $M_n = \max\{S_i : 1 \leq i \leq n\}$. Verify your answer with the theoretical value.
- (3) Write a program to compute the $P(\tau_4 \leq 10)$ where $\tau_m = \min\{i : S_i = m\}$. Verify with theoretical answer.
- (4) The factorial function has an asymptotic approximation given by $n! \approx (\frac{n}{e})^n \sqrt{2\pi n}$. This is known as Stirlings' approximation. Verify this by writing a computer program.
- (5) Consider a random walk starting from the origin and ending in $2n$ time steps. Let $\alpha_{2n}(2k)$ be the probability that the last visit to the origin occurred at time $2k$. Simulate the random walk for $2n = 100$ time steps and plot the empirical density of $\alpha_{2n}(2k)$.