

Mathematics 1550H – Introduction to probability

TRENT UNIVERSITY, Summer 2017

Assignment #4

A Random Walk

Due on Wednesday, 19 July.

One fair coin has sides labelled U and D , and another fair coin has sides labelled L and R , respectively. A token is placed at $(0,0)$ on the Cartesian plane and the two coins are tossed simultaneously, over and over. After each toss, the token is moved as follows: up or down by 1 depending on whether the first coin came up U or D , and left or right by 1 depending on whether the second coin came up L or R . For example, if the token were at $(3,1)$ and the coins came up D and R , the token would be moved to $(3-1, 1+1) = (2,2)$.

Let the random variable Y_n be the *taxicab distance** the token is from $(0,0)$ after $n \geq 0$ rolls and the consequent moves. It should be pretty obvious that $Y_0 = 0$: the token starts at $(0,0)$ and $n = 0$ moves have taken place. After that it gets more interesting ...

1. What is $E(Y_n)$? Explain why as best you can. [5]
2. What is $V(Y_n)$? Explain why as best you can. [5]

* The taxicab distance from $(0,0)$ to (a,b) is $|a| + |b|$.