

Mathematics 1550H – Introduction to probability

TRENT UNIVERSITY, Winter 2017

Assignment #3

A Random Walk

Due on Thursday, 16 March, 2017.

A fair four-sided die has its sides labelled U , D , L , and R , respectively. A token is placed at $(0, 0)$ on the Cartesian plane and the die is then rolled repeatedly. After each roll, the token is moved as follows:

Roll	Move
U	$(a, b) \rightarrow (a, b + 1)$
D	$(a, b) \rightarrow (a, b - 1)$
L	$(a, b) \rightarrow (a + 1, b)$
R	$(a, b) \rightarrow (a - 1, b)$

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 $|a| + |b|$.