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Mathematical Modeling II

13 February 2024

Results

I have created a model capable of simulating a random walk, with adjustable parameters. These parameters include a threshold to determine the strength of bias, the number of trials to be run, the number of steps to be taken per trial, and whether step distance should be randomized. I added the last feature as it led to some notable insights. The haphazardly labeled images attached indicate the number of trials, type of plot (path or bar, P or B), type of step distance (uniform or random, U or R), and direction of bias (left or right or none, L or R or N). When adding the feature of randomized step distance, major changes took place regarding both plots. The path plots became far more visible, as lines no longer precisely intersected each other in a grid like fashion (10PUN). With regard to bar plots, this randomized step distance adjustment removed the requirement that the results land only on intervals two units apart from one another. This allowed for normal distributions produced by the bar plots to become even more apparent. Throughout the 10-trial series, the results seemed to stick around the origin, but somewhat randomly at that. Throughout the 50-trial series, you can see a normal distribution start to form. Both randomly generated bar plots (50BRN and 50BUN) appear somewhat normally distributed. The path plot (50PRN) shows an emphasis on paths fizzling out towards the middle, with just a few branches going far in either direction. In the 100-trial series, I began to implement the bias feature as I believed that the differences would be more noticeable with so many trials to diminish randomness. You see mostly similar features to the 50-series here. With the left biased bar charts (100BRL and 100BUL) you see normal distributions forming with a mean around a lower value (-5). The left biased path (100PRL) also shows a similar distribution, but now with a center of the trend around -5 as well. Lastly, in the 1000-trial series, you see very nicely formed normal distributions of both types. As these bar charts (1000BRR and 1000BUR) are right biased, the center value is also to the right (~4). With such a huge trial size, the path plot (1000PRR) has amalgamated into a mesh of color also focused approximately around 4. Even though you cannot compare densities towards the center of the path plot due to oversaturation, you can notice how most of the paths reside within a central cluster. Only a few strands dare to exist beyond.