

Computational Physics - PH3264

Assignment 1

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Roll:20201017

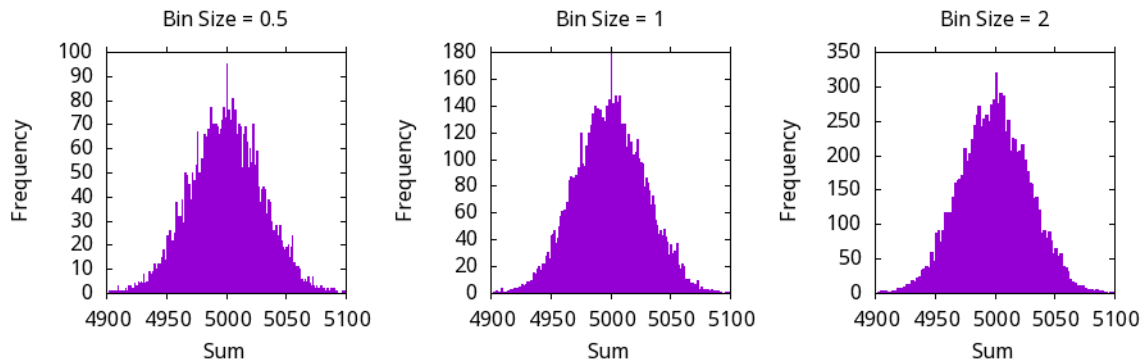
- a. For a-f, refer to respective .cpp and .out files for demonstration - all involve printing random numbers with different seeds, and other simple tasks.
- g. The output from g.out is as follows:

Absolute difference between 0.5 and average of random numbers

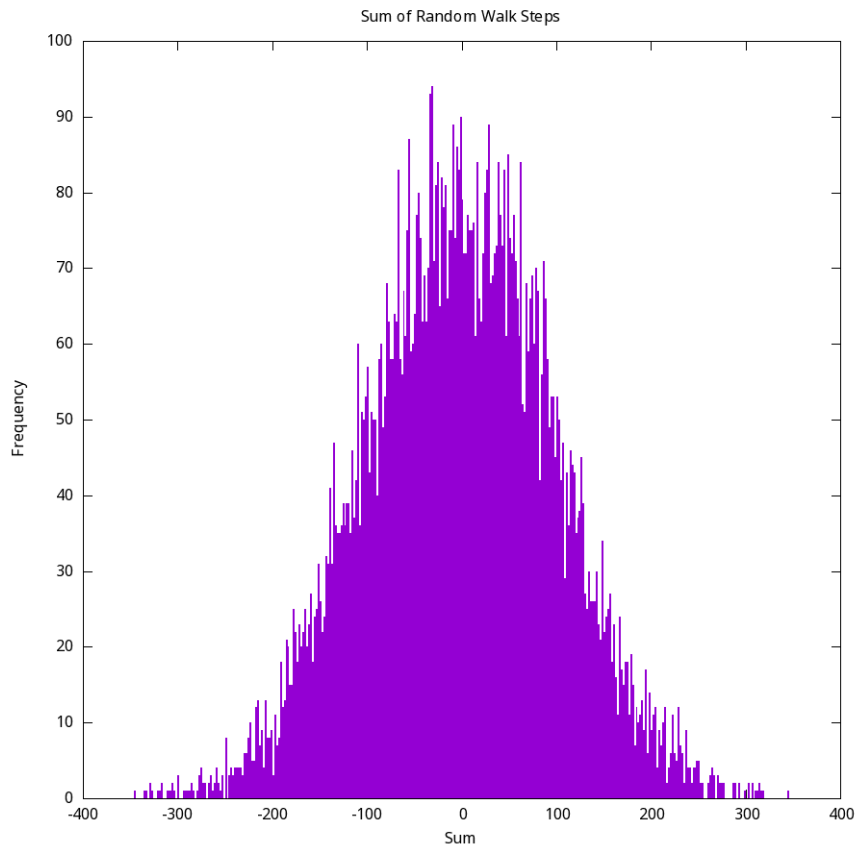
```
10      : 0.1838132364
100     : 0.02390399648
10000   : 0.0004469846813
1000000 : 5.272165292e-05
```

The expected value is 0 (as the number of random numbers sampled tends to infinity, the average approaches 0.5). As the number of sample here increases, the difference gets closer to 0 - verifying the law of large numbers.

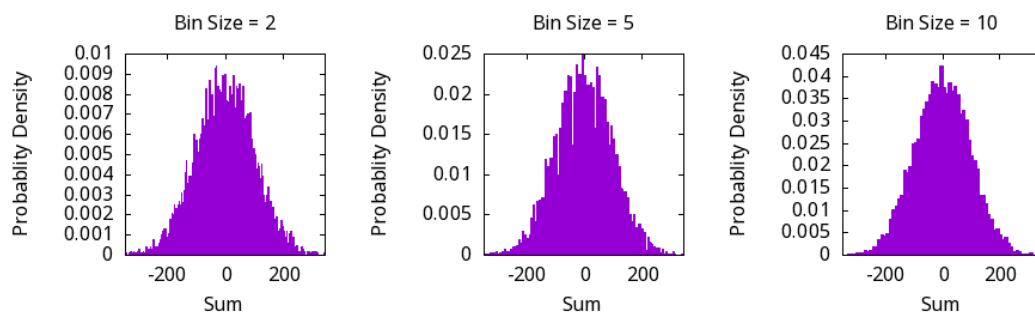
- h. The following plot shows the distribution of the sum of 10000 random numbers, computed 10000 times.



- i. While it is not clear from the plot shown, zooming in shows that the bars alternate - this is because the sum of 10000 odd numbers (-1 and 1) is always even, causing the values for the bins $(2n, 2n+1)$ to be 0.

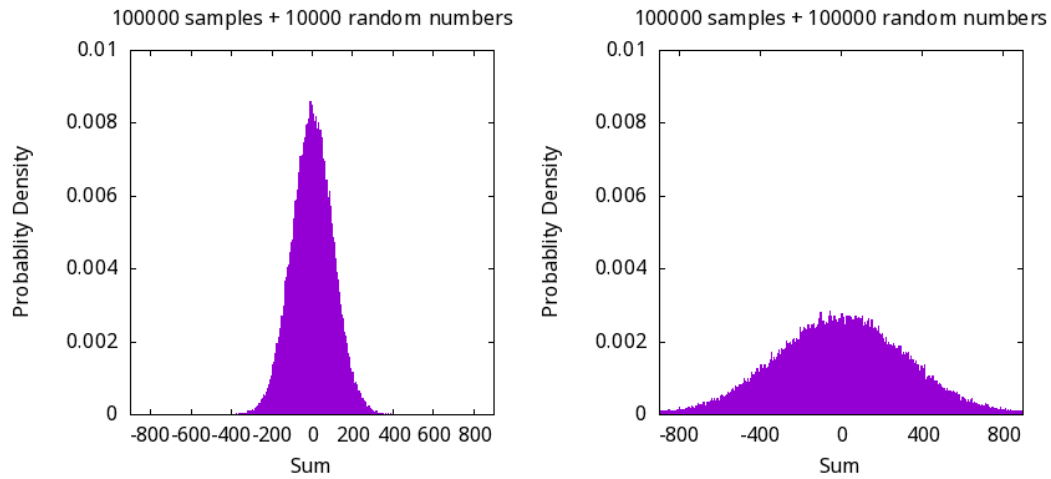


- j. The plot below shows the same distribution with various bin sizes - Histograms with larger bin sizes are smoother.



Note: All plots hereafter are normalized such that the cumulative sum is 1.

- k. The plots for 10^5 samples of sum of 10^4 steps and 10^5 steps are shown below, using a bin width of 2.
- l. As can be seen in the plots below, with more samples at every step, the standard deviation increases. More samples indicates more steps - with more steps in a walk, regions farther from the origin are more accessible, explaining this spread.



- m. Shown below are the distributions with gaussian fits.(binsize=1)

