## Assignment 8 Project P342

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- Use either C/C++ or Python for your program.
- You are expected to write a small discussion (not exceeding 120 words) for each problem and upload the same (in pdf format) along with the codes, plots and data in the Classroom.

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1. Write a code on random walk simulation on a 2-dim plane. **[7]**
   (a) Consider 5 different set of steps $N = 250, \ldots$ and perform at least 100 different random walks (using different sequence of random numbers, of course) for each $N$, each time starting from the origin.
   (b) Plot any 5 random walks from each of the 5 sets in 5 different graphs (label appropriately).
   (c) Calculate the radial distance $R$, $R_{\rm rms}$ and average displacement in the $x$ and $y$ directions for each set.
   (d) Plot $R_{\rm rms}$ vs $\sqrt{N}$ and comment in the discussion note on the agreement with the analytical result.
2. Using Monte Carlo method, determine the volume of an ellipsoid of semi-axes $a = 1.0$, $b = 1.5$, $c = 2.0$ unit. **[8]**
   (a) At the least a set of 10 trials should be taken starting with step number $N = 100$. (Do not go over 50,000 steps.)
   (b) Compare your result to the analytical value of the ellipsoid sphere in a plot.
   (c) Plot the fractional error vs. step numbers.
   (d) Make a 3-D plot of the ellipsoid Monte Carlo data for a moderately large $N$ (say $\sim 10,000$).