# Computation Project

Discussion

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## Q1(Random Walk problem)

In this project we tried to demonstrated random walk in 2D plane and verified it's consequences. We demonstrated 2D random walk for five different step numbers(I chose 250,500,1000,2500,5000 as different step numbers) .A function which can take number as input was created and it returned $R_{Value}$ (Radial distance from the centre after the completion of the random walk of given number of steps ,each step was of step size 1 unit), $R_{rms}$,resultant dispacement in x and y axises(After the completion of the random walk process) and two matrices containing resultant dispacement in x and y axises after the completion of each step. For each step sizes we repeated the process for 100 times and $R_{rms}$, and average displacements were computed using this 100 different datas, which gave more accuracy in our results.The average displacement obtained in x and y axises were very close to zero, which perfectly agreed the fact that the probality to move in any direction in the 2D plane is equal in random walk. The $R_{rms}$ vs $\sqrt{N}$ gave almost a straight line and with the increase in number of steps it became more close to the analytical expectation.

## Q2(Ellipsoid problem)

Using Monte-carlo method we successsfully computed the volume of an ellipsoid. In this method we applied probability concept to compute Volume of the ellipsoid. We enclosed the ellipsoid with cuboid of dimension which is equal to the axises of ellipsoid and threw 'n' number of random points to the cuboid. Then the fraction of the volume occupied by the ellipsoid inside the cuboid is directly proportional to the fraction of number points fallen inside the ellipsoid.It can be written as

$$Volume_{ellipsoid} = \frac{N_{ellipsoid}}{N_{cuboid}} \times Volume_{cuboid}$$

where,
$N_{ellipsoid}$=Number of points fallen inside the Ellipsoid
$N_{cuboid}$=Total number of points inside the cuboid.

We computed Volume giving 10 different values for N (The number of points throwing to the cuboid) . With the increase in number of points ,eventhough the computed Volume values were fluctuating it was moving closer to the analytical solution(The analytical solution for the given ellipsoid was 12.566370614359172 $unit^3$). Fractional error also followed the same trend with the number of points.