

# Introduction to Probability and Random Variables - Project

Syed Fazl ur Rehman - sr02910  
Instructor: Dr. Musabbir Majeed

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## 1 Tasks

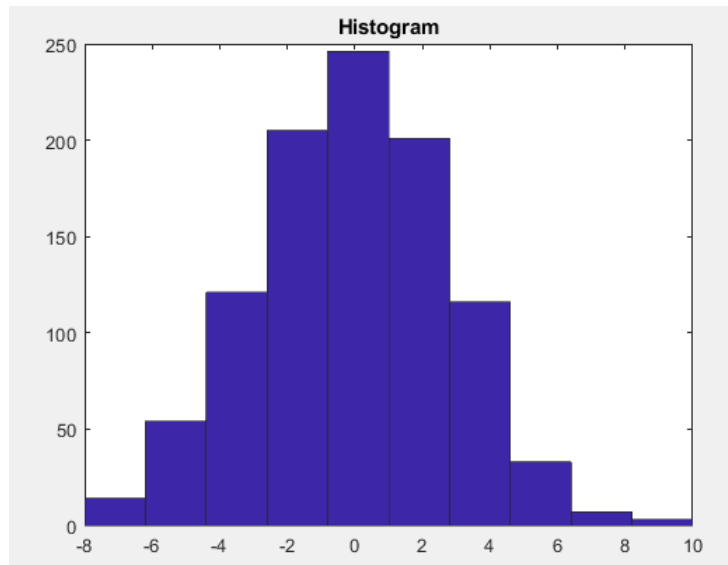
### Task 1: Discrete Random Variables

In this task a one dimensional random walk model was created which calculates the expected distance from the starting point. The model was tested for range of scenarios such as equal and unequal probabilities of moving right and left. The expectation was obtained by taking average of distances after performing simulation for reasonable times.

Mathematically, this expectation can be modelled as [1],

$$E[distance] = \sqrt{\frac{2n}{\pi}}$$

The histogram plot can provide a good visualisation of Expectation.



## **Task 2: Discrete Random Variables**

In this task one dimensional random walk model was created which calculates the expected time to meet two people while traversing the grid. The model in task 1 was used for modelling of Random walk. The collision is detected using the coordinates and expected time is calculated.

## **Task 3: Discrete Random Variables**

In this task two dimensional random walk model in a circular region was created. Step size and orientation were randomly selected from  $[0,0.5,1]$  and [East (0 degree), North (90 degree), West (180 degree), South (270 degree)] respectively. The Cartesian coordinates were transformed to polar coordinates and re entry model was designed to keep the traversing node inside the circular region.

## **Task 4: Continuous Random Variables**

Task 1 was repeated with step size as a continuous random variable. `Unifrnd()` built-in function of MATLAB was used to obtain uniform RV within specified range.

## **Task 5: Continuous Random Variables**

Task 3 was repeated with step size and orientation modelled as a continuous random variable. `Unifrnd()` built-in function of MATLAB was used to obtain uniform RV within specified range.

## **Task 7: Continuous Random Variables**

Task 3 was repeated with step size as a discrete RV and orientation as a continuous RV. `Unifrnd()` built-in function of MATLAB was used to obtain uniform RV within specified range.

## **References**

- [1] J. Hižak, R. Logožar, "A derivation of the mean absolute distance in one-dimensional random walk", *Tehnički glasnik*, 5(1) (2011).