Lab Report: Random Number Simulation in Discrete Event Simulation

Objective: The objective of this lab is to:

- Generate random numbers in Excel using built-in functions.
- Test the randomness of the generated numbers.
- Apply the random numbers in a basic simulation scenario.

1. Introduction

Random numbers are sequences of numbers that lack any predictable pattern. They are essential in various fields, including simulations, modeling, and statistical analysis. This lab explores the generation of random numbers using Microsoft Excel and investigates their properties.

2. Methodology

2.1 Random Number Generation

1. Random numbers were generated in Excel using the following functions:
   'RAND()': This function generates a random real number between 0 and 1.
   'RANDBETWEEN(bottom, top)': This function generates a random integer between the specified "bottom" and "top" values.
2. Transform these values using the formula: 1-2*rand().
3. Collect and Analyze samples of sizes 100, 500, 1000, 5000.

2.2 Sample Size

A total of 100, 500, 1000, 5000 random numbers were generated for this experiment.

2.3 Scatter Diagram for Randomness Visualization

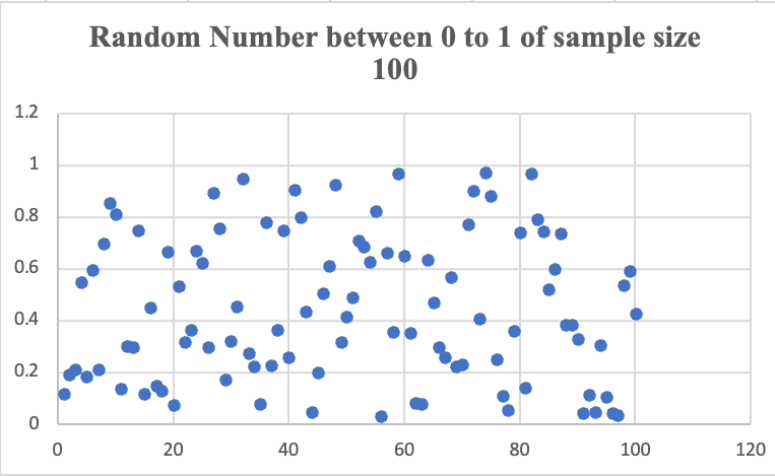
A scatter diagram was plotted in Excel to visualize the randomness of the generated numbers. The steps to create the scatter diagram were as follows:

- A sequence of random numbers was generated using the `RAND()` or `RANDBETWEEN()` functions.
- Each random number was paired with its sequence order (e.g., 1, 2, 3, ...) to create an (X, Y) data set.
- A scatter plot was created in Excel with:
  - **X-axis** representing the sequence order of the numbers.
  - **Y-axis** representing the generated random values.

3. Results

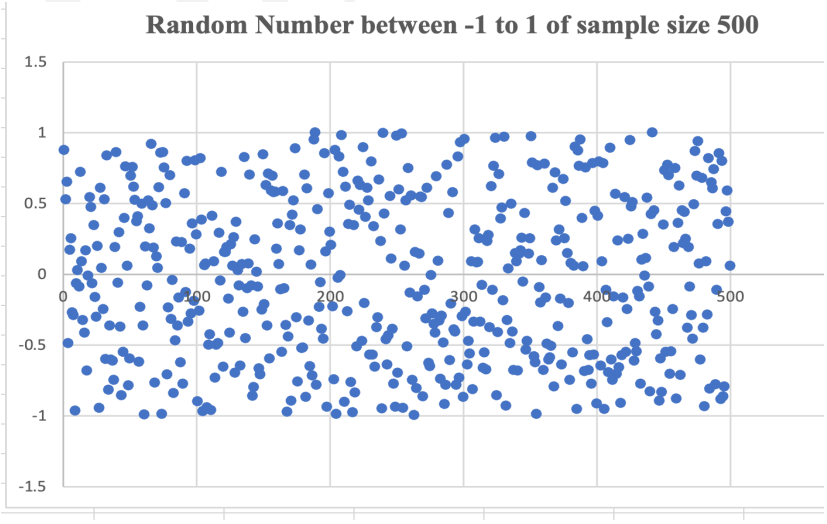
Sample Size: 100

The scatter diagram for the 100 random numbers displayed a sparse but random spread of points across the graph. No visible patterns or clustering were observed, indicating that the numbers appear to be independent and randomly distributed.



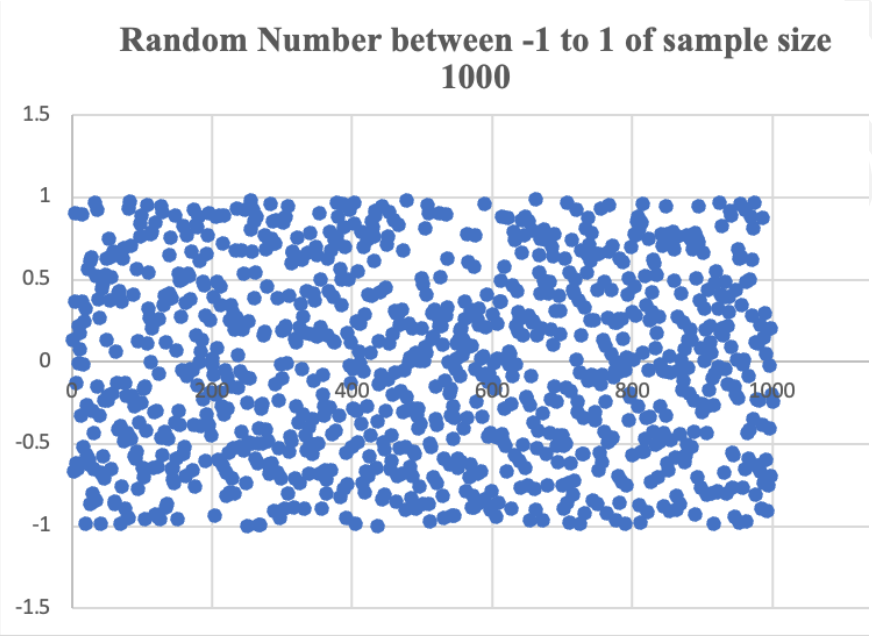
Sample Size: 500

The scatter diagram for the 500 random numbers displayed a denser spread compared to the smaller sample size of 100. The greater number of points in this sample allowed for a clearer visualization of randomness within the specified range.



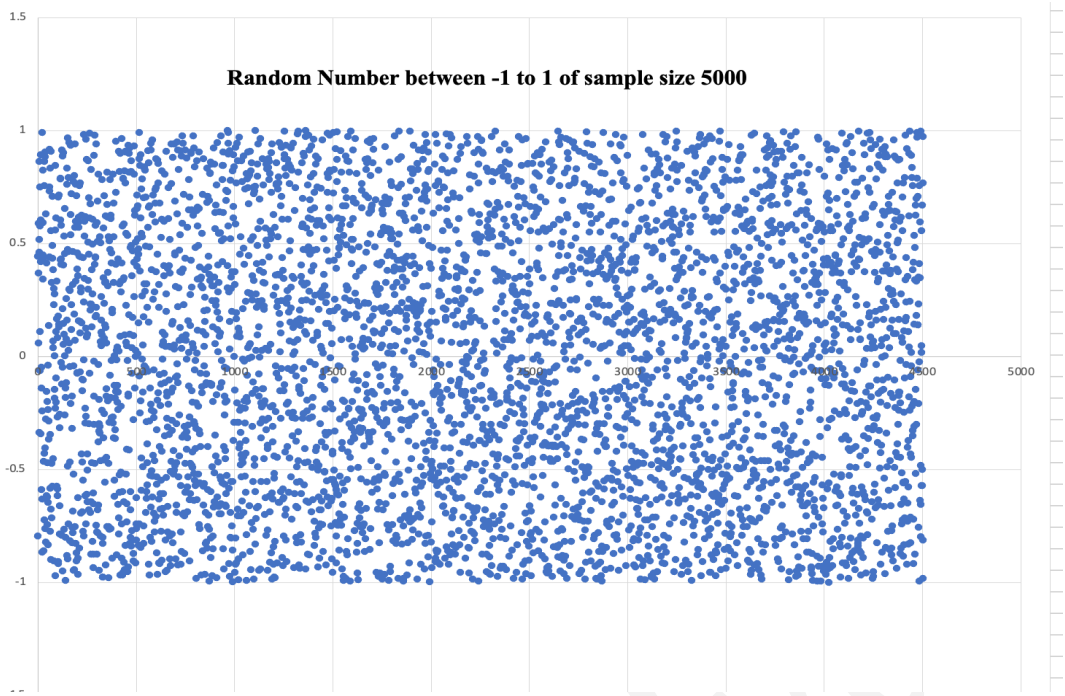
Sample Size: 1000

The scatter diagram for the 1000 random numbers displayed a dense spread of points across the range, with no discernible clustering, patterns, or trends. The increased sample size provided a clearer demonstration of randomness, as the points uniformly filled the plot area. This visualization strongly supports the hypothesis that the generated numbers are both random and independent.



Sample Size: 5000

The points are evenly distributed throughout the square, with no discernible patterns, clustering, or gaps. This uniform scatter visually demonstrates the random nature of the data within the defined bounds.



Random numbers were also generated in the experiment using the C program as:

```
#include <stdio.h>
#include <stdlib.h>
int main(){
   int random_number;
   for (int i = 0; i <= 10; i++) {
      random_number = rand();
      printf("Random Number: %d\n", random_number);
   }
   return 0;
}
```

Sample Output:

```
Random Number: 16807
Random Number: 282475249
Random Number: 1622650073
Random Number: 984943658
Random Number: 1144108930
Random Number: 470211272
```

Random Number: 101027544

Random Number: 1457850878

Random Number: 1458777923

Random Number: 2007237709

Random Number: 823564440

4. Conclusion

In conclusion, Excel's random number generation functions 'RAND()' and 'RANDBETWEEN()' provide a practical tool for generating random data for various applications. While the randomness tests indicate that these functions produce reasonably random numbers for basic applications, they may not be sufficient for tasks requiring cryptographic-level randomness or highly accurate simulations. Further exploration using larger sample sizes and alternative randomness tests could enhance the reliability of the findings.