SYSTEM SIMULATION AND MODELLING

LECTURE 1

Section D

TOPIC COVERED: Properties of Random Numbers, Generation of Pseudo-Random Numbers,

Random Number Generation

- A Random number is a number generated by a process, whose outcome is unpredictable and which cannot be subsequentials reliably reproduced.
- Random numbers are widely used ingredient in the simulation of almost all discrete systems. Simulation languages generate random numbers that are used to generate event times and other random variables. Random number generators have applications in gambling, statistical sampling, computer simulation, cryptography, completely randomized design and other areas where producing an unpredictable result is desirable. The generation of pseudo random numbers is an important and common task in computer programming.

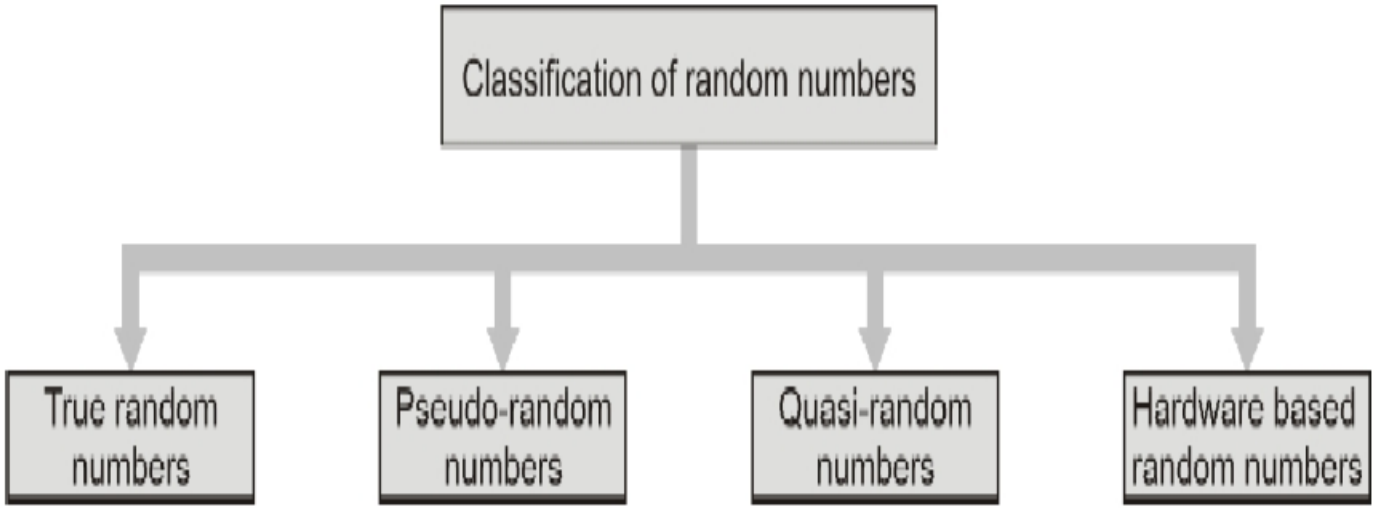
PROPERTIES OF RANDOM NUMBERS

- A good random number generation should have the following properties:

1. Good statistical properties.
2. The algorithm must execute fast.
3. Any algorithm used as a generator starts repeating the sequence after a finite length.
4. A random number generation must produce identical results across several computing platforms.
5. The random numbers should be replicable.
6. The generated random numbers should closely approximate the ideal statistical properties of uniformity and independence.

CLASSIFICATION OF RANDOM NUMBERS

Random numbers in use can be classified into four different categories as described below.



- **True random numbers:** True random numbers are not produced by any mathematical algorithm. These random numbers are generally used in cryptography. These random numbers are generated from naturally occurring phenomenon such as radioactive decay of isotopes.
- **Pseudo-random numbers:** Pseudo random numbers are generated by a mathematical algorithm. These random numbers are statistical independent and follow a uniform distribution.
- **Quasi random numbers:** Quasi random numbers are generated by algorithm formulated to optimize uniform distribution to improve the accuracy of Monte Carlo method.
- **Hardware based random numbers:** Hardware based random numbers are produced by an algorithm encoded in the hardware.