Random Number Generation
&
Random Variate Generation

Lecture # 25

Lecture by Engr. Sidra

Random Numbers

- Random numbers are numbers that occur in a sequence.
- The sequence of random numbers must have two statistical properties:
  - Uniformity: The values are uniformly distributed over a defined interval or set, or they are equally probable every where
  - Independence: It is impossible to predict future values based on past or present ones or the current value has no relation with previous values.

Pseudo Random Numbers

- A sequence of pseudo random numbers
  - Will repeat eventually
  - Can always be predicted based on current state (i.e., seed)
- True randomness cannot be predicted.

Random Variates

- A random variable is a variable whose value is subject to variation due to chance.
- A random variate is a particular outcome of random variable.
- It is variable generated from uniformly distributed pseudo random numbers,
- Depending on how they are generated it can be uniformly or non uniformly distributed.
- A value being sampled from a proven distribution of input variable.

Independent and Identically Distributed (IID)

- If each random variable has same probability distribution and are mutually independent.
- There are various techniques to generate variate from desired input distribution.
- All algorithms have same general form.
  - Generate one or more IID, U(0,1) →Transformation(depends on desired distribution) → Return X ~ desired distribution.

Independent and Identically Distributed (IID)

- Several distribution form want
  - Exact: X has exactly (not approx.) desired distribution unavoidable external limitations of machine accuracy and exactness of U(0,1) generator.
  - Efficient: Both in terms of storage space and execution time
  - Simple: understandable, often tradeoff efficiency.