Performance Modeling and Design of Computer Systems- Ch 4 Generating Random Variables for Simulation

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Overview

Random Variable Generation

- **Problem** : Assume a system in which
  - **interarrival times of jobs** are well modeled by an **Exponential distribution**
  - **Job sizes** (service requirements) are well modeled by a **Normal distribution**.
  - We want to simulate the system
- We need to be able to generate instances of
  - **Exponential distribution** &
  - **Job sizes** (service requirements) are well modeled **Normal distribution**.
- **Solution** : 2 Basic maethods for generating random variables
  - Assuming we already have a generator of Uniform(0,1) random variables

Inverse-Transform Method
Basics

- This method assumes that we know the
  - c.d.f. (cumulative distribution function), $F_X(x) = PX \leq x$, of the random variable X that we are trying to generate, and
  - that this distribution is easily invertible, namely that we can get x from $F_X(x)$
- T variations
  - Continuous
  - Discrete

Inverse-Transform Method
Continuous Case

Idea: Map each element u generated by uniform distribution to some x of desired distribution

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Inverse-Transform Method
Basics

- Server i receives external arrivals ("outside arrivals") with rate r_i .
- Server i also receives internal arrivals from some of the other servers.
- A packet that finishes service at server i is next routed to server j with probability p_{ij} .
- Multiple **"class"** of the packet, may have different probability according to routing scheme