Performance Modeling and Design of Computer Systems- Ch 10 Exponential Distribution and the Poisson Process

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Overview

Exponential Distribution

- A random variable X is distributed Exponentially with rate λ,

  $$X \sim Exp(\lambda)$$

  If X has the probability density function:

  $$f(x) = \begin{cases} \lambda e^{-\lambda x} & x \geq 0 \\ 0 & x < 0 \end{cases}$$

  The cumulative distribution function,

  $$F(x) = P\{X \leq x\} = \int_{-\infty}^{x} f(y)dy = \begin{cases} 1 - e^{-\lambda x} & x \geq 0 \\ 0 & x < 0 \end{cases}$$

Exponential Distribution

- Mean of Exp Dis.

$$E[X] = \int_{-\infty}^{\infty} xf(x)dx = \frac{1}{\lambda}$$

- second moment of Exp Dis.

$$E[X^2] = \frac{2}{\lambda^2}$$

- variance of Exp Dis.

$$Var(x) = E[X^2] - (E[X])^2 == \frac{1}{\lambda^2}$$

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- Exp Dist. is memoryless : next state $((t = 1)$th) is independent of current state $(t$'th)