

DTSA 5001 - Final Exam - Formula Sheet

Some Common Random Variables

Bernoulli(p): A Bernoulli random variable is also known as a binary random variable.

$$\begin{aligned}P\{X = 1\} &= p \quad \text{and} \quad P\{X = 0\} = 1 - p \\E[X] &= p \\V[X] &= p(1 - p)\end{aligned}$$

Discrete Uniform(n):

$$\begin{aligned}P\{X = i\} &= \frac{1}{n} \quad \text{for } i = 0, 1, 2, \dots, n \\E[X] &= n/2 \\V[X] &= n(n + 2)/12\end{aligned}$$

Geometric(p):

$$\begin{aligned}P(X = i) &= p(1 - p)^{i-1} \quad \text{for } i = 1, 2, 3, \dots \\E[X] &= \frac{1}{p} \\V[X] &= \frac{1 - p}{p^2}\end{aligned}$$

Binomial(n, p):

$$\begin{aligned}P(X = i) &= \binom{n}{i} p^i (1 - p)^{n-i} \quad \text{for } i = 0, 1, 2, \dots, n \\E[X] &= np \\V[X] &= np(1 - p)\end{aligned}$$

Negative Binomial(r, p):

$$\begin{aligned}P(X = i) &= \binom{i + r - 1}{r - 1} p^r (1 - p)^i \quad \text{for } i = 0, 1, 2, \dots \\E[X] &= r(1 - p)/p \\V[X] &= r(1 - p)/p^2\end{aligned}$$

Poisson(λ):

$$\begin{aligned}P(X = i) &= \frac{e^{-\lambda} \lambda^i}{i!} \quad \text{for } i = 0, 1, 2, \dots \\E[X] &= \lambda \\V[X] &= \lambda\end{aligned}$$

Uniform(a, b):

$$f(x) = \begin{cases} \frac{1}{b-a} & \text{for } a < x < b \\ 0 & \text{else} \end{cases}$$

$$E[X] = \frac{a+b}{2}$$

$$V[X] = \frac{(b-a)^2}{12}$$

Exponential(λ):

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

$$E[X] = 1/\lambda$$

$$V[X] = 1/\lambda^2$$

Normal(μ, σ^2): A normal random variable is also known as a Gaussian random variable.

$$f(x) = \frac{1}{\sqrt{2\pi}\sigma} e^{-(x-\mu)^2/2\sigma^2} \text{ for } -\infty < x < \infty$$

$$E[X] = \mu$$

$$V[X] = \sigma^2$$