DTSA 5001 - Final Exam - Formula Sheet Some Common Random Variables

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

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

Discrete Uniform(n):

$$P{X = i} = \frac{1}{n}$$
 for $i = 0, 1, 2, ..., n$
 $E[X] = n/2$
 $V[X] = n(n+2)/12$

Geometric(p):

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

Binomial(n, p):

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

Negative Binomial(r, p):

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

Poisson(λ):

$$P(X = i) = \frac{e^{-\lambda}\lambda^i}{i!} \text{ for } i = 0, 1, 2, \dots$$

$$E[X] = \lambda$$

$$V[X] = \lambda$$

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):

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

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

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

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

$$\begin{array}{lcl} f(x) & = & \frac{1}{\sqrt{2\pi}\sigma}e^{-(x-\mu)^2/2\sigma^2} \text{ for } -\infty < x < \infty \\ E[X] & = & \mu \\ V[X] & = & \sigma^2 \end{array}$$