(Note pdf's are 0 off of the indicated sets.)

I. IMPORTANT DISCRETE DISTRIBUTIONS**.**

1) **Name** : Binomial **Shorthand** : X~ B(n,p)

pdf: $f(x) = \binom{n}{x} p^x q^{n-x}$, x {0,1,…,n}

μ = mean = np, variance = σ^2 = npq

2) **Name** : Geometric **Shorthand** : X~ Ge(p)

pdf: $f(x) = q^{x-1} p$, x {1,2,… }

$\mu = \frac{1}{p}$ $\sigma^2 = q / p^2$

3) **Name** : Hypergeometric **Shorthand** : X~ H(N,D,n)

pdf: $f(x) = \frac{\binom{D}{x}\binom{N-D}{n-x}}{\binom{N}{n}}$

$\mu = n\frac{D}{N}$ $\sigma^2 = n\frac{D}{N}\left(1 - \frac{D}{N}\right)\left(\frac{N-n}{N-1}\right)$

4) **Name** : Poisson **Shorthand** : X ~ P(λ)

pdf: $f(x) = \frac{\lambda^x e^{-\lambda}}{x!}$, x { 0,1, … }

$\mu = \lambda$ $\sigma^2 = \lambda$

II. IMPORTANT CONTINUOUS DISTRIBUTIONS

1) **Name**: Normal **Shorthand**: X ~ N(μ,σ^2)

pdf: $f(x) = \frac{1}{\sqrt{2\pi}\ \sigma} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right)$

μ σ^2

2) **Name**: Gamma **Shorthand** : X ~ G(α,β)

pdf: $f(x) = \frac{x^{\alpha-1} e^{-x/\beta}}{\Gamma(\alpha)\beta^{\alpha}}$, $x > 0$

$\mu = \alpha\beta$ $\sigma^2 = \alpha\beta^2$

3) **Name**: Beta **Shorthand** : X ~ Be(α, β)

pdf: $f(x) = \frac{\Gamma(\alpha+\beta)}{\Gamma(\alpha)\Gamma(\beta)} x^{\alpha-1}(1-x)^{\beta-1}$, $0 < x < 1$

$\mu = \frac{\alpha}{\alpha+\beta}$ $\sigma^2 = \frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)}$

4) **Name**: Weibull **Shorthand** : X ~ We(α,β)

pdf: $f(x) = \alpha\beta x^{\beta-1}\exp(-\alpha x^{\beta})$

$\mu = \alpha^{-1/\beta}\Gamma(1+1/\beta)$ $\sigma^2 = \alpha^{-2/\beta}\Gamma(1+2/\beta) - \mu^2$

Notes on Linear Combinations of Random Variables

I. Summary of Reproductive Properties

$X_1, X_2, \ldots, X_k$ are independent random variables.

$$S = \sum_{i=1}^{k} X_i .$$

If	then
$X_i \sim B(n_i, p)$	$S \sim B(\sum_{i=1}^{k} n_i , p)$
$X_i \sim P(\lambda_i)$	$S \sim P(\sum_{i=1}^{k} \lambda_i)$
$X_i \sim G(\alpha_i, \beta)$	$S \sim G(\sum_{i=1}^{k} \alpha_i , \beta)$
$X_i \sim N(\mu_i, \sigma_i^2)$	$S \sim N(\sum_{i=1}^{k} \mu_i , \sum_{i=1}^{k} \sigma_i^2)$

II. Summary of expectation information for linear combinations of random variables.

$X_1, X_2, \ldots, X_k$ are random variables with means $E[X_i] = \mu_i$, variances $Var(X_i) = \sigma_i^2$, and covariances $\sigma_{ij} = Cov(X_i, X_j)$.

If

$$Y = \sum_{i=1}^{n} a_i X_i$$

then

$$\mu_Y = E(Y) = \sum_{i=1}^{n} a_i \mu_i$$

and

$$\sigma_Y^2 = \sum_{i=1}^{n} a_i^2 \sigma_i^2 + \sum_{i \neq j}\sum a_i a_j \sigma_{ij} .$$

If X and Y are independent random variables then $Cov(X,Y) = 0$.