Formula Sheet for Econ 221 Midterm

mean of data – sample or population	$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$	covariance – populaton	$Cov(x,y) = \sigma_{xy} = \frac{\sum_{i=1}^{N}(x_i - \mu_x)(y_i - \mu_y)}{N}$
variance of data – population	$\sigma^2 = \frac{\sum_{i=1}^{N}(x_i - \mu)^2}{N}$	covariance – sample	$Cov(x,y) = s_{xy} = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{n-1}$
variance of data – sample	$s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n\text{-}1}$		
counting – permutations	$P_x^n = n(n-1)(n-2)...(n-x+1) = \frac{n!}{(n-x)!}$	counting - combinations	$C_k^n = \frac{P_x^n}{x!} = \frac{n!}{x!\,(n-x)!}$
Expected Value – Discrete Random Variable			$E[X] = \mu = \sum_x xP(x)$
Variance – Discrete Random Variable			$\sigma^2 = E[(X-\mu)^2] = \sum_x (x-\mu)^2 P(x)$
Covariance – Discrete Random Variables			$Cov(X,Y) = E[(X-\mu_X)(Y-\mu_Y)] = \sum_x \sum_y (x-\mu_x)(y-\mu_y)P(x,y)$
Expected Value – Continuous Random Variable			$E[X] = \int_x x f(x)\,dx$
Variance – Continuous Random Variable			$Var[X] = E[(X - \mu)^2]$
Covariance – Continuous Random Variables			$Cov(X,Y) = E[(X-\mu_x)(Y-\mu_y)]$

For two of either discrete or continuous random variables,

$$\mu_W = E[W] = E[aX + bY] = a\mu_X + b\mu_Y \qquad \sigma_W^2 = a^2\sigma_X^2 + b^2\sigma_Y^2 + 2abCov(X,Y)$$

Discrete Random Variables: Probability Distribution Functions	
X ~ Bernoulli(p) E[X] = p, Var[X] = p(1-p)	$P(0) = (1-P)$ and $P(1) = P$
X ~ Binomial (n, p) E[X] = np, Var[X] = np(1-p)	$P(X = x)$ $= \frac{n!}{x!\,(n-x)!} P^X (1-P)^{n-X}$
X ~ Hypergeometric	$P(x) = \frac{C_x^S C_{n-x}^{N-S}}{C_n^N}$
X ~ Poisson(λ) E[X] = λ, Var[X] = λ	$P(x) = \frac{e^{-\lambda}\lambda^x}{x!}$

Continuous Random Variables: Probability Density and Cumulative Distribution Functions	
Uniform(a,b) E[X] = (a + b)/2 Var[X] = $(b - a)^2/12$	f(x) = $\frac{1}{b-a}$ if $a \le x \le b$ 0 otherwise
Exponential (λ) E[X] = $1/\lambda$, Var[X] = $1/\lambda^2$	Cumulative Distribution function: $F(t) = 1 - e^{-\lambda t}$