Characteristics of Probability Distributions

Econ 253

I. Expected Value, $E(X) = \sum_X X f(X)$

1. $E(b) = b$
2. $E(X + Y) = E(X) + E(Y)$
3. $E(X/Y) \neq \frac{E(X)}{E(Y)}$
4. $E(XY) \neq E(X)E(Y)$ in general, but
   $= E(X)E(Y)$ if X and Y are independent
5. $E(aX) = aE(X)$

II. Variance, $var(X) = \sigma_X^2 = E(X - \mu_X)^2 = \sum_X (X - \mu_X)^2 f(X)$

1. $var(b) = 0$
2. $var(X + b) = var(X)$
3. $var(aX) = a^2 var(X)$
4. $var(X + Y) = var(X) + var(Y) + 2cov(X, Y)$

III. Covariance, $cov(X, Y) = E[(X - \mu_X)(Y - \mu_Y)]$

1. $cov(X, Y) = 0$ if X, Y independent
2. $cov(a + bX, c + dY) = bdcov(X, Y)$
3. $cov(X, X) = var(X)$

IV. Correlation Coefficient, $\rho_{X,Y} = \frac{cov(X,Y)}{\sigma_X \sigma_Y}$