UNIVARIATE CASE

TERMINOLOGY	NOTATION	RELATED FORMULAS
RANDOM VARIABLE	X, Y, Z, etc.	
PARTICULAR VALUE OF A RANDOM VARIABLE	a, b, i, j, n, x, y, z, w etc.	
CUMULATIVE DISTRIBUTION FUNCTION (cdf) OR DISTRIBUTION FUNCTION (df)	F(.)	$F(b) = P(X \le b)$ $P\{a < X \le b\} = F(b) - F(a)$ FOR DISCRETE CASE $F(a) = \sum_{\text{all } x_i \le a} p(x_i)$ FOR CONTINUOUS CASE $F(a) = \int_{-\infty}^{a} f(x)dx$
PROBABILITY MASS FUNCTION (pmf) (discrete case)	p(.)	$p(a) = P(X=a)$
PROBABILITY DENSITY FUNCTION (pdf) (continuous case)	f(.)	$f(a) = \frac{d}{da}F(a)$ $P(X=a) = 0$ $P(X \in B) = \int_B f(x)dx$ $P\{a \le X \le b\} = \int_a^b f(x)dx$
EXPECTATION OF A RANDOM VARIABLE (EXPECTED VALUE OF X)	E[X]	FOR DISCRETE CASE $E[X] = \sum_{x:p(x)>0} xp(x)$ FOR CONTINUOUS CASE $E[X] = \int_{-\infty}^{\infty} xf(x)dx$
EXPECTATION OF A FUNCTION OF A RANDOM VARIABLE (g(X))	E[g(X)]	FOR DISCRETE CASE $E[g(X)] = \sum_{x:p(x)>0} g(x)p(x)$ FOR CONTINUOUS CASE $E[g(X)] = \int_{-\infty}^{\infty} g(x)f(x)dx$ IN GENERAL $E[aX + b] = aE[X] + b$
nth MOMENT OF A RANDOM VARIABLE	$E[X^n]$	FOR DISCRETE CASE $E[X^n] = \sum_{x:p(x)>0} x^n p(x)$ FOR CONTINUOUS CASE $E[X^n] = \int_{-\infty}^{\infty} x^n f(x)dx$
VARIANCE OF A RANDOM VARIABLE	Var(X)	$Var(X) = E[(X - E[X])^2] = E[X^2] - (E[X])^2$ $Var(aX + b) = a^2 Var(X)$
MOMENT GENERATING FUNCTION OF A RANDOM VARIABLE	$\phi(t)$ or $\phi_X(t)$	IN GENERAL $\phi(t) = E[e^{tX}]$ FOR DISCRETE CASE $\phi(t) = \sum_{x:p(x)>0} e^{tx}p(x)$ FOR CONTINUOUS CASE $\phi(t) = \int_{-\infty}^{\infty} e^{tx}f(x)dx$ IN GENERAL $\phi'(0) = E[X]$ $\phi^n(0) = E[X^n]$, $n \ge 1$

MULTIVARIATE CASE
(JOINTLY DISTRIBUTED RANDOM VARIABLES)

TERMINOLOGY	NOTATION	RELATED FORMULAS
JOINT CUMULATIVE PROBABILITY DISTRIBUTION FUNCTION (jcdf or jdf) OF X AND Y	F(.,.)	$F(a,b) = P\{X \le a, Y \le b\}$
MARGINAL DISTRIBUTION FUNCTION OF X (Y)	$F_X(.)$ $(F_Y(.))$	$F_X(a) = F(a,\infty) = P\{X \le a\}$ $(F_Y(B) = F(\infty,b) = P\{Y \le b\})$
JOINT PROBABILITY MASS FUNCTION OF X AND Y (jpmf) (discrete case)	p(.,.)	$p(x,y) = P\{X=x, Y=y\}$ $p_X(x) = \sum_{y:p(x,y)>0} p(x,y)$ $p_Y(y) = \sum_{x:p(x,y)>0} p(x,y)$
JOINT PROBABILITY DENSITY FUNCTION OF X AND Y (jpdf) (continuous case)	f(.,.)	$P(X \in A, Y \in B) = \int_B \int_A f(x,y)dxdy$ $f_X(x) = \int_{-\infty}^{\infty} f(x,y)dy$ $f_Y(y) = \int_{-\infty}^{\infty} f(x,y)dx$
EXPECTATION OF FUNCTIONS OF TWO VARIABLES X AND Y	E[g(X,Y)]	FOR DISCRETE CASE $E[g(X,Y)] = \sum_y \sum_x g(x,y)p(x,y)$ FOR CONTINUOUS CASE $E[g(X,Y)] = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} g(x,y)f(x,y)dxdy$
THE COVARIANCE OF X AND Y	Cov(X,Y)	IN GENERAL $Cov(X,Y) = E[(X - E[X])(Y - E[Y])]$ $= E[XY] - E[X]E[Y]$ $Var(X + Y) = Var[X] + Var[Y] + 2Cov[X,Y]$ $Var[X - Y] = Var[X] + Var[Y] - 2Cov[X,Y]$ If X and Y are independent then $Cov[X,Y] = 0$