Discrete Distributions

Distribution	Probability Mass Function (PMF)	Expected Value	Variance
Discrete Random Variable (x)	$P(x)$	$E(x) = \sum x \cdot P(x)$	$\sigma^2 = \sum x^2 \cdot P(x) - [E(x)]^2$
Geometric(p)	$P(x) = p(1-p)^{x-1}$ x=1, 2,…	$E(x) = \frac{1}{p}$	$\sigma^2 = \frac{(1-p)}{p^2}$
Bernoulli(p)	$P(x) = p^x(1-p)^{1-x}$ x=0,1,…, n	$E(x) = p$	$\sigma^2 = p(1-p)$
Binomial(n, p)	$P(x) = \binom{n}{r} p^x(1-p)^{n-r}$ x= 0,1, …, n	$E(x) = np$	$\sigma^2 = np(1-p)$
Multinomial $(\mathbf{n_1, n_2, \ldots n_k, p_1, p_2, \ldots p_k})$	$P(x_1 \ldots x_k) = \frac{n!}{n_1!\, n_2! \ldots \ldots n_k!} p_1^{x_1} p_2^{x_2} \ldots p_k^{x_k}$	$E(x_i) = np_i$	$Var(x_i) = np_i(1-p_i)$
Negative Binomial(r, p)	$P(x) = \binom{x-1}{r-1} p^r q^{x-r}$ x= r, r+1,…	$E(x) = \frac{r}{p}$	$\sigma^2 = \frac{r(1-p)}{p^2}$
Hypergeometric(N, r, n)	$P(x) = \frac{\binom{r}{x}\binom{N-r}{n-x}}{\binom{N}{n}}$ $\max(0, r-(N-r)) \le x \le \min(r, n)$	$E(x) = \frac{nr}{N}$	$\sigma^2 = n \cdot \left(\frac{r}{N}\right) \cdot \left(\frac{N-r}{N}\right) \cdot \left(\frac{N-n}{N-1}\right)$
Poisson (λ)	$P(x) = \frac{\lambda^x e^{-\lambda}}{x!}$ x= 0,1, 2…	$E(x) = \lambda$	$\sigma^2 = \lambda$
Discrete Uniform U(a, b, 1)	$P(x) = \frac{1}{b-a+1}$ $x = a, a+1, \ldots, b$	$E(x) = \frac{a+b}{2}$	$\sigma^2 = \frac{(b-a+2)(b-a)}{12}$
Equal Spaced Discrete Uniform U(a, b, c)	$P(x) = \frac{c}{(b-a)+c}$ $x = a, a+c, a+2c, \ldots, b$	$E(x) = \frac{a+b}{2}$	$\sigma^2 = \frac{(b-a+2c)(b-a)}{12}$