# RV Catalog, Math 464, Fall 2010

$\mu$ is the mean, $\sigma^2$ is the variance, $M(t) = E[e^{tX}]$ is the moment generating function.

**Binomial (2 parameters, $p \in [0,1]$ and positive integer $n$) :**

$$P(X=k) = \binom{n}{k} p^k \, (1-p)^{n-k}, \quad k = 0,1,2,\ldots,n$$

$$\mu = np, \quad \sigma^2 = np(1-p), \quad M(t) = (pe^t + 1 - p)^n$$

**Geometric (1 parameter $p \in (0,1]$) :**

$$P(X=k) = p(1-p)^{k-1}, \quad k = 1,2,\ldots$$

$$\mu = \frac{1}{p}, \quad \sigma^2 = \frac{1-p}{p^2}, \quad M(t) = \frac{pe^t}{1-(1-p)e^t}$$

**Poisson (1 parameter $\lambda > 0$) :**

$$P(X=k) = \frac{e^{-\lambda}\lambda^k}{k!}, \quad k = 0,1,2,\ldots \qquad \mu = \lambda, \quad \sigma^2 = \lambda, \quad M(t) = \exp(\lambda(e^t - 1))$$

**Negative binomial (2 parameters, $p \in [0,1]$ and positive integer $n$) :**

$$P(X=k) = \binom{k-1}{n-1} p^n \, (1-p)^{k-n}, \quad k = n, n+1, n+2, \ldots$$

$$\mu = \frac{n}{p}, \quad \sigma^2 = \frac{n(1-p)}{p^2}, \quad M(t) = \left[\frac{pe^t}{1-(1-p)e^t}\right]^n$$

**Exponential (1 parameter, $\lambda > 0$) :**

$$f(x) = \lambda e^{-\lambda x}, \quad x \geq 0, \qquad \mu = \frac{1}{\lambda}, \quad \sigma^2 = \frac{1}{\lambda^2}, \quad M(t) = \frac{\lambda}{\lambda - t}$$

**Normal (2 parameters, $\mu$ and $\sigma^2 > 0$) :**

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right), \qquad M(t) = \exp(\mu t + \frac{1}{2}\sigma^2 t^2)$$

The standard normal is the special case of $\mu = 0, \sigma = 1$.

**Gamma (2 parameters, $\lambda > 0$, $w > 0$):**

$$f(x) = \frac{\lambda^w}{\Gamma(w)} x^{w-1} e^{-\lambda x}, \quad x \geq 0$$

$$\mu = \frac{w}{\lambda}, \quad \sigma^2 = \frac{w}{\lambda^2}, \quad M(t) = \left(\frac{\lambda}{\lambda - t}\right)^w$$

**Uniform on $[a,b]$:**

$$f(x) = \frac{1}{b-a}, \quad a \leq x \leq 1, \qquad \mu = \frac{a+b}{2}, \qquad \sigma^2 = \frac{(b-a)^2}{12}, \qquad M_X(t) = \frac{e^{tb} - e^{ta}}{t(b-a)}$$