

$$\sum_{y=0}^n \binom{n}{y} P^y (1-P)^{n-y} = 1$$

$$(P + (1-P))^n = 1$$

$$(a+b)^n$$

i.e.

$$Y = \sum_{i=1}^n Y_i$$

$$Y_i = \begin{cases} 1 \\ 0 \end{cases}$$

i^{th} trial
is success

i^{th} trial
is failure

$$\sum_y y p(y) = np$$

$$\sum_{y=1}^{\infty} \frac{\lambda^{y-1}}{(y-1)!} = \frac{\lambda^0}{0!} + \frac{\lambda^1}{1!} + \frac{\lambda^2}{2!} + \dots$$

$$= \sum_{j=0}^{\infty} \frac{\lambda^j}{j!}$$

$$V[Y] = E[(Y - E[Y])^2]$$

$$= E[Y^2] - \{E[Y]\}^2$$

$$= E[Y(Y-1)] + E[Y] + E[Y] - \{E[Y]\}^2$$

$$F(y) = \int_{-\infty}^y f(t) dt$$

$$= \int_0^y f(t) dt$$

$$\frac{1}{\sqrt{2\pi}\sigma^2} \int_{-\infty}^{\infty} y \exp\left\{-\frac{1}{2\sigma^2} (y-\mu)^2\right\} dy$$

$$t = y - \mu$$

$$\Leftrightarrow y = t + \mu.$$

$\Rightarrow$ integral is

$$\frac{1}{\sqrt{2\pi}\sigma} \int_{-\infty}^{\infty} (t+\mu) \exp\left\{-\frac{t^2}{2\sigma^2}\right\} dt$$

$$= N \int_{-\infty}^{\infty} \frac{1}{\sqrt{2\pi}\sigma^2} e^{-t^2/2\sigma^2} dt + \int_{-\infty}^{\infty} \frac{t}{\sqrt{2\pi}\sigma^2} e^{-t^2/2\sigma^2} dt$$

$$N \int_{-\infty}^{\infty} \frac{1}{\sqrt{2\pi}\sigma} e^{-t^2/2\sigma^2} dt = \mu$$

$$\int_{-\infty}^{\infty} t \frac{1}{\sqrt{2\pi}\sigma} e^{-t^2/2\sigma^2} dt = 0$$

$$Y \sim N(\mu, \sigma^2)$$

$$Z = \frac{Y - \mu}{\sigma}$$

$$F_Z(z) = P(Z \leq z) = P\left(\frac{Y - \mu}{\sigma} \leq z\right)$$

$$= P(Y \leq \sigma z + \mu)$$

$$= \int_{-\infty}^{\sigma z + \mu} \frac{1}{(\sqrt{2\pi}\sigma)^{1/2}} \exp\left\{-\frac{1}{2\sigma^2}(\sigma t + \mu - \mu)^2\right\} dt$$