

Theory

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1

Starting from q trials we will get q successful values.

$$\begin{aligned}
 p(\eta = q) &= \sum_{k=q}^{\infty} p(\eta = q | \xi = k) \cdot p(\xi = k) = \sum_{k=q}^{\infty} \binom{k}{q} p^q (1-p)^{(k-q)} \frac{\lambda^k}{k!} e^{-\lambda} \\
 &= \frac{p^q \lambda^q}{q!} e^{-\lambda} \sum_{k=q}^{\infty} \frac{(1-p)^{(k-q)} \lambda^{(k-q)}}{(k-q)!} \stackrel{Taylor}{\approx} \frac{p^q \lambda^q}{q!} e^{-\lambda} e^{-\lambda(1-p)} = \frac{(p\lambda)^q}{q!} e^{-p\lambda}
 \end{aligned}$$

2

$$p(kind | t = 10) = \frac{p(kind) \cdot p(t = 10, \mu_2, \sigma_2)}{p(strict) \cdot p(t = 10, \mu_1, \sigma_1) + p(kind) \cdot p(t = 10, \mu_2, \sigma_2)}$$

$$p(kind | 10 \leq t < 10 + \delta) = \frac{p(10 \leq t < 10 + \delta | kind) p(kind)}{p(10 \leq t < 10 + \delta)}$$

$$\begin{aligned}
 \lim_{\delta \rightarrow 0} \int_{10}^{10+\delta} f_{t|kind}(\hat{t}) d\hat{t} &= f_{t|kind}(10) \cdot \delta \\
 \lim_{\delta \rightarrow 0} \int_{10}^{10+\delta} f_t(\hat{t}) d\hat{t} &= f_t(10) \cdot \delta
 \end{aligned}$$

$$\frac{p(kind) \cdot f(t = 10, \mu_2, \sigma_2) \cdot \delta}{p(strict) \cdot f(t = 10, \mu_1, \sigma_1) \cdot \delta + p(kind) \cdot f(t = 10, \mu_2, \sigma_2) \cdot \delta} = \frac{0.0108}{0.0162} = \frac{2}{3}$$