Modelo M/M/1

$$p_n = (1-\rho)(\rho)^n$$

$$\rho = \lambda/\mu$$

$$L = \frac{\rho}{1-\rho}$$

$$F_W(t) = 1 - e^{-(\mu-\lambda)t}$$

Modelo M/M/c:

$$p_n = \begin{cases} p_0 \dfrac{(\lambda/\mu)^n}{n!} & (n < c) \\ p_0 \dfrac{c^c}{c!}\left(\dfrac{\lambda}{c\mu}\right)^n & (n \ge c) \end{cases}$$

$$\rho = \frac{\lambda}{c\mu}$$

$$p_0 = \left[\sum_{n=0}^{c-1} \frac{(\lambda/\mu)^n}{n!} + \frac{(\lambda/\mu)^c}{c!(1-\rho)}\right]^{-1}$$

$$P_q = \frac{p_c}{1-\rho} = E_c(c,u)$$

$$L = \frac{P_q \rho}{1-\rho} + c\rho$$

Modelo M/M/c/c:

$$p_n = p_0 \left(\frac{\lambda}{\mu}\right)^n \frac{1}{n!} \quad (0 \le n \le c)$$

$$p_0 = \left[\sum_{n=0}^{c} \left(\frac{\lambda}{\mu}\right)^n \frac{1}{n!}\right]^{-1}$$

Modelo M/G/1:

$$L = \frac{\lambda^2 \mathrm{E}\left[S^2\right]}{2(1-\rho)} + \rho$$

$$\rho = \lambda/\mu$$

Modelo M/M/1/K:

$$p_n = p_0 \left(\frac{\lambda}{\mu}\right)^n \quad (0 \le n \le K)$$

$$p_0 = \begin{cases} \left[\dfrac{1-\lambda/\mu}{1-(\lambda/\mu)^{K+1}}\right] & (\lambda \ne \mu) \\ \dfrac{1}{K+1} & (\lambda = \mu) \end{cases}$$

$$\rho = \begin{cases} \dfrac{\lambda}{\mu}\left[\dfrac{1-(\lambda/\mu)^K}{1-(\lambda/\mu)^{K+1}}\right] & (\lambda \ne \mu) \\ \dfrac{K}{K+1} & (\lambda = \mu) \end{cases}$$

$$L = \begin{cases} \dfrac{\lambda/\mu}{1-\lambda/\mu}\left[\dfrac{1-(K+1)(\lambda/\mu)^k + K(\lambda/\mu)^{K+1}}{1-(\lambda/\mu)^{K+1}}\right] & (\lambda \ne \mu \\ \dfrac{K}{2} & (\lambda = \mu \end{cases}$$

Modelo M/M/1//M

$$p_n = p_0 \binom{M}{n} n! \left(\frac{\lambda}{\mu}\right)^n = p_0 \frac{M!}{(M-n)!}\left(\frac{\lambda}{\mu}\right)^n$$

$$p_0 = \left[\sum_{n=0}^{M} \frac{M!}{(M-n)!}\left(\frac{\lambda}{\mu}\right)^n\right]^{-1}$$

$$\rho = 1 - p_0$$

$$L = M - \frac{\lambda'}{\lambda} = M - \frac{\mu}{\lambda}\rho$$

Modelo M/M/c//M

$$p_n = \begin{cases} p_0 \dbinom{M}{n}\left(\dfrac{\lambda}{\mu}\right)^n & (0 \le n < c) \\ p_0 \dbinom{M}{n} \dfrac{n!}{c^{n-c} c!}\left(\dfrac{\lambda}{\mu}\right)^n & (c \le n < M) \end{cases}$$

$$p_0 = \left[\sum_{n=0}^{c-1} \binom{M}{n}\left(\frac{\lambda}{\mu}\right)^n + \sum_{n=c}^{M} \binom{M}{n} \frac{n!}{c^{n-c} c!}\left(\frac{\lambda}{\mu}\right)^n\right]^{-1}$$

$$\rho = 1 - \sum_{n=0}^{c-1} p_n \frac{c-n}{c}$$

$$L = M - \frac{\lambda'}{\lambda} = M - \frac{c\mu}{\lambda}\rho$$