FORMULARIO

- **Cola M/M/1**

$$p_n = (1-\rho)\rho^n \qquad n = 0, \ldots \qquad (\rho = \tfrac{\lambda}{\mu})$$
$$L = \frac{\rho}{1-\rho}; \qquad L_q = \frac{\rho^2}{1-\rho}; \quad W = \frac{1}{\mu(1-\rho)}; \qquad W_q = \frac{\rho}{\mu(1-\rho)}$$

- **Cola M/M/1/k**

$$p_n = \frac{1-\rho}{1-\rho^{k+1}}\rho^n \quad n = 0, \ldots, k; \quad (\rho = \frac{\lambda}{\mu} \neq 1) \qquad (p_n = \frac{1}{k+1} \quad \rho = 1);$$
$$\lambda_{EF} = \lambda(1-p_k) \quad \lambda_{PERD.} = \lambda p_k; \quad L = E[N]; \quad \ldots$$

- **Cola M/G/1**

$$L = \rho + \frac{\rho^2 + \lambda^2\sigma_S^2}{2(1-\rho)} \qquad \ldots \qquad (\rho = \frac{\lambda}{\mu})$$

- **Sistema Cerrado o Fuente Finita (m) con un servidor(M/M/1)**

$$p_n = \frac{m!}{(m-n)!}\rho^n p_0 = (m-n+1)\rho p_{n-1} \quad n = 0, \ldots, m \quad (\rho = \frac{\lambda}{\mu}) \qquad p_0 = (1 + \sum_{n=1}^{m} \frac{m!\rho^n}{(m-n)!})^{-1}$$
$$L = m - \frac{1-p_0}{\rho}; \qquad L_q = m - \frac{1+\rho}{\rho}(1-p_0); \quad W_q = \frac{L_q}{(m-L)\lambda} = \frac{1}{\mu}(\frac{m}{1-p_0} - \frac{1+\rho}{\rho}); \quad \ldots$$

- **Cola M/M/c**

$$p_n = \begin{cases} \frac{1}{n!}\left(\frac{\lambda}{\mu}\right)^n p_0 = \frac{c\rho}{n}p_{n-1} & 1 \leq n < c \\ \frac{1}{c!c^{n-c}}\left(\frac{\lambda}{\mu}\right)^n p_0 = \rho p_{n-1} & n \geq c \end{cases} \qquad (\rho = \tfrac{\lambda}{c\mu}) \qquad p_0 = \frac{1}{\frac{(c\rho)^c}{c!(1-\rho)} + \sum_{n=0}^{c-1}\frac{(c\rho)^n}{n!}};$$
$$L = \frac{(c\rho)^c\rho}{c!(1-\rho)^2}p_0 + c\rho; \qquad L_q = \frac{(c\rho)^c\rho}{c!(1-\rho)^2}p_0; \qquad \ldots$$

- **Cola M/M/c/k**

$$p_n = \begin{cases} \frac{1}{n!}\left(\frac{\lambda}{\mu}\right)^n p_0 = \frac{c\rho}{n}p_{n-1} & 1 \leq n < c \\ \frac{1}{c!c^{n-c}}\left(\frac{\lambda}{\mu}\right)^n p_0 = \rho p_{n-1} & c \leq n \leq k \end{cases} \qquad p_0 / \sum_{n=0}^{k} p_n = 1 \qquad (\rho = \frac{\lambda}{c\mu}) \neq 1$$
$$L_q = p_0\frac{(c\rho)^c\rho}{c!(1-\rho)^2}[1 - \rho^{k-c+1} - (k-c+1)(1-\rho)\rho^{k-c}]; \qquad \lambda_{EF} = (1-p_k)\lambda \quad \lambda_{PERD.} = p_k\lambda; \quad \ldots$$

- **Sistema Cerrado o Fuente Finita (m) con c servidores (M/M/c)**

$$p_n = \begin{cases} \binom{m}{n}\left(\frac{\lambda}{\mu}\right)^n p_0 & 1 \leq n \leq c \\ \binom{m}{n}\frac{n!(\lambda/\mu)^n}{c!c^{n-c}}p_0 & c \leq n \leq m \end{cases} \qquad p_0 = / \sum_{n=0}^{m} p_n = 1; \quad L = E[N]; \qquad \lambda_{EF} = \lambda(m-L); \quad \ldots$$