# Caractéristiques des Systèmes d'Attente

- **Caractéristiques générales :**
  1. $L = \lambda \times W$.
  2. $L_q = \lambda \times W_q$.
  3. $W = W_q + 1/\mu$.
  4. $L = L_q + \lambda/\mu$.
- **M/M/1 :**
  1. $P_n = (1 - \frac{\lambda}{\mu}) \times \left(\frac{\lambda}{\mu}\right)^n$.
  2. $\rho = \frac{\lambda}{\mu}$.
  3. $L = \frac{\rho}{1-\rho}$.
  4. $L_q = \frac{\rho^2}{1-\rho}$.
  5. $W = \frac{1}{\mu \times (1-\rho)}$.
  6. $W_q = \frac{\rho}{\mu \times (1-\rho)}$.
- **M/M/s :**
  1. $P_n = \begin{cases} \frac{(\lambda/\mu)^n}{n!} \times P_0 & n \leq s, \\ \frac{(\lambda/\mu)^n}{s! \times s^{n-s}} \times P_0 & n \geq s. \end{cases}$
  2. $\rho = \lambda/s\mu$.
  3. $P_0 = \left[\sum_{n=0}^{s} \frac{(\lambda/\mu)^n}{n!} + \frac{(\lambda/\mu)^{s+1}}{s! \times (s-\lambda/\mu)}\right]^{-1}$.
  4. $P(attente) = \frac{P_s}{1-\rho}$.
  5. $L_q = \frac{\lambda^s \times \rho \times P_0}{\mu^s \times s! \times (1-\rho)^2}$.
  6. $L = s \times \rho + \frac{\rho \times P_s}{(1-\rho)^2}$.
- **M/M/1/k :**
  1. $\rho = \frac{\lambda}{\mu}$.
  2. $P_n = \rho^n \times P_0$.
  3. $P_0 = \frac{1-\rho}{1-\rho^{k+1}}$.
  4. $L = \frac{\rho}{1-\rho} - (k+1) \times \frac{\rho^{k+1}}{1-\rho^{k+1}}$.
  5. $W = \frac{L}{\lambda \times (1-P_k)}$.
  6. $L_q = L - (1 - P_0)$.
  7. $W_q = \frac{L_q}{\lambda(1-P_k)}$.