Stocks

*caso básico:

$$CTE = bD + \frac{1}{2} q c_1 T + k\frac{D}{q}$$

$$n = \frac{D}{q} = \frac{T}{t} \; ; \; q_0 = \sqrt{\frac{2kD}{Tc_1}} \qquad \gamma = \frac{k'}{k}$$

$$\lambda = \frac{CVT}{CVT_0} \; , \; \alpha = \frac{q}{q_0} = \sqrt{\frac{\gamma\,\delta}{\beta}} \qquad \delta = \frac{D'}{D} \qquad \beta = \frac{c_1'}{c_1}$$

$$\lambda = \frac{1}{2}\left(\alpha + \frac{1}{\alpha}\right)$$

$$S_R = L_T \cdot d$$

$$\varepsilon = \frac{1}{2}\left(\alpha + \frac{1}{\alpha}\right) - 1$$

*reposición no instantánea:

$$S = q\left(1 - \frac{d}{p}\right)$$

$$CTE = bD + \frac{1}{2} q\left(1 - \frac{d}{p}\right) c_1 T + k\frac{D}{q}$$

$$q_0 = \sqrt{\frac{2kD}{T c_1 \left(1 - \frac{d}{p}\right)}}$$

$L_T \le t - t_{1p}$:

$$S_R = L_T \cdot d$$

$L_T > t - t_{1p}$:

$$S_R = (t - L_T)(p - d)$$

$$t_{1p} = \frac{q}{p} = \frac{S}{p - d}$$

$$t_{1d} = \frac{S}{d}$$

*+ agotamiento:

$$CTE = bD + \frac{1}{2}\frac{S^2 c_1 T}{q\left(1 - \frac{d}{p}\right)} + \frac{kD}{q} + \frac{1}{2}\frac{S_A^2 c_2 T}{q\left(1 - \frac{d}{p}\right)}$$

$$SA_0 = \frac{c_1 q_0 \left(1 - \frac{d}{p}\right)}{c_1 + c_2}$$

*con stock de seguridad:

$$CTE' = CTE + S_p c_1 T$$

$$n' = n \; ; \; q_0' = q_0$$

$$S_R' = S_R + S_p$$

*con agotamiento:

$$q_0' = q_0 \cdot \sqrt{\frac{c_1 + c_2}{c_2}}$$

stock máximo

stock de agotamiento

$$CTE' = bD + \frac{1}{2}\frac{S^2}{q} c_1 T + \frac{1}{2}\frac{S_A^2}{q} c_2 T + k\frac{D}{q}$$

$$S = q - S_A \qquad S_R' = S_R - S_A$$

$$t_1 = \frac{S \cdot t}{q_0} \oplus t_2 = \frac{S_A \cdot t}{q_0} \Rightarrow t = \frac{T}{n}$$

*costo independiente del tiempo:

$$CTE'' = CTE' + S_A \cdot f_2 \frac{D}{q}$$

$$q_0 = \sqrt{\frac{2kD}{Tc_1} - \frac{(f_2 D)^2}{c_1(c_1 + c_2)}} \cdot \sqrt{\frac{c_1 + c_2}{c_1}}$$

*costo fijo → lo sumo al k

$$SA_0 = \frac{c_1 q_0 - f_2 D}{c_1 + c_2}$$

Fórmulas generales ⇒

$$\boxed{CTE = bD + \frac{1}{2}\frac{\left[q(1-\frac{d}{p})-S_A\right]^2}{q(1-d/p)} c_1 T + \frac{1}{2}\frac{S_A^2}{q(1-d/p)} c_2 T + k\frac{D}{q} + S_A f_2 \frac{D}{q} + F\frac{D}{q} + S_p c_1 T}$$

$$\boxed{q_0 = \sqrt{\frac{2(k+F_2)D}{Tc_1(1-\frac{d}{p})} - \frac{(f_2 D)^2}{c_1(c_1+c_2)}}\sqrt{\frac{c_1+c_2}{c_2}}}$$

$$\boxed{S_{A0} = \frac{(c_1 q_0 - f_2 D)(1-d/p)}{c_1+c_2}}$$

* Producción → objetivo: determinar el tamaño de lote de descarga

$S_R = S_{max} - L_T \cdot p$

$S_D = S_F + S_p + \cancel{q}^{\,S} + S_E$ ↳ espacio extra

fondo

• c/ descarga no instantánea: $L_T < t_p$: $S_R = S - pL_T$

$S = q\left(1 - P/d\right)$ $\qquad$ $L_T > t_p$: $S_R = (L_T - t_p)(d-p)$

* <u>Varios Items</u>:

$\mathcal{L} = f(x_1, x_n) + \sum_{i=1}^{m} \lambda_i \left[g_i(x_1, x_m) - b_i\right]$

$T_i^{\circ} \cdot T_O = \frac{1}{2}\left[\sum \sqrt{D_i b_i}\right]^2$

⇒ $T_i = \lambda T_O \Rightarrow q_{oi} = \sqrt{\frac{2\lambda D_i}{b_i}}$

⇒ $T_O = \mu T_i^{\circ} \Rightarrow q_{oi} = \sqrt{\frac{2D_i}{\mu b_i}}$

* Demanda aleatoria:

$CTE(S) = \sum_{0}^{S}(S-x)\,c_e\,p(x) + \sum_{S+1}^{\infty}(x-S)\,f_2\,p(x)$

$b\cdot p_R$

lo q pierdo si sub estimo

$L(S_0-1) \leq \frac{c_2}{c_1+c_2} \leq L(S_0)$

$L(S) = p(x \leq S) + \sum_{S+1}^{\infty}\frac{p(x)}{x}(S + 1/2)$

Stock máximo

$P(x \leq S_0-1) \leq \frac{f_2}{c_e+f_2} \leq P(x \leq S_0)$

ó $\quad \frac{f_2}{c_e+f_2} = F(x)$ → $F_N\left(\frac{x-\mu}{\sigma}\right)$

Colas

Sistemas de colas

$$\boxed{p(n) = \frac{\lambda_{n-1}}{\mu_n} p(n-1)}$$

$$\boxed{\mu_n = \mu\, p(s/n)}$$

1. $M \to \begin{cases} n\mu & 0 < n < M \\ M\mu & n \geq M \end{cases}$

2. $A_n \to \{ \mu + A_n$

$$\boxed{\lambda_n = \lambda \times p(i/n)}$$

1. $N \to \lambda_N = 0$

2. impaciencia: $p(i/n) = f(n)$

3. $N' \to \lambda_n = (N'-n)\lambda_r\, p(i/n)$

$\oplus$

$$\boxed{\sum_0^{\infty} p(n) = 1}$$

$\oplus$

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

* Ecuaciones generales:

$$L = \sum_0^{\infty} n p(n)$$

$$L_c = \sum_{M+1}^{\infty} (n-M) p(n)$$

$$H = \sum_1^{M} n p(n) + \sum_{M+1}^{\infty} M p(n)$$

$L = L_c + H$

$\%$ ocup. del canal $= \frac{H}{M} \times 100$

$$\bar{\lambda} = \sum_0^{N} \lambda_n p(n) = \lambda - \bar{R}$$

$$\bar{\mu} = \sum_0^{N} \mu_n p(n) = \mu H$$

$\bar{\lambda} = \bar{\mu} + \bar{A}$

$$W_c = \frac{L_c}{\bar{\lambda}}$$

$$W = \frac{L}{\bar{\lambda}}$$

$W = W_c + T_s$

* Población Finita:

$U = T_r = 1/\lambda_r$

$J = N' - n$

$X = \frac{T_s}{T_s + U}$ (f. de servicio)

$F = \frac{T_s + U}{T_s + U + W_c}$ (f. de eficiencia)

* P/P/1:

. $p(n) = \rho^n (1-\rho) \to P_0 = 1-\rho$

. $L = \frac{\lambda}{\mu - \lambda}$ $\oplus$ $L_c = L - \rho$, $H = \rho$

. $w(t) = e^{-(\mu-\lambda).t}$. $w_c(t) = \rho\, w(t)$

. $P(n \geq 4) = \rho^4$. $p(n > 4) = \rho^{4+1}$

. $\mu_o = \lambda + \sqrt{\frac{\lambda C_e}{C_s}}$

* P/P/1/N: $\bar{R} = \lambda p(N)$

* Tareas simultáneas:

$T_A > T_B$ $\quad T_S = T_A + \frac{T_B^2}{T_A + T_B}$

* P/P/M:

. $\rho / M < 1$

Redes de colas

$[P(1)\ P(2) \cdots P(N)] * \mathbf{P} = [P(1)\ P(2) \ldots P(N)]$

$$P = \begin{array}{c|c} & \begin{array}{cccc} 0 & 1 & 2 & 3 \end{array} \; j \\ i & \\ \begin{array}{c} 0 \\ 1 \\ 2 \\ 3 \end{array} & \left[\begin{array}{c} \text{La matriz de} \\ \text{transición de } i \\ \text{a } j \\ \\ \end{array} \right] \end{array}$$

ó $\underbrace{\sum_i p(n).p(n,i)}_{\text{saliente}} = \underbrace{\sum_j p(j).p(i,n)}_{\text{entrante}}$

* $W = W_A . P_A + W_B . P_B$
* $\psi = \rho / M$

* Redes cerradas $\rightarrow N' = L =$ conocido
  $\hookrightarrow \lambda = \mu [1 - P(N)]$
  La prob. de que no pueda entrar

* sistemas vinculados $\rightarrow$ dibujar $\neq$ estados posibles y dsps ver cada uno con el otro sistema

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