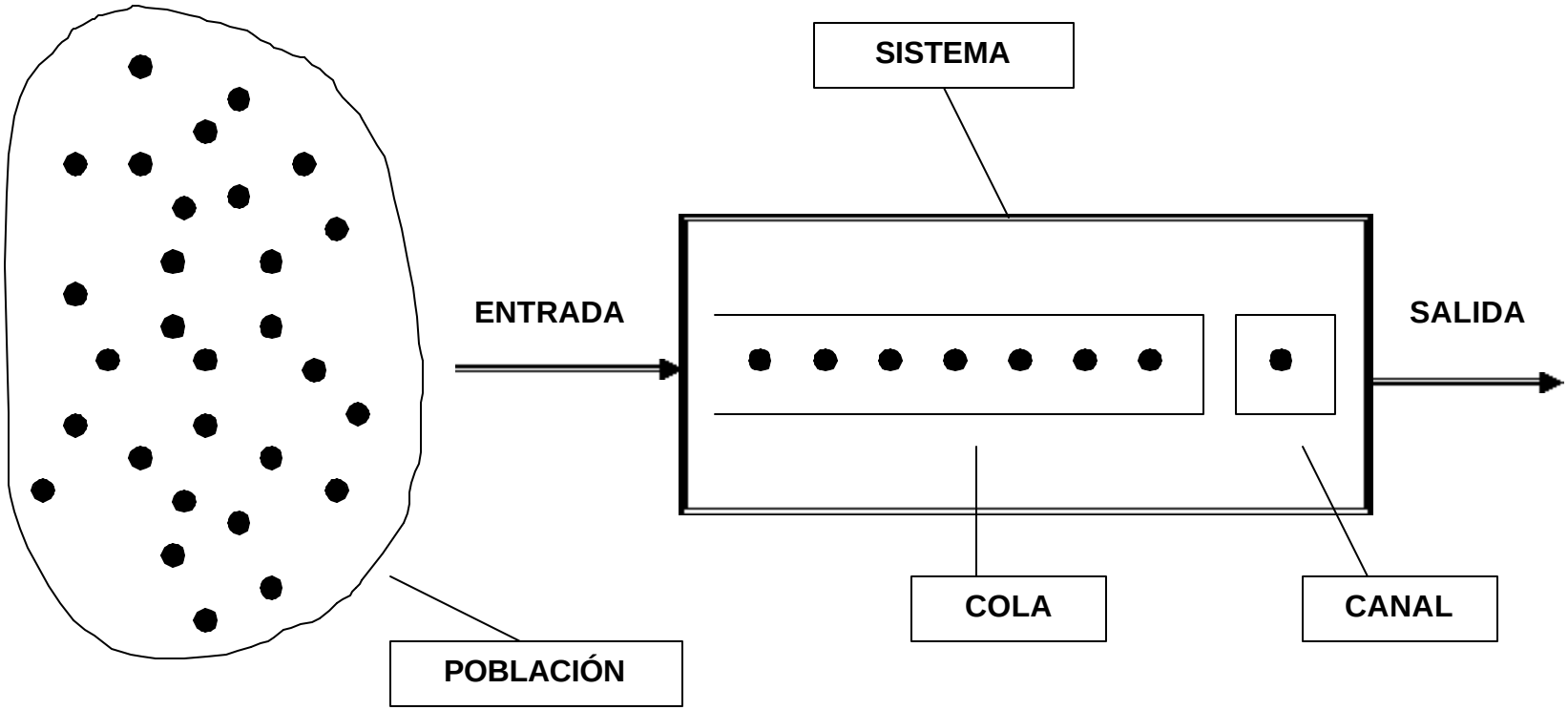
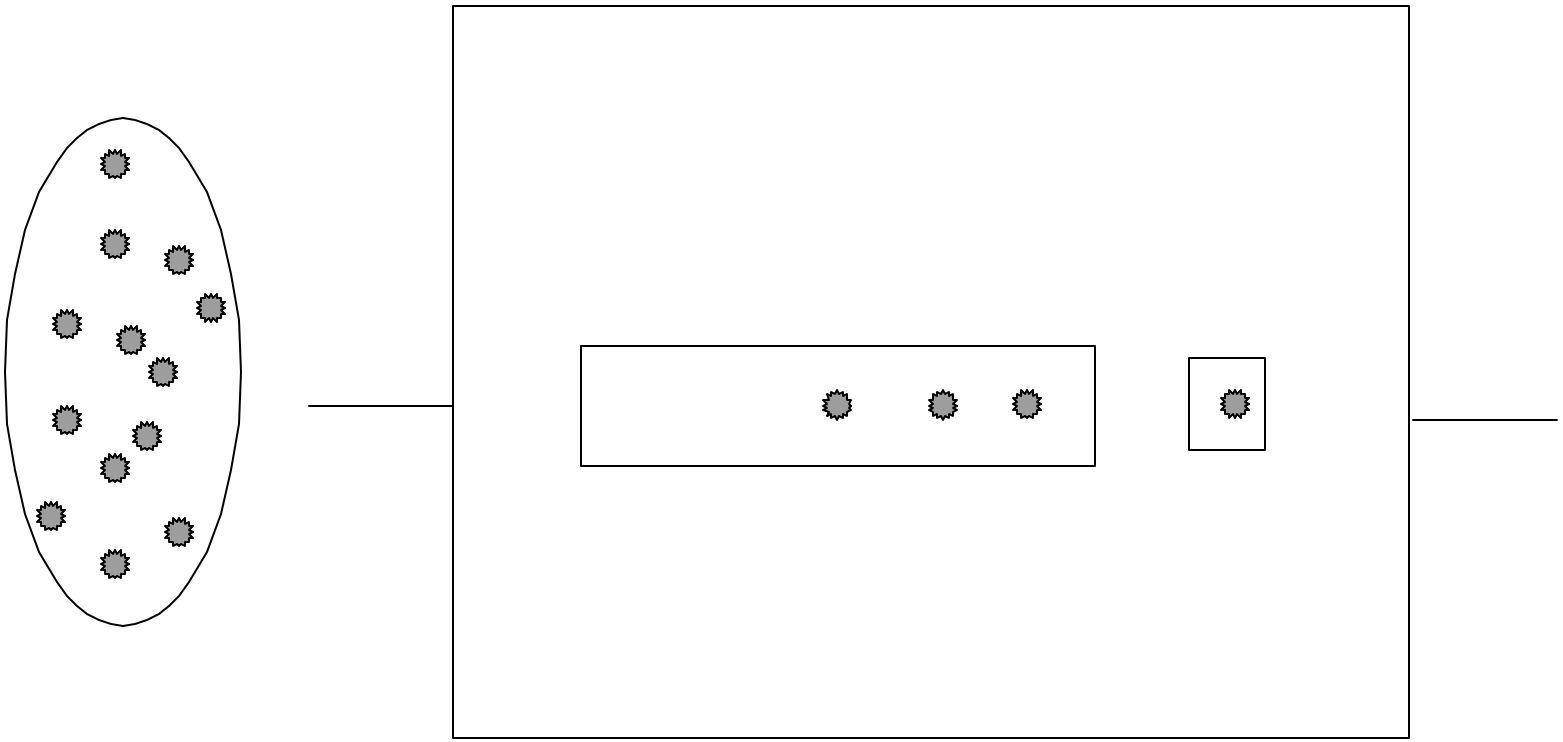
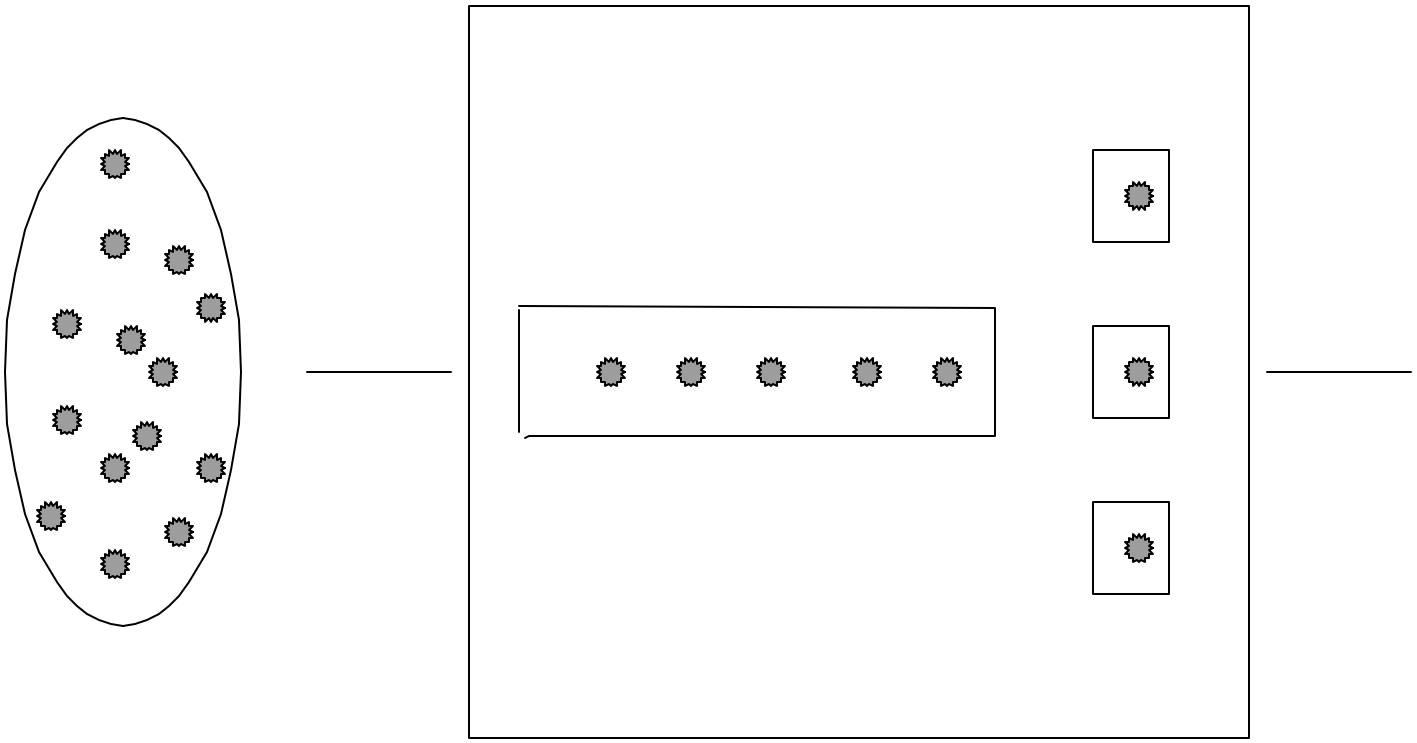

SISTEMA
ENTRADA
SALIDA
COLA
CANAL
POBLACIÓN

- POBLACION
- ARRIBOS
- IMPACIENCIA
- CAPACIDAD
- INGRESO AL SISTEMA
- PRIORIDAD O DISCIPLINA
- DURACION
- EGRESO DEL SISTEMA





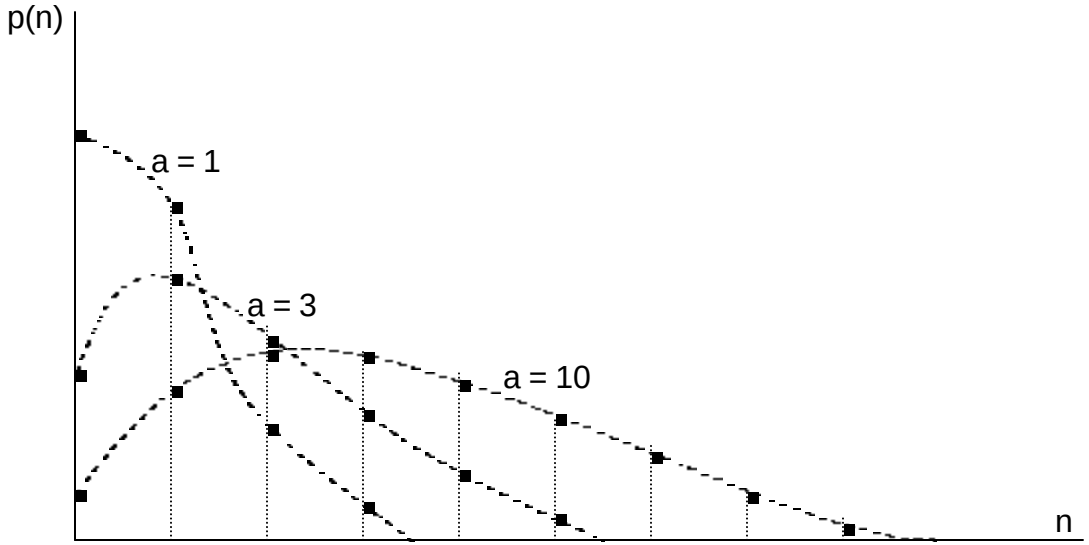
NOTACION KENDALL

_ _ _ _ _ (_)

DISTRIBUCIÓN POISSON

$$p(n) = \frac{(\lambda \Delta t)^n \cdot e^{-\lambda \Delta t}}{n!}$$

$$\begin{cases} a = \lambda.t \\ \sigma = \sqrt{\lambda t} \end{cases}$$



$$p(n) = \frac{(\lambda \Delta t)^n \cdot e^{-\lambda \Delta t}}{n!}$$

$$p(0) = \frac{(\lambda \Delta t)^0 \cdot e^{-\lambda \Delta t}}{0!} = e^{-\lambda \Delta t}$$

$$p(1) = \frac{(\lambda \Delta t)^1 \cdot e^{-\lambda \Delta t}}{1!} = \lambda \Delta t \cdot e^{-\lambda \Delta t}$$

$$e^{-\lambda \Delta t} + \lambda \Delta t . e^{-\lambda \Delta t} = 1$$

$$e^{-\lambda \Delta t}(1 + \lambda \Delta t) = 1$$

$$e^{-\lambda \Delta t} = \frac{1}{1 + \lambda \Delta t}$$

$$e^{-\lambda \Delta t} = \frac{1-\lambda \Delta t}{(1-\lambda \Delta t).(1-\lambda \Delta t)} = \frac{1-\lambda \Delta t}{1^2-(\lambda \Delta t)^2} = 1-\lambda \Delta t$$

$$p(0) = 1-\lambda \Delta t$$

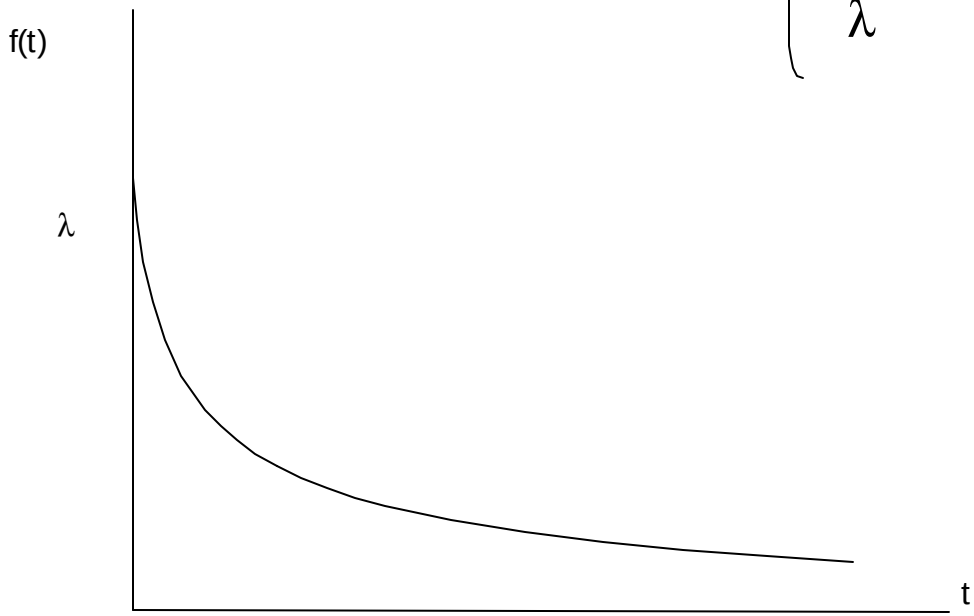
$$p(1) = \lambda \Delta t$$

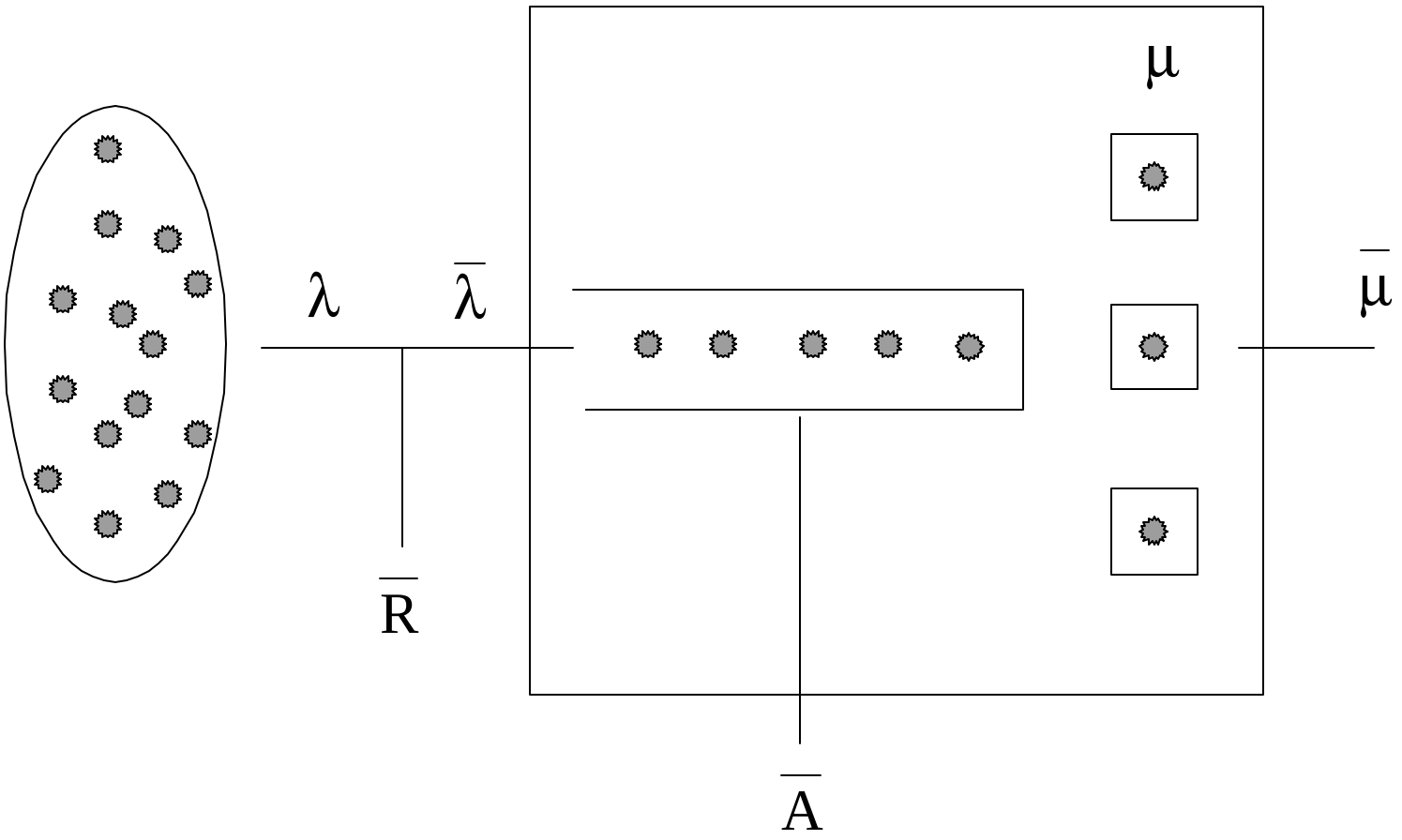
DISTRIBUCIÓN GAMMA

$$f(t) = \lambda . e^{-\lambda t}$$

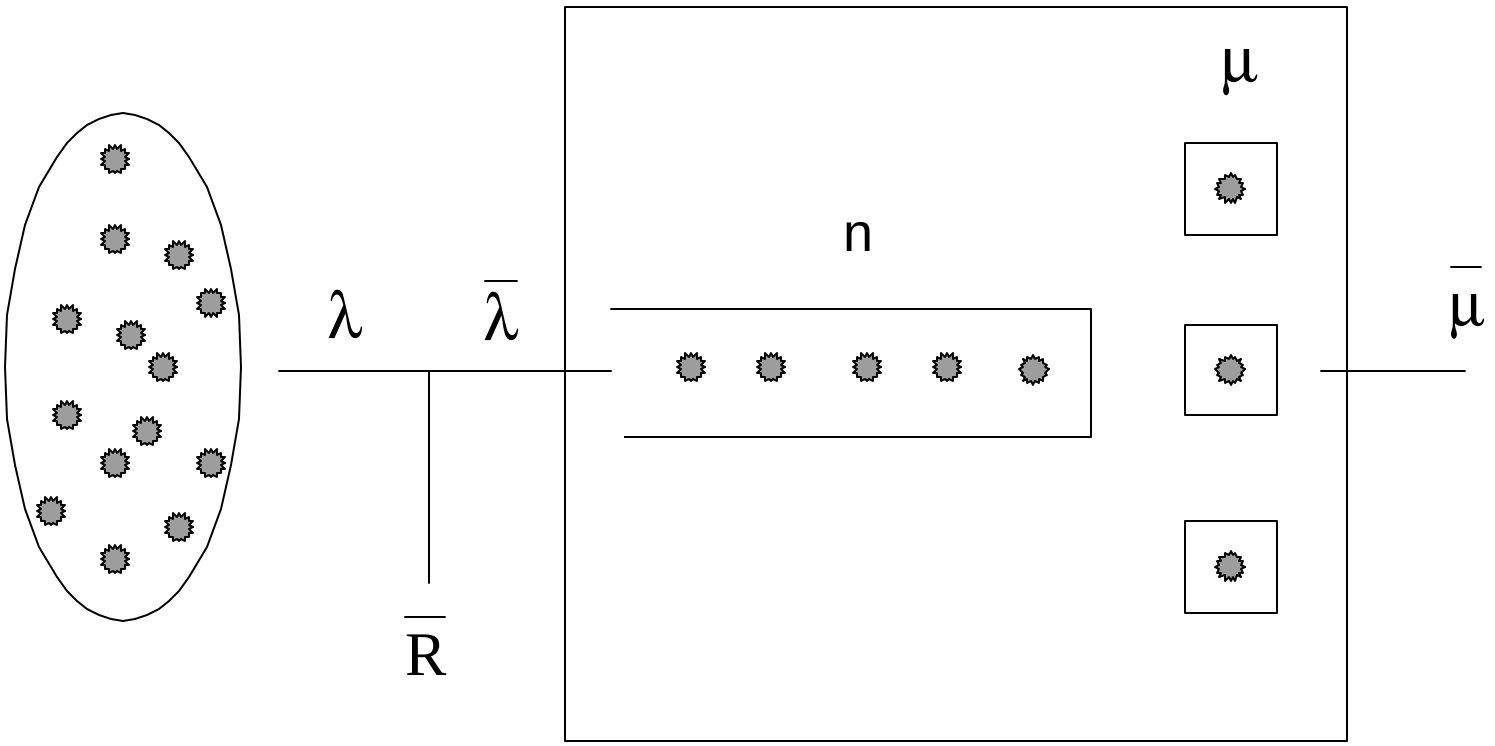
$$p(n) = \frac{(\lambda \Delta t)^n \cdot e^{-\lambda \Delta t}}{n!}$$

$$\begin{cases} \frac{1}{\lambda} \\ \frac{1}{\lambda} \end{cases}$$




μ
λ
λ̄
μ̄
R̄
Ā

$$T_a = \frac{1}{\lambda} \qquad \rho = \frac{\lambda}{\mu} \qquad T_s = \frac{1}{\mu}$$

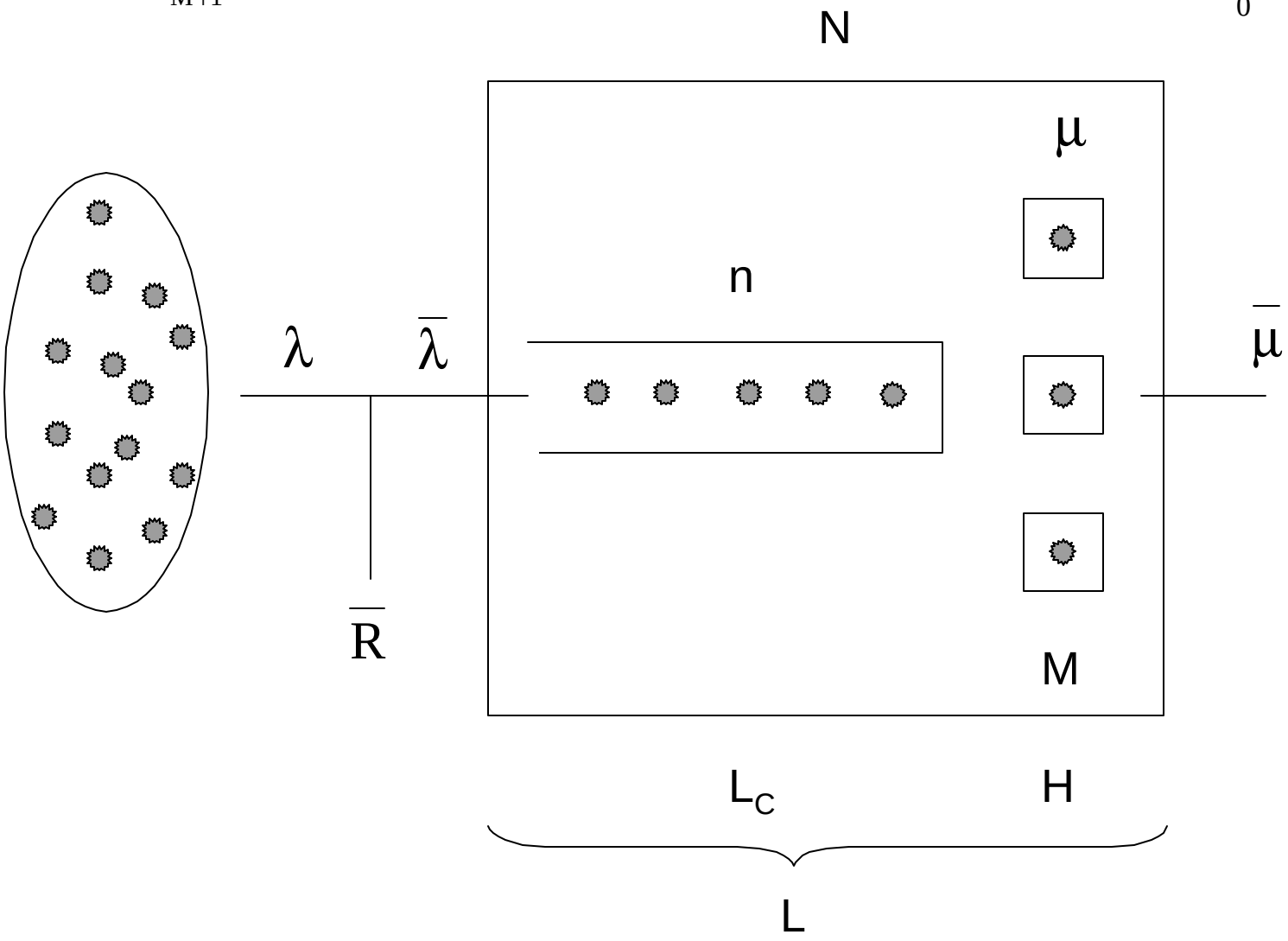


$p(i/n)$ $\qquad\qquad$ $p(n)$

$$\lambda_n = \lambda \cdot p(i/n)$$

$$L_C = \sum_{M+1}^{N} (n - M).p(n)$$

$$L = \sum_{0}^{N} n.p(n)$$

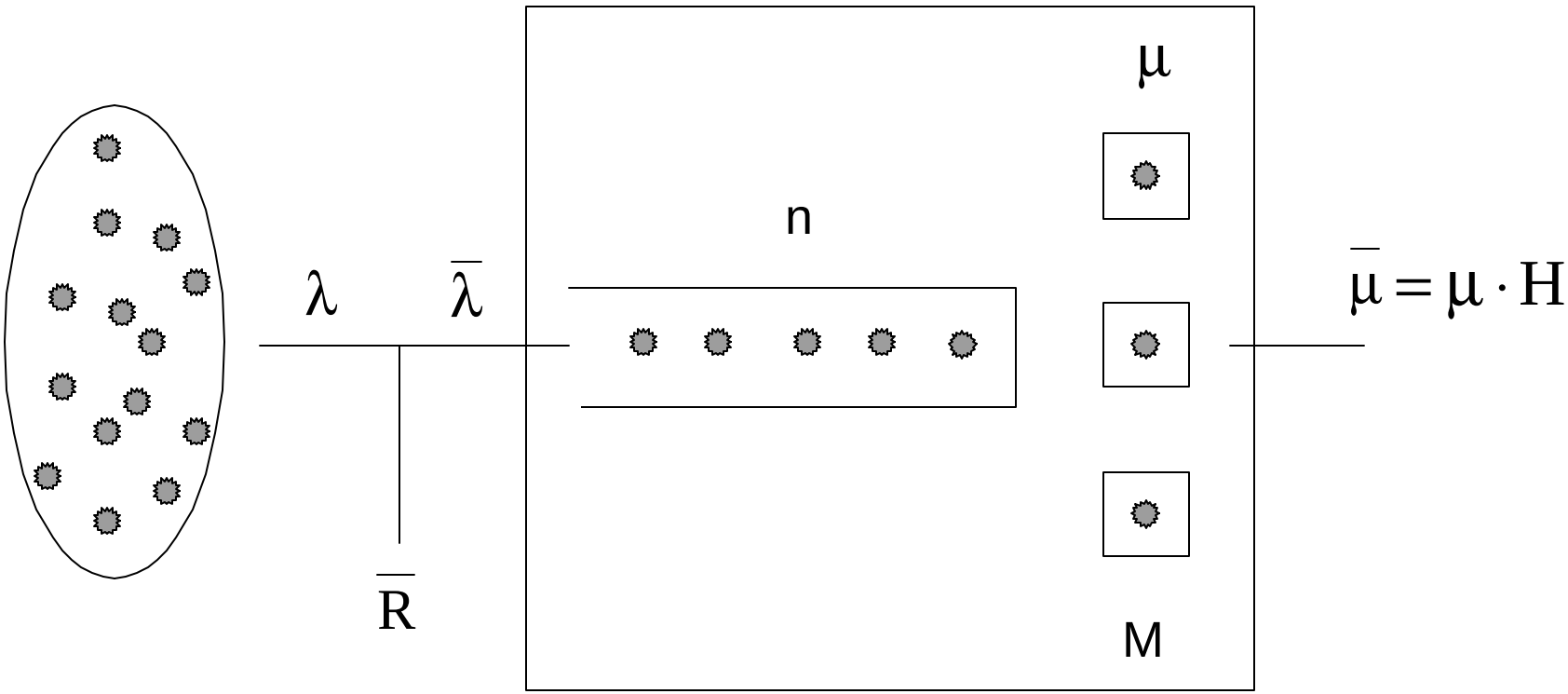


$$PA = \frac{H}{M}$$

$$L = L_C + H$$

$$\bar{\lambda} = \sum_{0}^{N} \lambda_n p(n)$$

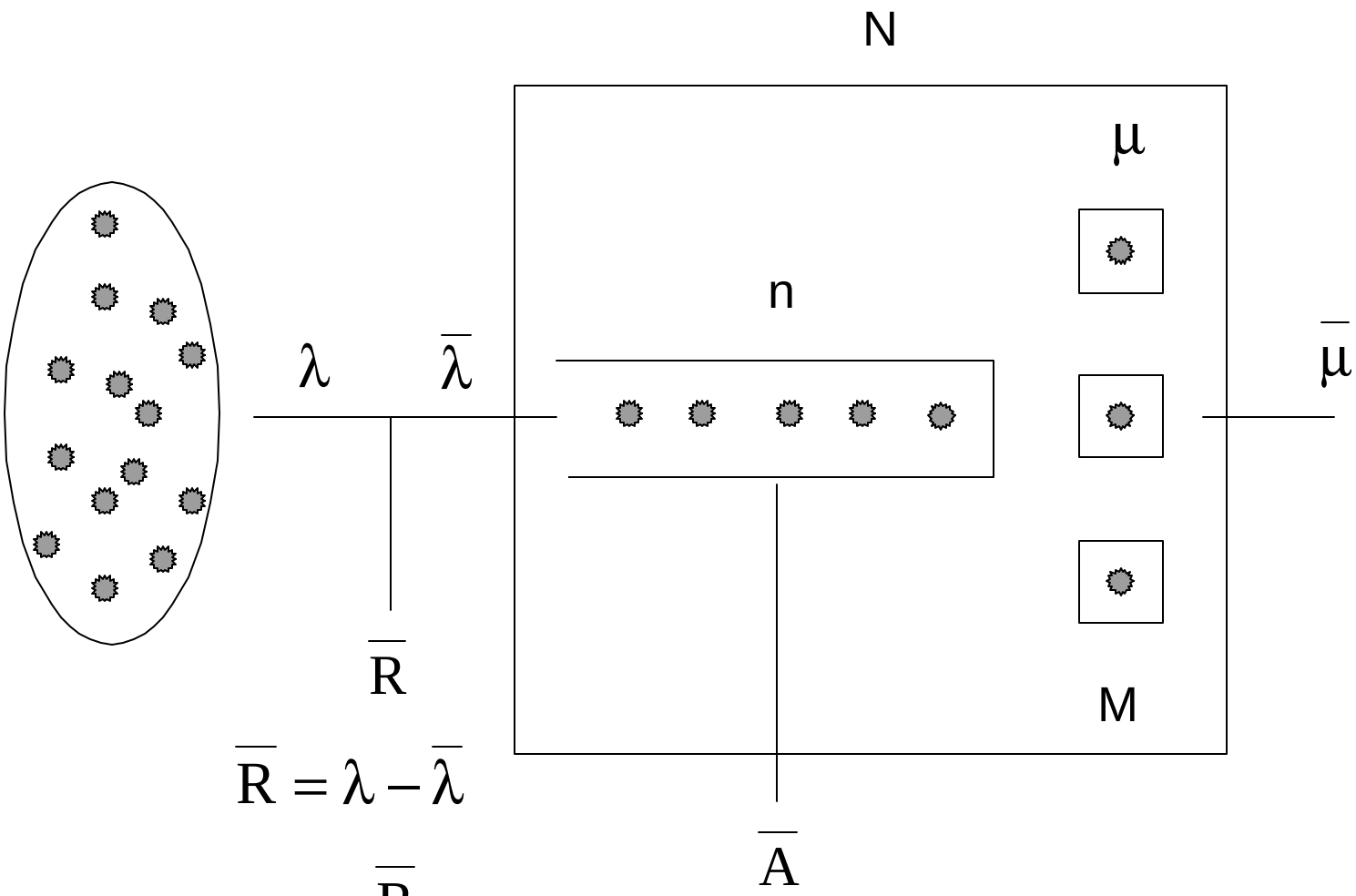
$$\bar{\mu} = \sum_{0}^{N} \mu_n p(n)$$



$$W_C = \frac{L_C}{\bar{\lambda}}$$

$$W = W_C + T_S$$

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

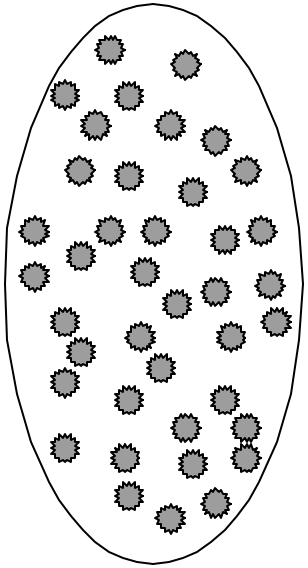


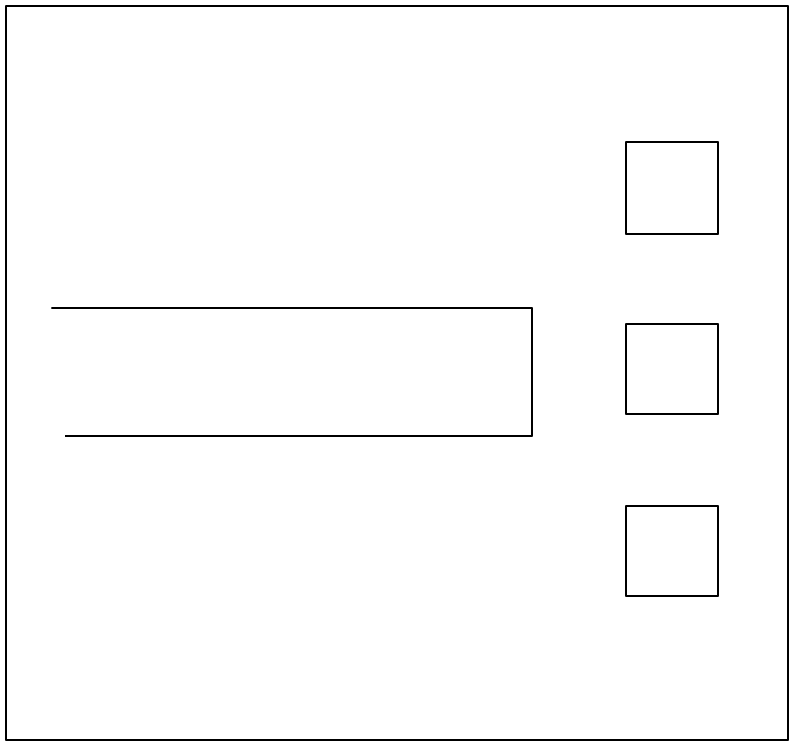
$$\overline{R} = \lambda - \overline{\lambda}$$

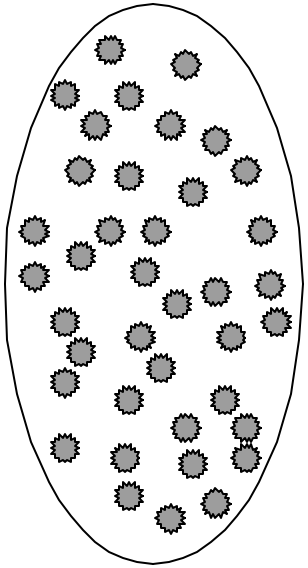
$$PR = \frac{\overline{R}}{\lambda}$$

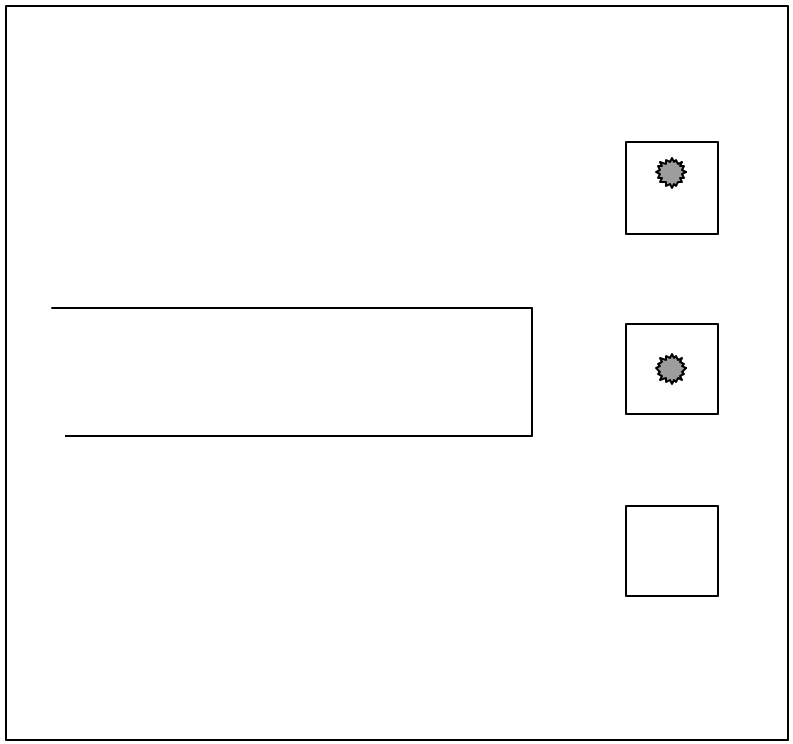
$$\overline{\lambda} = \overline{\mu} + \overline{A}$$

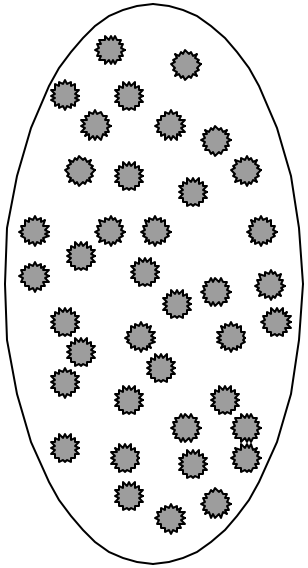
$$PAB = \frac{\overline{A}}{\overline{\lambda}}$$

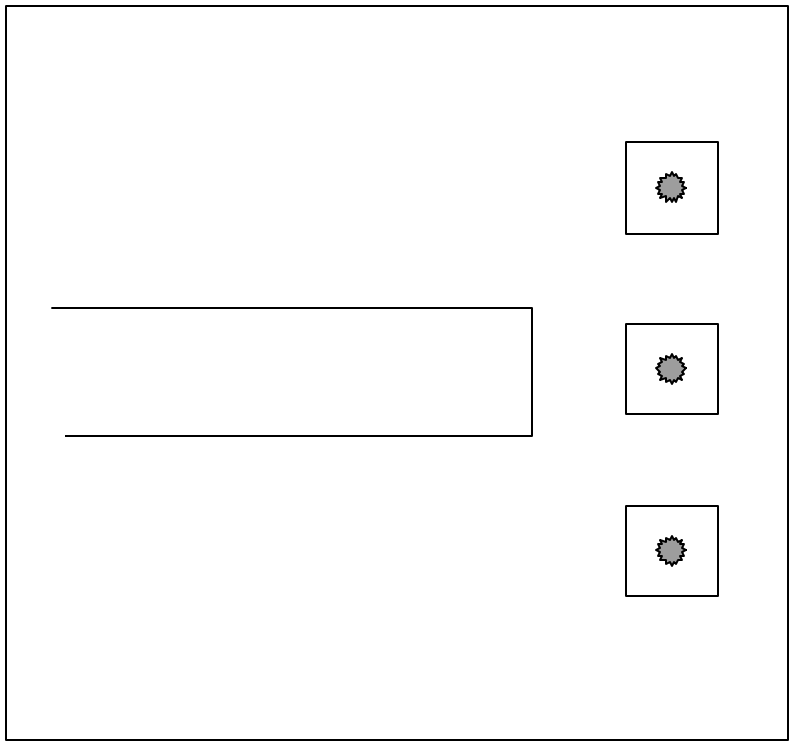


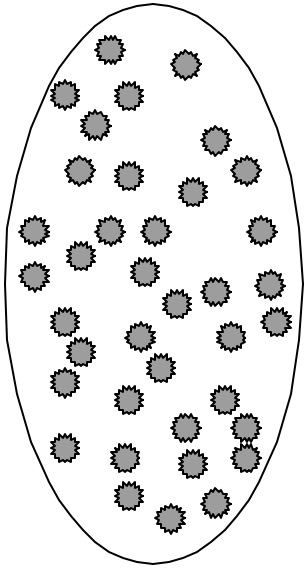


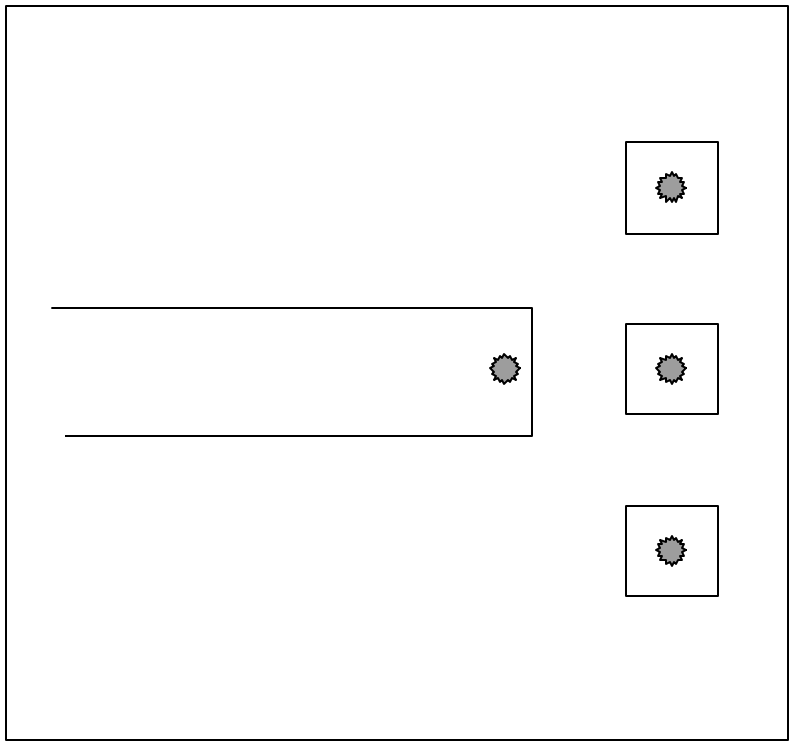


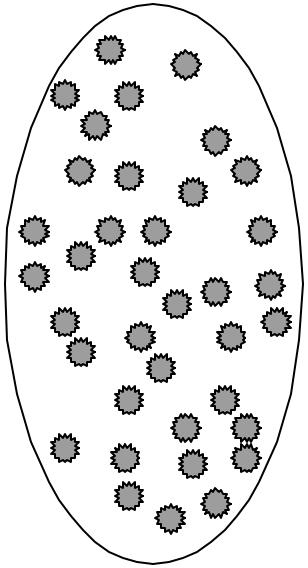


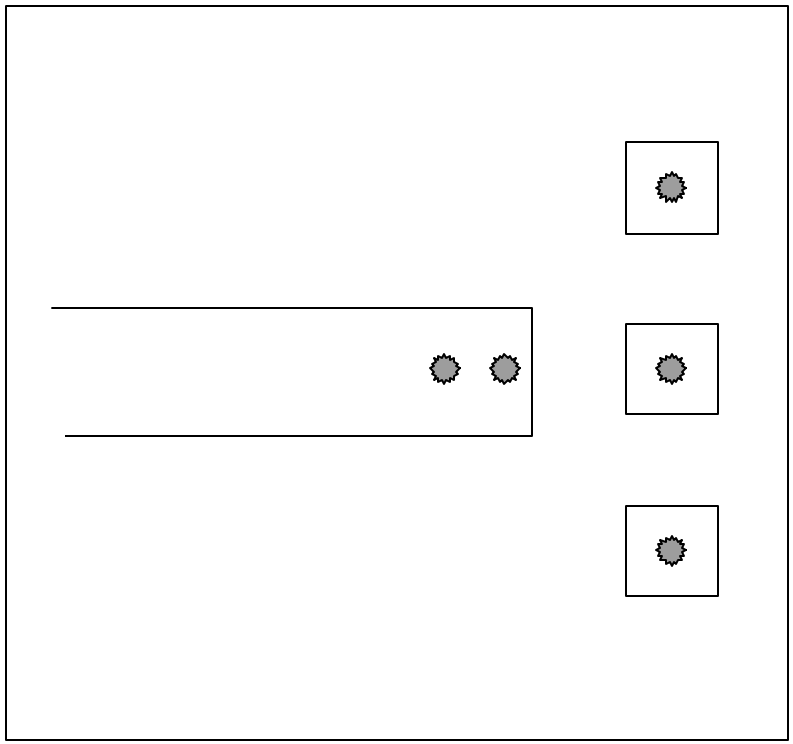


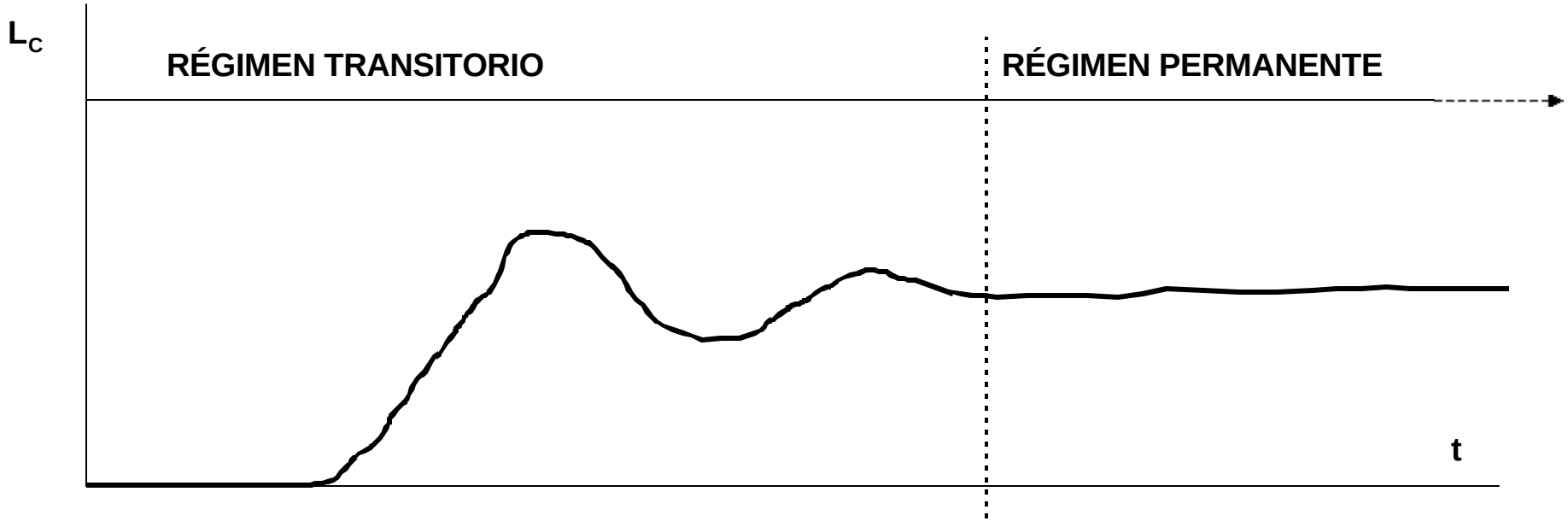








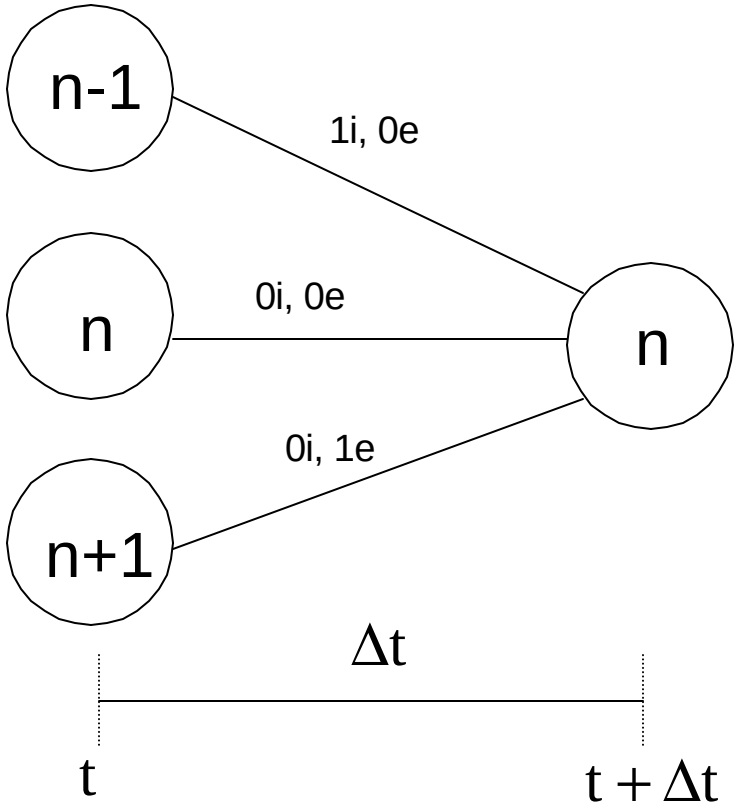



L_C
RÉGIMEN TRANSITORIO
RÉGIMEN PERMANENTE
t

Δt $\Delta t^2 \Rightarrow 0$

$p(\text{ingreso}/n) = \lambda_n \Delta t$ $p(\text{no ingreso}/n) = 1-\lambda_n \Delta t$

$p(\text{egreso}/n) = \mu_n \Delta t$ $p(\text{no egreso}/n) = 1-\mu_n \Delta t$



$$p(n, t+\Delta t) = p(n-1, t)\cdot \lambda_{n-1}\,\Delta t\cdot\left[1-\mu_{n-1}\,\Delta t\right] + p(n, t)\cdot\left[1-\lambda_{n}\,\Delta t\right]\cdot\left[1-\mu_{n}\,\Delta t\right]$$

$$+ p(n+1, t)\cdot \mu_{n+1}\,\Delta t\cdot\left[1-\lambda_{n+1}\,\Delta t\right]$$

$$p(n, t+\Delta t) = p(n-1, t)\cdot \lambda_{n-1}\,\Delta t\cdot\left[1-\mu_{n-1}\,\Delta t\right] + p(n, t)\cdot\left[1-\lambda_{n}\,\Delta t\right]\cdot\left[1-\mu_{n}\,\Delta t\right] + p(n+1, t)\cdot \mu_{n+1}\,\Delta t\cdot\left[1-\lambda_{n+1}\,\Delta t\right]$$

$$p(n, t+\Delta t) = p(n-1, t)\cdot \lambda_{n-1}\cdot\Delta t + p(n, t) - p(n, t)\cdot\left[\lambda_{n}\,\Delta t+\mu_{n}\,\Delta t\right] + p(n+1, t)\cdot \mu_{n+1}\,\Delta t$$

$$p(n,t+\Delta t) = p(n,t) = p(n)$$

$$p(n) = p(n-1)\cdot \lambda_{n-1}\,\Delta t + p(n) - p(n)\cdot\left[\lambda_{n}+\mu_{n}\right]\cdot\Delta t + p(n+1)\cdot \mu_{n+1}\,\Delta t$$

$$0 = p(n-1)\cdot \lambda_{n-1}\cdot\Delta t\,. - p(n)\cdot\left[\lambda_{n}+\mu_{n}\right]\cdot\Delta t + p(n+1)\cdot \mu_{n+1}\cdot\Delta t$$

$$0 = p(n-1)\cdot \lambda_{n-1} - p(n)\cdot\left[\lambda_{n}+\mu_{n}\right] + p(n+1)\cdot \mu_{n+1}$$

$$0 = p(n-1)\cdot\lambda_{n-1} - p(n)\cdot[\lambda_n + \mu_n] + p(n+1)\cdot\mu_{n+1}$$

n = 0

$$0 = -p(0)\cdot\lambda_0 + p(1)\cdot\mu_1$$

$$p(1) = p(0)\cdot\frac{\lambda_0}{\mu_1}$$

n = 1

$$0 = p(0)\cdot\lambda_0 - p(1)\cdot\lambda_1 - p(1)\cdot\mu_1 + p(2)\cdot\mu_2$$

$$0 = p(0)\cdot\lambda_0 - p(1)\cdot\lambda_1 - p(0)\cdot\frac{\lambda_0}{\mu_1}\cdot\mu_1 + p(2)\cdot\mu_2$$

$$p(2) = p(1)\cdot\frac{\lambda_1}{\mu_2}$$

n = 2

$$0 = p(1).\lambda_1 - p(2).\lambda_2 - p(2).\mu_2 + p(3).\mu_3$$

$$0 = p(1)\cdot\lambda_1 - p(2)\cdot\lambda_2 - p(1)\cdot\frac{\lambda_1}{\mu_2}\cdot\mu_2 + p(3)\cdot\mu_3$$

$$p(3) = p(2)\cdot\frac{\lambda_2}{\mu_3}$$

n = 3

$$0 = p(2)\cdot\lambda_2 - p(3)\cdot\lambda_3 - p(3)\cdot\mu_3 + p(4)\cdot\mu_4$$

$$0 = p(2)\cdot\lambda_2 - p(3)\cdot\lambda_3 - p(2)\cdot\frac{\lambda_2}{\mu_3}\cdot\mu_3 + p(4)\cdot\mu_4$$

$$p(4) = p(3)\cdot\frac{\lambda_3}{\mu_4}$$

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

ECUACIÓN DE ESTADO DE RÉGIMEN PERMANENTE

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

- MODELOS DESCRIPTIVOS
- MODELOS OPTIMIZANTES

CLASIFICACION

- POR TAMAÑO DE POBLACION
  - POBLACION FINITA
  - POBLACION INFINITA
- POR CAPACIDAD
  - COLA FINITA
  - COLA INFINITA

- POR DISCIPLINA DE ATENCION
  - FIFO
  - LIFO
  - SIRO
  - PRIO
- POR CANTIDAD DE CANALES DEL CENTRO DE ATENCION
  - 1 CANAL
  - VARIOS CANALES EN PARALELO

- POR OBJETIVO
  - MODELOS DESCRIPTIVOS
  - MODELOS OPTIMIZANTES
- POR CARACTERISTICAS DE LA POBLACION
  - SIN IMPACIENCIA
  - CON IMPACIENCIA

- POR METODO DE RESOLUCION
  - MODELOS CUANTITATIVOS
  - MODELOS DE SIMULACION

- POR CARACTERISTICAS DE LOS PARAMETROS
  - DETERMINISTICOS
  - ALEATORIOS

- POR CARACTERISTICAS DE ANALISIS DEL SISTEMA
  - REGIMEN PERMANENTE
  - REGIMEN TRANSITORIO

APLICACIONES

- SISTEMAS DE TRANSPORTE
  - PUERTOS
  - AEROPUERTOS
  - AUTOPISTAS
  - ESTACIONES TERMINALES

- SISTEMAS DE COMPUTACION
  - CPU
  - IMPRESORAS

- CENTRALES TELEFONICAS
- SISTEMAS DE PRODUCCION
- SISTEMAS DE CARGA Y DESCARGA
- SISTEMAS DE REPARACION O MANTENIMIENTO DE UNIDADES PRODUCTIVAS

- SISTEMAS DE ATENCION AL PUBLICO
  - BANCOS
  - SUPERMERCADOS
  - RENTADORAS DE AUTOS
  - EMERGENCIA DOMICILIARIA
  - NEGOCIOS DE VENTA
  - ESTACIONES DE SERVICIO

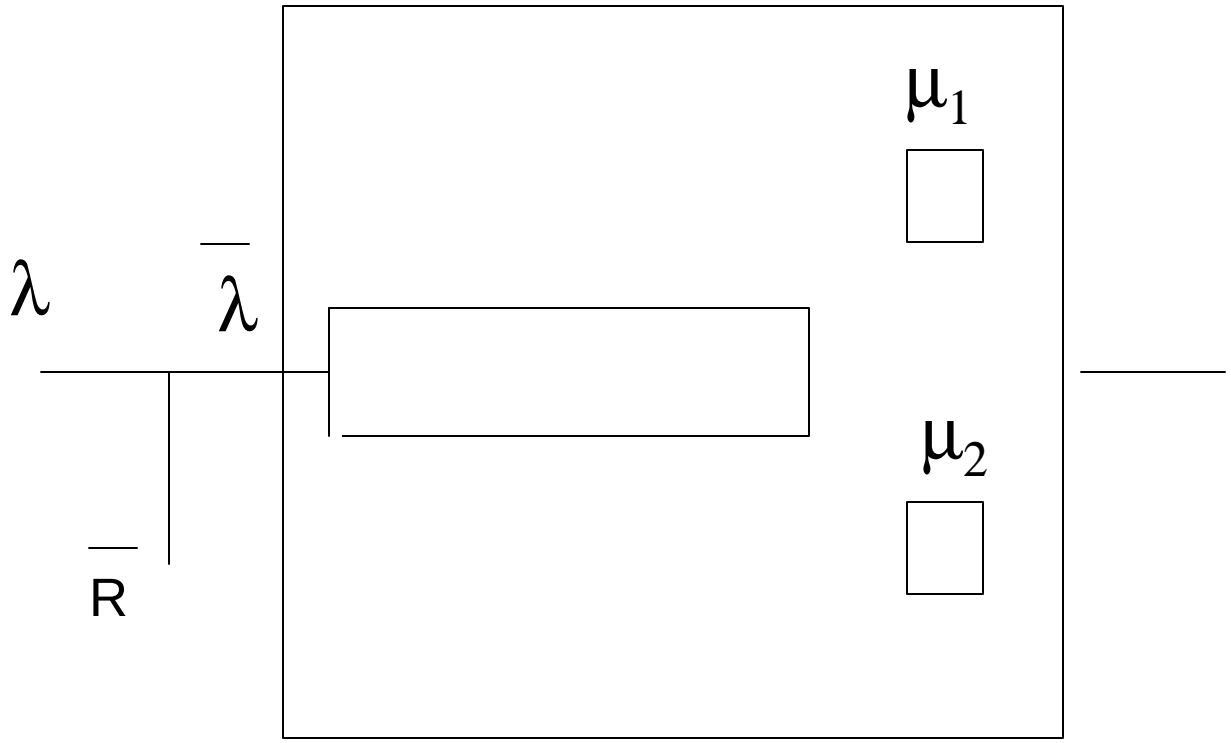
- SISTEMAS DE PROCEDIMIENTOS ADMINISTRATIVOS

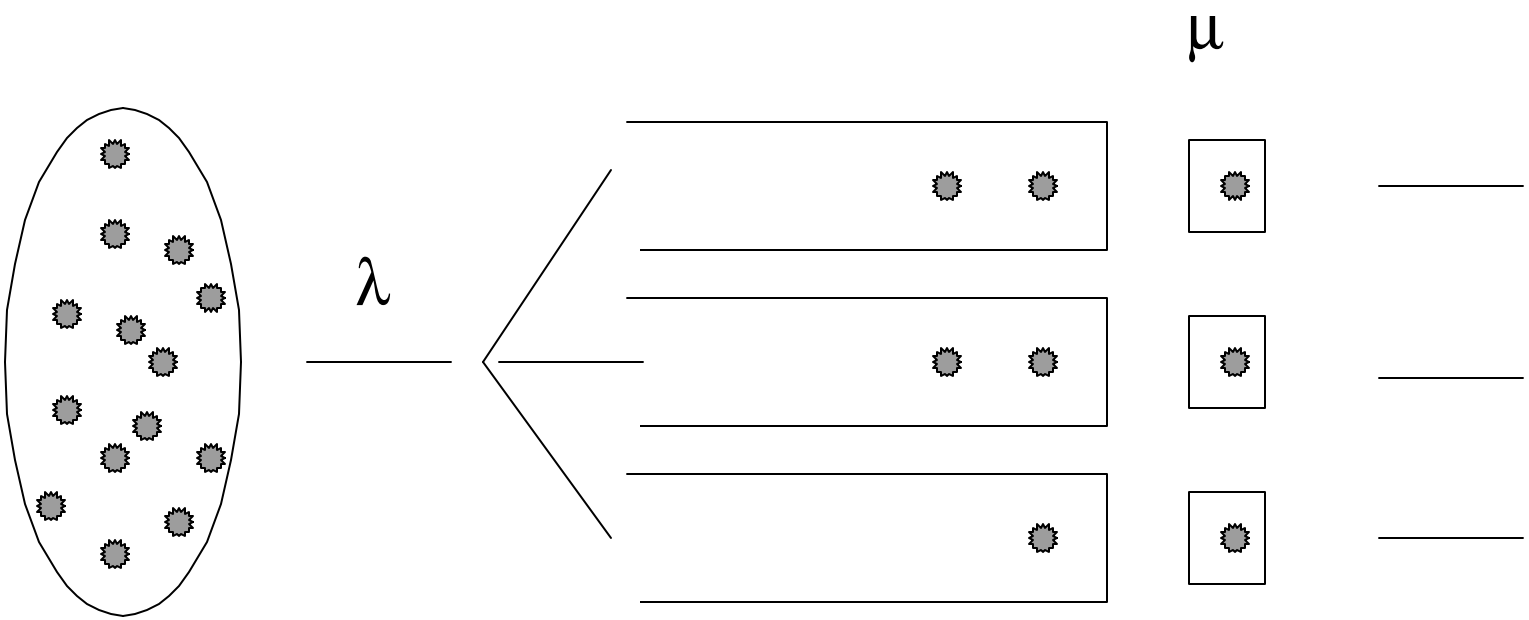
- INNUMERABLES SISTEMAS DE LA VIDA COTIDIANA
  - ASCENSORES
  - TELEFONOS PUBLICOS
  - RESTAURANTS, etc.

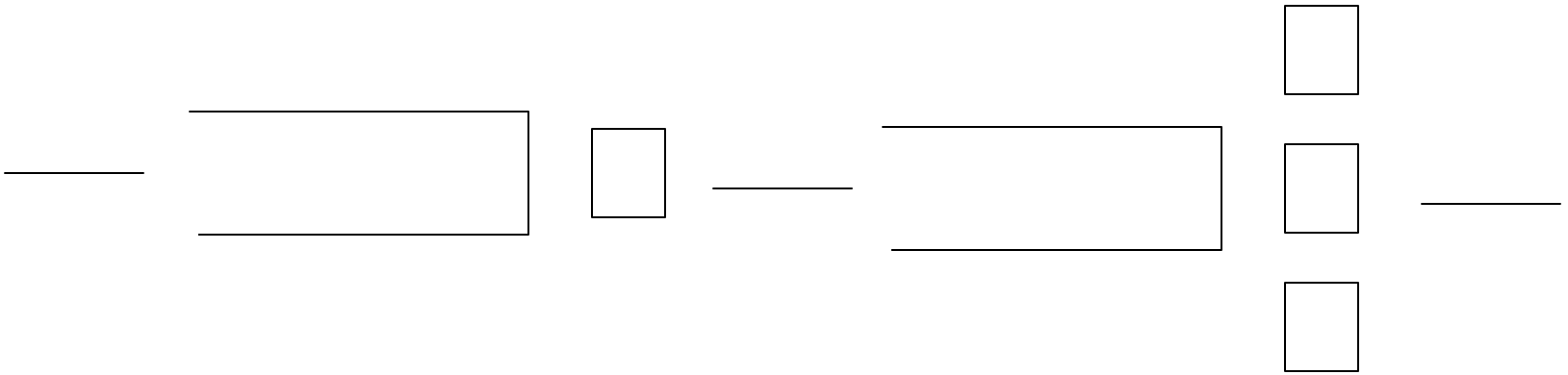
SOFTWARE

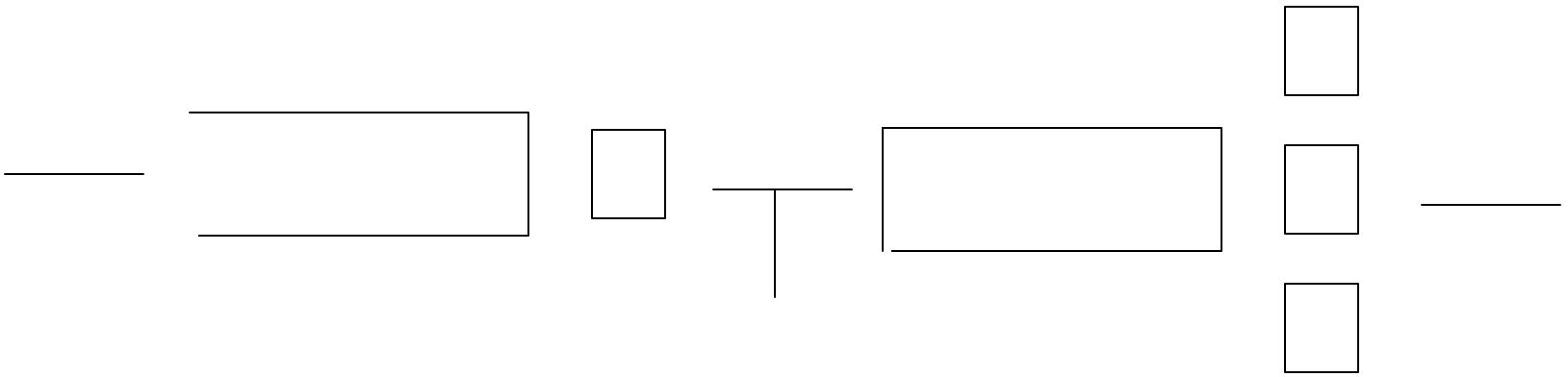
- PARA TECNICAS CUANTITATIVAS
  - STORM
  - QSB (y QBS)
  - GINO, etc.

- PARA TECNICAS NUMERICAS
  - ARENA
  - GPSS/PC
  - PROOF ANIMATION
  - QUEST, etc.

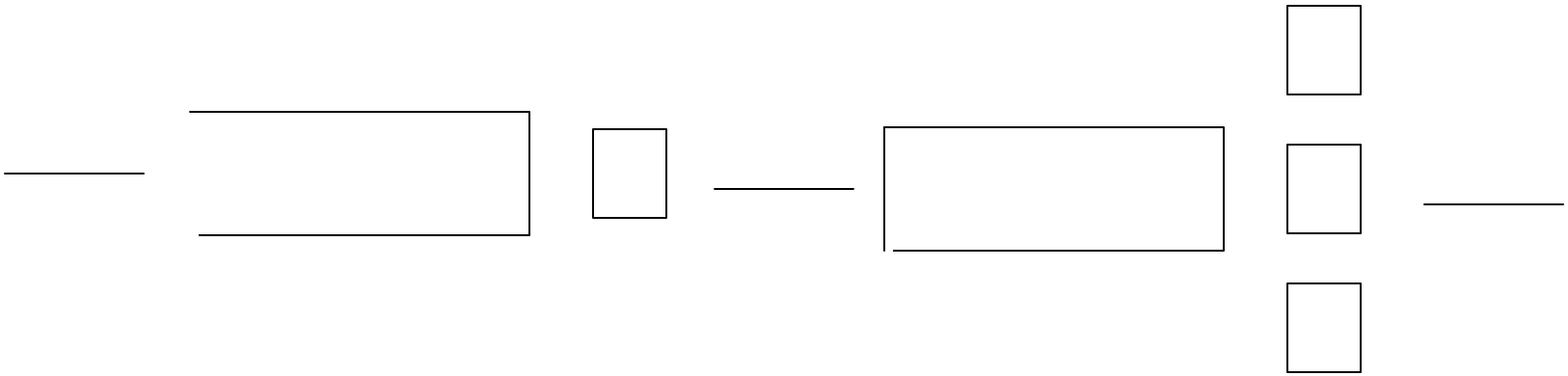

λ
λ
R
μ1
μ2

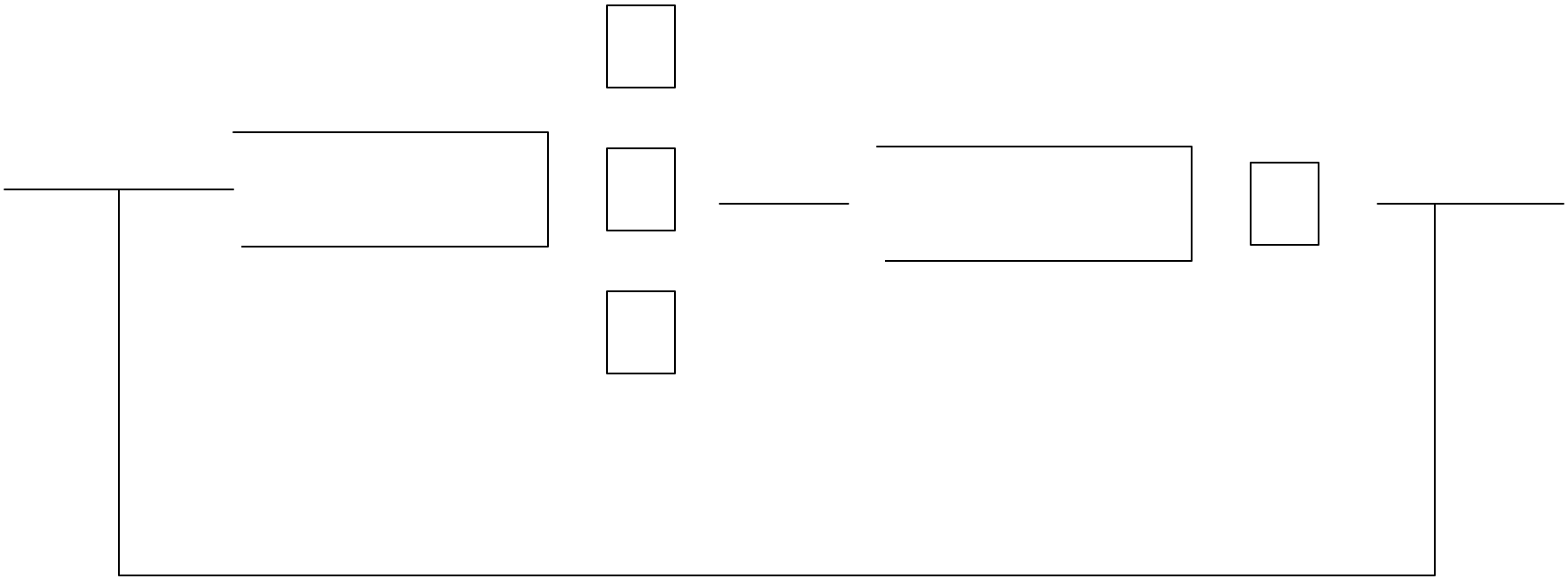

μ
λ





BLOQEO DE CANALES EN SERIE





REDES DE COLAS