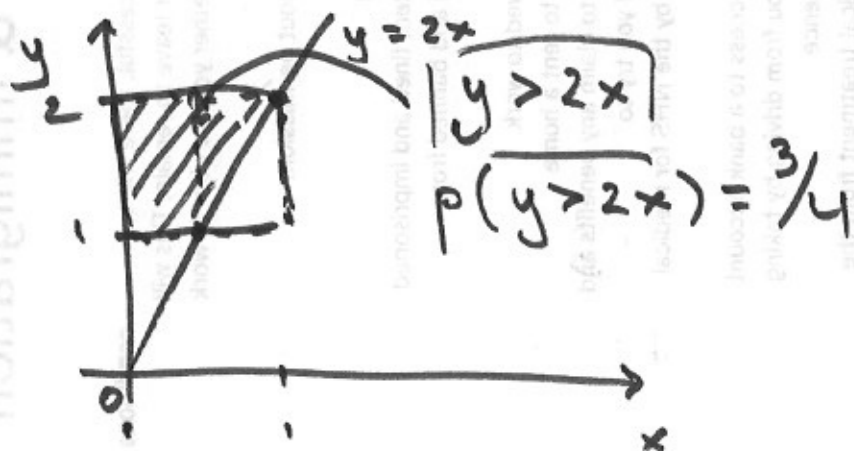


MSAI

1)

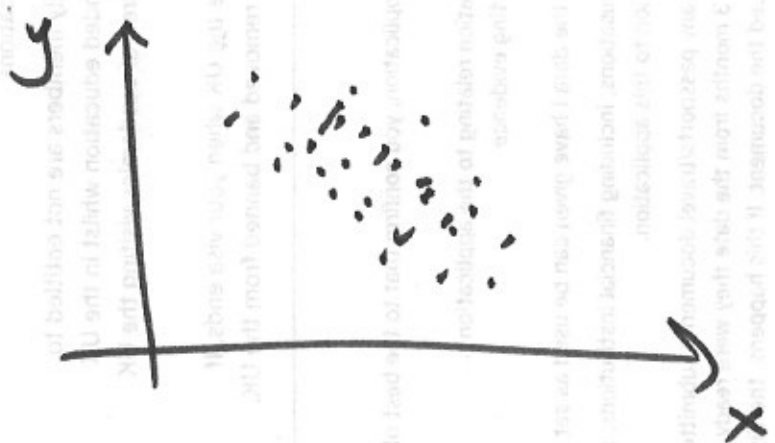
$$x \sim U([0, 1])$$

$$y \sim U([1, 2])$$



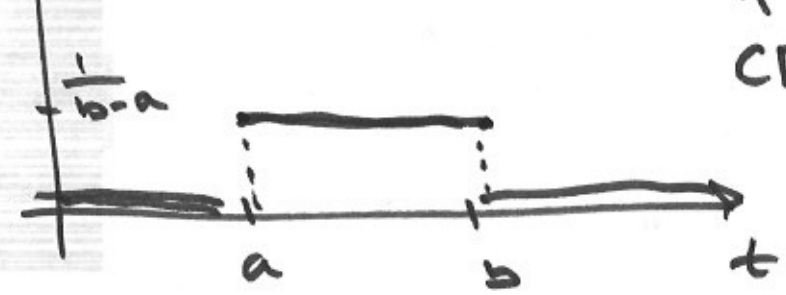
2)

$$-0.8$$



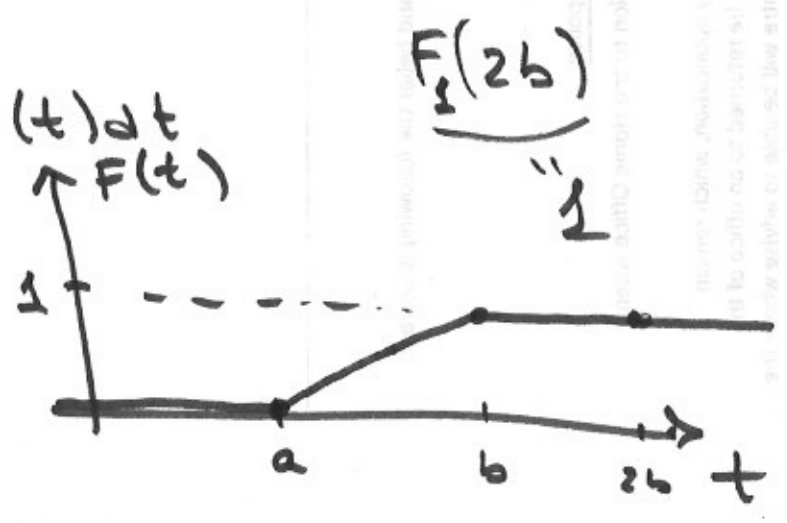
1) $p(t) = \frac{I_{[a,b]}(t)}{b-a}$

PDF
 $p(t)$



$$F(t) = \int_{-\infty}^t p(t) dt$$

↑
CDF



Problem 3)

Poisson distribution

$$1) \quad p(x) = \frac{\lambda^x e^{-\lambda}}{x!} \quad x = 0, 1, 2, \dots$$

$$P(2Z_+)$$

even numbers

$$2) \quad p(x) = p \cdot (1-p)^{x-1}$$

$$x \in \mathbb{N}$$

$$x = 1, 2, \dots$$

$$p(x=2) = \frac{\lambda^2 e^{-\lambda}}{2!}$$

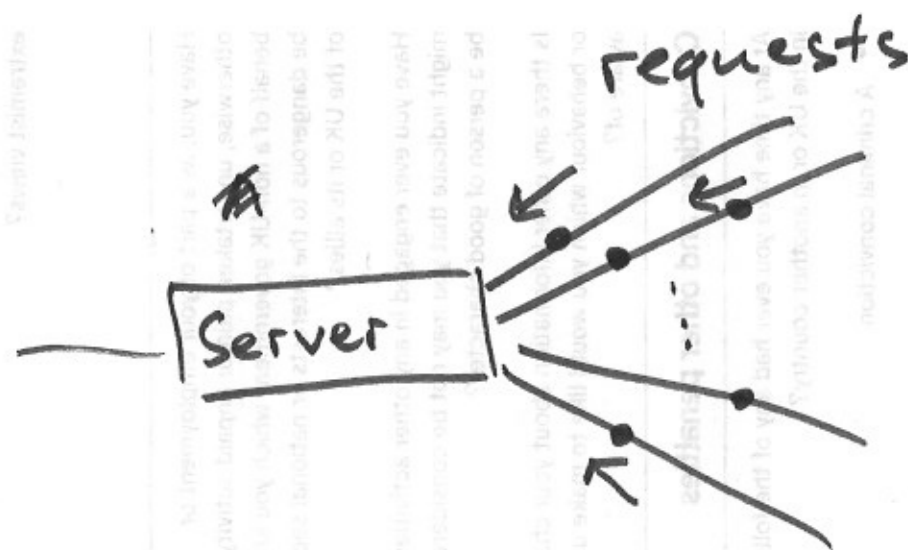
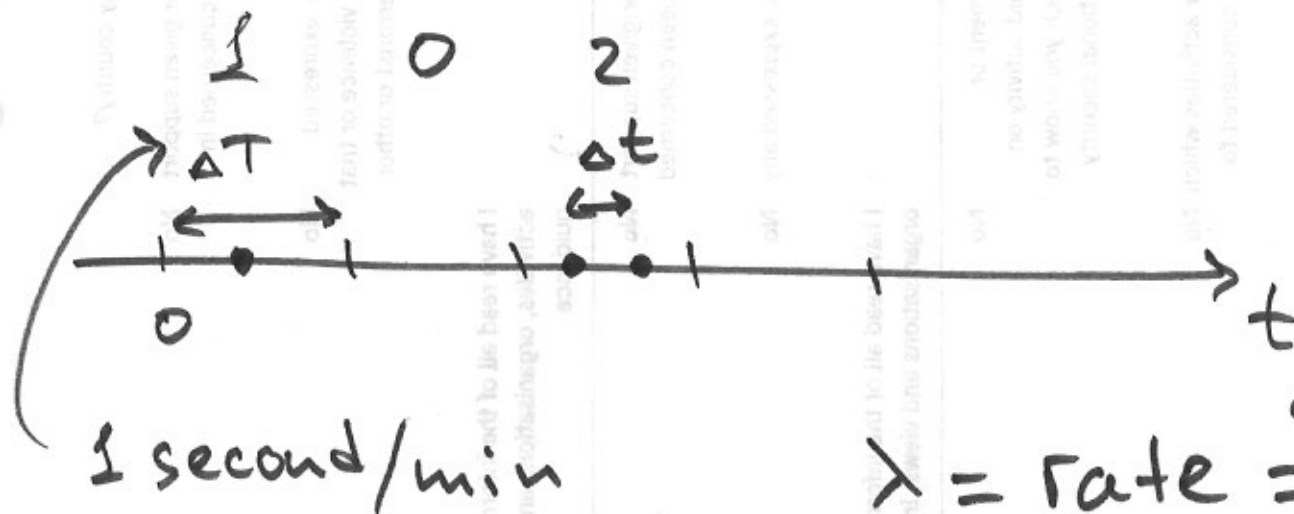
$$\sum_{k=0}^{+\infty} p(k) = \frac{\lambda^0 e^{-\lambda}}{0!} + \frac{\lambda^1 e^{-\lambda}}{1!} + \dots$$

$$= e^{-\lambda} \left(\frac{\lambda^0}{0!} + \lambda + \frac{\lambda^2}{2!} + \frac{\lambda^3}{3!} + \dots \right) = e^0 = 1$$

Poisson distribution

$$p(x) = \frac{\lambda^x e^{-\lambda}}{x!}$$

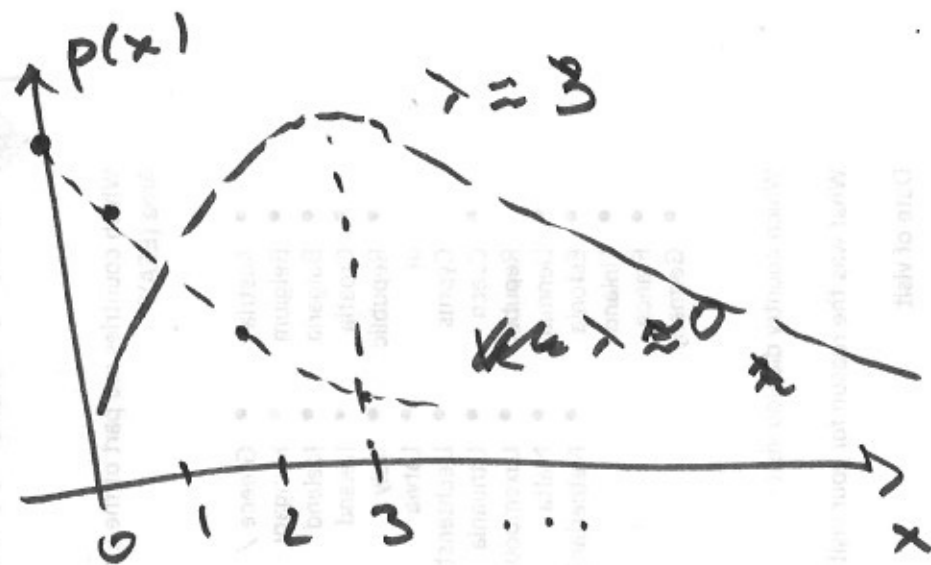
$$x = 0, 1, 2, \dots$$



$$\lambda = \text{rate} = \frac{\langle \# \text{ requests} \rangle}{\Delta T}$$

$$\lambda = 2$$

Poisson distribution if requests
are independent



Binomial Distribution

$$0 \quad 1 \quad 0 \quad \dots \quad 0 \quad 1$$

N

$$\langle x \rangle = p \cdot N$$

~~pk~~

$$p(x=k) = \binom{N}{k} p^k (1-p)^{N-k}$$

$$t = \begin{cases} 1, & p \\ 0, & 1-p \end{cases}$$

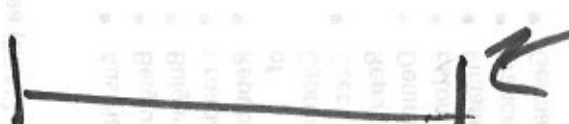
$\leftarrow 0/1$

$$x = \sum t_i$$

$$x = 0, 1, \dots, N$$

Visas

which countries are part of the European Economic



ΔT

- Austria
- Belgium
- Bulgaria
- Croatia
- Cyprus
- Czech
- Denmark
- Germany
- Estonia
- Finland
- France
- Greece
- Hungary
- Ireland
- Italy
- Latvia
- Lithuania
- Luxembourg
- Malta
- Netherlands
- Poland
- Portugal
- Romania
- Slovakia
- Slovenia
- Spain
- Sweden
- UK

$0, 1, \dots, 1, 0$

$N \rightarrow \infty$

$\lambda = p \cdot N - \text{fixed}$

C_N^k

$$C_N^k = \frac{N!}{k!(N-k)!}$$

$$N! \sim \left(\frac{N}{e}\right)^N$$

$$N \rightarrow \infty$$

Stierling formula

Poisson:

$$p(x) = \frac{\lambda^x e^{-\lambda}}{x!}$$

$$\langle x \rangle = \lambda$$

$$\langle (x - \langle x \rangle)^2 \rangle = \lambda$$

$$\text{Std}(x) = \sqrt{\lambda}$$

~~100 requests~~

4 requests/min

$$4 \pm \frac{\sqrt{4}}{2}$$

requests/min

Exponential distribution

Δt (between consecutive requests)

$$\Delta t \sim \text{Exp}(\lambda)$$

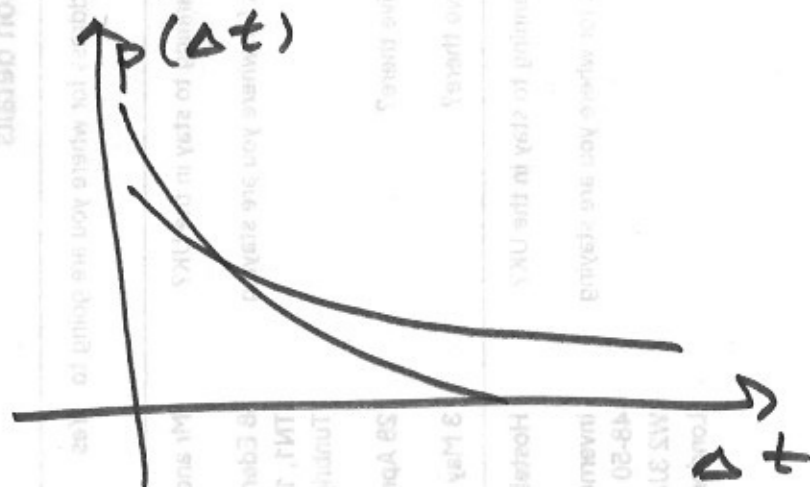
$$p(\Delta t) = \lambda e^{-\lambda \Delta t}$$

$$[\text{rate}] = \frac{1}{\text{sec}}$$

$$\langle \Delta t \rangle = \frac{1}{\lambda}$$

$$\text{Std}(\Delta t) = \frac{1}{\lambda}$$

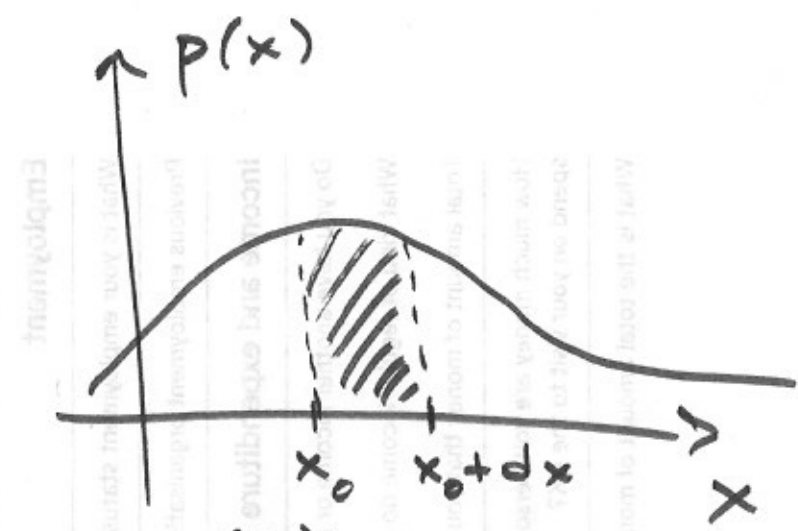
$$\langle \Delta t \rangle = \int_0^{+\infty} x \cdot p(x) dx = \int_0^{+\infty} x \cdot \lambda \cdot e^{-\lambda x} dx = \frac{1}{\lambda}$$



$$x \sim p(x) = \lambda e^{-\lambda x}$$

$$x \sim ?$$

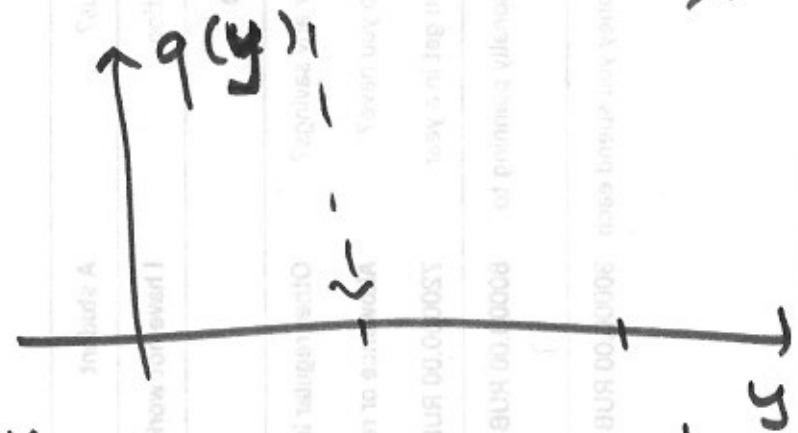
$$1 - e^{-x} \sim ?$$



$$x \sim p_*(x)$$

$$y = f(x) \sim ? q(y)$$

monotonic function



$$q(y) = p(f^{-1}(y)) \cdot \left| \frac{d}{dy} (f^{-1}(y)) \right|$$

$$q(y) = p\left(\frac{y}{2}\right) \cdot \frac{1}{2}$$

$$f(x) = 2x$$

$$f^{-1}(x) = \frac{x}{2}$$

$$\frac{d}{dx} f^{-1}(x) = \frac{1}{2}$$

