④ Poisson

063

Note Title 1/31/2011

Ex: if $\alpha = 0.5$

* The sample space of a Poisson R.V is exactly the same as that of a geometric R.V.

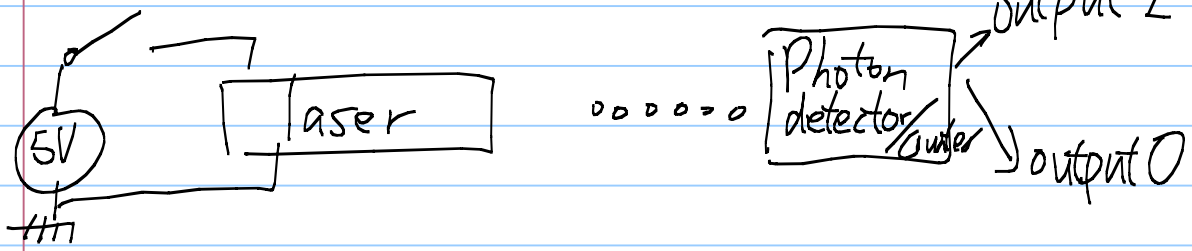
* Poisson random variable is used to model the experiment that ①

②

③

④

* Poisson is quite common, especially in physics.



A laser that can be turned on (5V) or off (0V)

Once it is on, in average 1000 photons/msec.

A photon detector count the number of photons X in 0.1 msec. And output 0 or 1 depending on X.

If there is no "ambient noise"

(but in reality, we choose instead.

What is the prob that the output

is 0 even if the laser is ON.

Ans:

Q: Suppose we reduce the interval to 0.01 msec

Y is the # of photons in 0.01 msec.

$$P(\text{Output} = 0 \mid \text{the laser is ON}) = ?$$

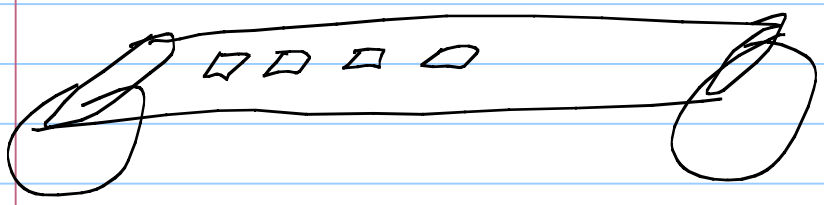
Ans:

Namely: sending at rate $\frac{1}{0.1\ \text{msec}} = 10k$. the error prob $\geq 1 \times 10^{-16}$ if we increase the rate to 100k.

the bit error rate increases to 1%.

a trade-off between communication speed and the error rate.

Ex: A factory uses X-ray to test the defective chips sequentially



We know that <u>in average</u> we will find 3 defective chips every 20 minutes.

Let X be the number of defective chips found from 1 - 2:30 pm

Q: $P(X \leq 6) = ?$

Ans:

Q: $E(X) = ?$

Ans:

Q: $E(X(X-1)) = ?$

Ans:

Q: $E(X^2) = ?$ $Var(X) = ?$

Ans:

$\Rightarrow$