Section 3.3: Poisson Probability Distribution

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Poisson – good model for data that represent the number of occurrances of a specified event in a given unit of time or space

examples:

- number of car accidents at a particular intersection during a given period of time
- number of people standing at a certain street corner at a given time
- number of pieces of litter in a given area of park at a certain time

then X = number of events occurring in that unit of time or space

μ = average number of such events expected to occur

and

$$P(X=k) = \frac{\mu^k e^{-\mu}}{k!} \quad \text{where } k = 0, 1, 2, \ldots$$

note: k has no maximum value → unbounded

$$\boxed{\begin{array}{ll} \text{mean: } & \mu \\ \text{std dev: } & \sigma = \sqrt{\mu} \end{array}}$$

example: For a particular cement mix, the average number of cracks per concrete specimen is 2.5. Assume that this number of cracks obeys a Poisson distribution.

a) find the mean and std dev for the number of cracks in a concrete specimen

b) What's the probability of having at least one crack in a randomly chosen specimen?

a) $\mu = 2.5$

$\sigma = \sqrt{\mu} = \sqrt{2.5} = 1.58 = 1.6$

b) $P(x \geq 1) = 1 - P(0)$

$$P(x=k) = \frac{\mu^k e^{-\mu}}{k!}$$

$$P(x=0) = \frac{(2.5)^0 e^{-2.5}}{0!}$$

$$= 0.082085$$

$$P(x \geq 1) = 1 - 0.082085$$

$$= 0.917915$$

$$= 92\%$$