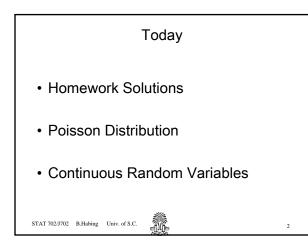
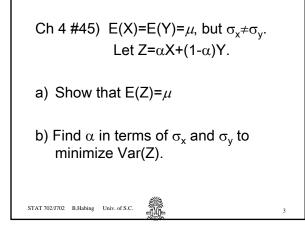
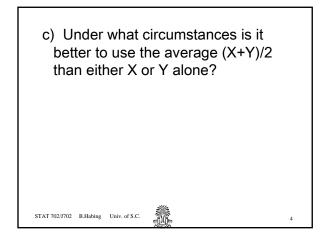
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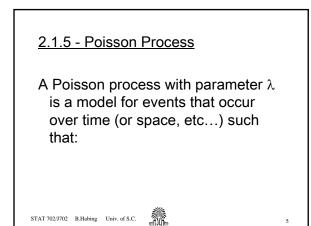
Instructor: Brian Habing Department of Statistics Telephone: 803-777-3578 E-mail: habing@stat.sc.edu

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- 1. Occurrences of events in nonoverlapping intervals are independent.
- 2. The probability of exactly one change in an interval of length *h* is  $\lambda h + o(h)$ .
- The probability of two or more occurences in an interval of length *h* is o(*h*).

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Examples include:

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- The number of radioactive particles emitted by a radioactive isotope.
- Number of people arriving in a line.
- The number of phone calls arriving at a telephone exchange.

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A Poisson process is very similar to a binomial experiment where the small sub-intervals constitute the trials and X is the number of occurrences. In fact we can derive the p.d.f. of the Poisson distribution by taking a binomial and letting  $n \rightarrow \infty$  and  $np \rightarrow \lambda$ .

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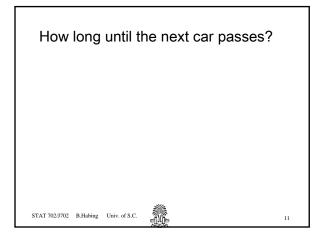
For the Poisson Distribution we have:  

$$P(X = x) = \frac{\lambda^x}{x!}e^{-\lambda}$$
  
 $\mu_X = \lambda$   
 $\sigma_X^2 = \lambda$   
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Example: Between 2am and 4am cars pass the mile marker at a rate of 24 per hour. What is the probability that 0 cars will pass in a 5 minute span?

One car?

What is the expected number of cars to pass by in the 5 minute span?



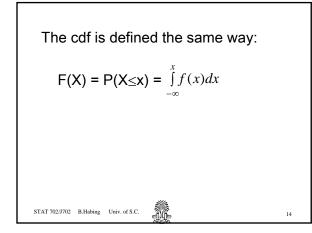
## 2.2 – Continuous Variables

Consider a random number generator that selects a real number at random from between 0 and 1.

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The probability density function (pdf)  

$$f(x)$$
 satisfies the following:  
a)  $f(x) \ge 0$  for all  $x$ .  
b)  $\int_{-\infty}^{+\infty} f(x)dx = 1$   
c)  $P(a < X < b) = \int_{a}^{b} f(x)dx$ 



For expected values we need to  
change the summation into an  
integral:  
$$E(X) = \sum xp(x) \implies \int_{-\infty}^{+\infty} xf(x)dx$$
$$Var(X) = \sum (x-\mu)^2 p(x)$$
$$\implies \int_{-\infty}^{+\infty} (x-\mu)^2 f(x)dx$$
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