Poisson Distribution

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Outline

Based on

"Probability with R: An Introduction with Computer Science Applications"
Jane Horgan

Limiting Binomial Distribution

```
lambda <- 0.61
x <- 0:5
prob <- dbinom(x, 200, lambda/200)

round( 200*dbinom(x, 200, lambda/200), 2)
round( 200*dpois(x, lambda), 2)


x<- 0:10
n <-10
prob<- 0.2
plot(x, dbinom(x, n, prob), xlab='X",
     ylab="P(X=x)", type="h")
```

Calculating Poisson pdfs

```
dpois(0, 2)
dpois(3, 2)
dpois(x, 2)
x<- 0:6
dpois(x, 3)
dpois(x, 4)
dpois(x, 6)
```

Plotting Poisson pdfs

```
par (mfrow = c(2,2))

x<-0:12
plot(x, dpois(x,2),
     xlab="X= number of trials", ylab="P(X=x)",
     type="h", main="N=52, M=13, n=5");

x<-0:12
plot(x, dpois(x, 3)
     xlab="X= number of trials", ylab="P(X=x)",
     type="h", main="N=6, M=3, n=3");

x<-0:12
plot(x+1, dpois(x, 4)
     xlab="X= number of trials", ylab="P(X=x)",
     type="h", main="N=20, M=4, n=10");

x<-0:12
plot(x+1, dpois(x, 6)
     xlab="X= number of trials", ylab="P(X=x)",
     type="h", main="N=100, M=30, n=20");
```

Calculating poisson cdfs

```
x <- 0:6

round( ppois(x, 2), 4 )
```

Plotting poisson cdfs

```
par (mfrow = c(2,2))

x<-0:12
plot(x, ppois(x, 2),
     xlab="X= number of trials", ylab="P(X<=x)",
     type="h", main="p=.95");

x<-0:12
plot(x, ppois(x, 3),
     xlab="X= number of trials", ylab="P(X<=x)",
     type="h", main="p=.5");

x<-0:12
plot(x, ppois(x, 4),
     xlab="X= number of trials", ylab="P(X<=x)",
     type="h", main="p=.2");

x<-0:12
plot(x, ppois(x, 6),
     xlab="X= number of trials", ylab="P(X<=x)",
     type="h", main="p=.01");
```

Quantile Function

```
qpois(.99, 2)
qpois(.90, 3)
qpois(.75, 6)
qpois(.25, 6)
qpois(.95, 1000)
ppois(1052, 1000)
```

Estimating Software Reliability Example

```
k<- seq(50000, 100000, 5000)
y<- 1-exp(-(0.0001)*k)
plot(k, y, xlab="X", ylab="Prob")
abline(h= .9995)
```

Modelling defects in integrated circuits

```
1 - ppois(4, 3)
```

Simulating Poission Probabilities

```
hits <- rpois(100, 2)

x<- 1:100
plot(x, hits, xlab="Day", ylab="Hit Number",
     type="l")

table(hits)

table(hits)/length(hits)

plot(table(hits)/length(hits), xlab="hit number",
     ylab="relative frequency", type="h")

mean(hits)
var(hits)
sd(hits)
```

Hypergeometric vs. Binomial

```
M <-2
L <-18
y <- dhyper(x, M, L, 10)
yround = round(y, 3)
names <- c(yround)
plot(x, y, type="h", ylim= c(0, .51), xlab= " ",
     main= Hyper(N=20, p=0.1, axes=FALSE)
text(x, dhyper(x, M, L, 10), names)
axis(1)
axis(2)
```