Binomial Distribution

Young W. Lim

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Outline

Based on

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

Calculating binomial pdfs

```
dbinom (x=4, size=5, prob=.96)
dbinom (4, 5, .96)

x <- 0:4
dbinom(x, size=4, prob=.95)

x <- 0:10
dbinom(x, size=10, prob=.95)

round(dbinom(x, size=10, prob=.95), 4)
```

Plotting binomial pdfs

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

x<-0:5
plot(x+1, dbinom(x, size=5, prob=.95),
     xlab="X= number of trials", ylab="P(X=x)",
     type="h", main="n=5, p=.95");

x<-0:10
plot(x+1, dbinom(x, size=10, prob=.5),
     xlab="X= number of trials", ylab="P(X=x)",
     type="h", main="n=10, p=.5");

x<-0:20
plot(x+1, dbinom(x, size=20, prob=.2),
     xlab="X= number of trials", ylab="P(X=x)",
     type="h", main="n=20, p=.2");

x<-0:20
plot(x+1, dbinom(x, size=100, prob=.01),
     xlab="X= number of trials", ylab="P(X=x)",
     type="h", main="n=100, p=.01");
```

Calculating binomial cdfs

```
pbinom(3, 5, .95)

prob <- pbinom(x, size=20, prob=.9)
round(prob, 4)


x<- 0:20
round(pbinom(x, size=20, prob=.2), 4)
```

Plotting binomial cdfs

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

x<-0:5
plot(x+1, pbinom(x, size=5, prob=.95),
     xlab="X= number of trials", ylab="P(X<=x)",
     type="s", main="n=5, p=.95");

x<-0:10
plot(x+1, pbinom(x, size=10, prob=.5),
     xlab="X= number of trials", ylab="P(X<=x)",
     type="s", main="n=10, p=.5");

x<-0:20
plot(x+1, pbinom(x, size=20, prob=.2),
     xlab="X= number of trials", ylab="P(X<=x)",
     type="s", main="n=20, p=.2");

x<-0:100
plot(x+1, pbinom(x, size=20, prob=.01),
     xlab="X= number of trials", ylab="P(X<=x)",
     type="s", main="n=100, p=.01");
```

quantile function

```
qbinom(.75, 20, .2)

pbinom(6, 20, .2)

plot(n, .999^n, type="1",
     ylab="P(error=0)",
     xlab="number",
     ylim= c(.9, .999))
```

Example 1

```
1-pbinom(1, 3, .7)

n <- seq(3, 29, 2)
majority <- (n+1)/2
pm <- 1 - pbinom(majority-1, n, .7)

round(pm, 4)

plot(n, pm, xlab="number", ylab="probability",
     ylim= c(.7,1), type="h")
```

Example 2

```
p <- c(.1, .2, .3, .4, .5)

plot(p, 1-pbinom(10, 21, p),
     xlab="p error", ylab="p 10+", type="h")

lines(p, p)
```

Binomial expectation

```
x <- 0.5
dbinom(x, size=5, prob=.25)

defect <- rbinom(50, 20, .2)
table(defect)

table(defect) / length(defect)

par(mfrow = c(1, 2))
plot(table(defective)/length(defect),
     xlab= "number", ylab="rel freq", tyhpe="h")
x<-1:9
plot(x, dbinom(x, 20, .2),
     xlab= "number", ylab="probability", tyhpe="h")

mean(defect)
sd(defect)
sqrt(20*.2*.8)
```

OOO