Assignment 2

Ben Arancibia

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Dobrow Chapter 3

3.3

If a tree has 70% change of being infected with root rot or bark disease there is a 40% chance it has root disease. If you take the compliment of 40%, (1-.4), then the infected tree has a 60% (.6) that it is bark disease.

P(Infected|Bark) = (.7) * (.6) P(I|B) = 0.42

3.6

Lottery tickets 1 and 1000 Tickets needed to buy to get probability of winning 50%

x=tickets needed to get probability of winning to 50%

.5=(1/1000)*x x=500 Tickets

3.8 50-50 chance that the queen carries hemophilia and each prince has 50-50 change of having hemophilia.

a) three princes without the disease, what the is the probability the queen is a carrier.

P(H|E) = P(H)P(E|H)/P(H)P(E|H + P(H$^{C)P(E|H}$C) .5^3 * .5 / (.5^3 * .5 + .5)

=.111

b) If there is a four prince what is the probability P(H|E) = P(H)P(E|H)/P(H)P(E|H + P(H$^{C)P(E|H}$C) .5^4 * .5 / (.5^4 * .5 + .5)

=0.05882353

3.16

$(n/k) = n!/k!(n-k)!$

a) Straight Flush (5 cards same suit) P(Straight Flush) = 36/(52/5) P(Straight Flush) = $36/(8.065818e + 67/(120 * 2.586232e + 59))$ =1.385169e-05

b) Four of a Kind (four cards one face value and one other card) P(Four of a Kind) = 624/(52/5) =$624/(8.065818e + 67/(120 * 2.586232e + 59))$ =0.000240096

c) Full House (three cards of one face value and wo of another face value) P(Full House) = 3744/(52/5) =$3744/(8.065818e + 67/(120 * 2.586232e + 59))$ = 0.001440576

d) Flush (five cards same suit) P(Flush) = 5108/(52/5) =$5108/(8.065818e + 67/(120 * 2.586232e + 59))$ = 0.001965401

e) Straight (Five cards in a sequence) P(Straight) = 10200/(52/5) =$10200/(8.065818e+67/(120*2.586232e+59))$ = 0.003924646

f) Three of a Kind (Three cards) P(Three Kind) = 54912/(52/5) =$54192/(8.065818e+67/(120*2.586232e+59))$ = 0.02085141

g) Two Pair P(Two Pair) = 123552/(52/5) =$123552/(8.065818e + 67/(120 * 2.586232e + 59))$ = 0.04753901

h) One Pair P(One Pair) = 1098240/(52/5) =1098240/(8.065818e+67/(120 $*$ 2.586232e+59)) = 0.4225689

3.22

```
p <- as.numeric(1/6)
scenarios <- c(1, 2, 3)

for (i in scenarios) {
  # Accumulate the probability that fewer than the target # of sixes occurs.
   x <- 0
   # Total number of dice.
   n <- 6 * i
   # Calculate the probability for each possible # of sixes that is less than the goal.
   for (j in 0:(i-1)) {
     x <- x + dbinom(j, n, p)
   }
   print(paste("Probability of at least", i, "six in", n, "fair dice:", 1 - x))
}
```

```
## [1] "Probability of at least 1 six in 6 fair dice: 0.665102023319616"
## [1] "Probability of at least 2 six in 12 fair dice: 0.618667373732309"
## [1] "Probability of at least 3 six in 18 fair dice: 0.597345685947723"
```

3.26

a) Find the Probability of zero detections

a = occupancy rate p = detection rate n = number of sites

Assume n = 1000 and occupancy rate = 0.25, detection rate

```
dbinom(0, 1000, .25)
```

```
## [1] 1.151499e-125
```

Based on these assumptions, 0.05 is the answer. More information is needed to determine chance for 0 detection rate. The question is very vague though

b)

The Probability function for Z is

P(Z) = 1 - P(Z<5) = 1 - *Sigma* P(Z=k) 1- *Sigma*(5/*k*) (.5)^k(.5)5-k

n = 5 p = .5 a = 0.75

3.34 Over 104 seasons there were there were 206 no hitter games. That means the rate of no hitters is 206 per 104 years. λ = 206/104. 206/104 = 1.98

```
probs <- dpois(0:7, 1.98)
probs <- c(probs, 1-ppois(7, 1.98))
games <- 104*probs
knitr::kable(games)
```

14.3592007
28.4312173
28.1469052
18.5769574
9.1955939
3.6414552
1.2016802
0.3399038
0.1070862

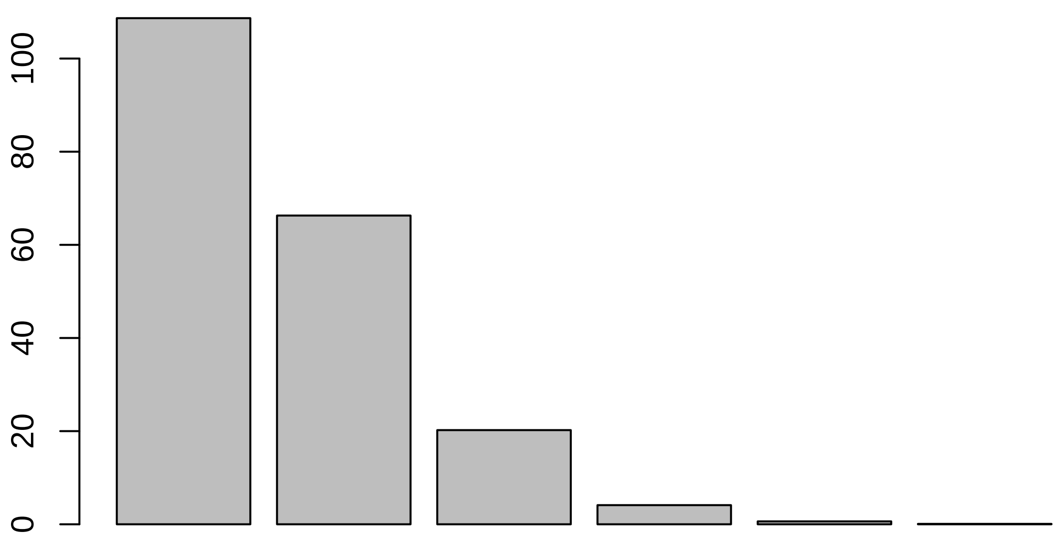
The table goes from 0 games to 7 games and the expected seasons per game. So 14.35 is the expected number of seasons with 0 no hitters, 28.43 seasons with 1 no hitter, etc.

3.45

```
probs <- dpois(0:4, 0.61)
probs <- c(probs, 1-ppois(4, 0.61))
expected <- 200*probs
expected
```

```
## [1] 108.67017381  66.28880603  20.21808584   4.11101079   0.62692915
## [6]   0.08499439
```

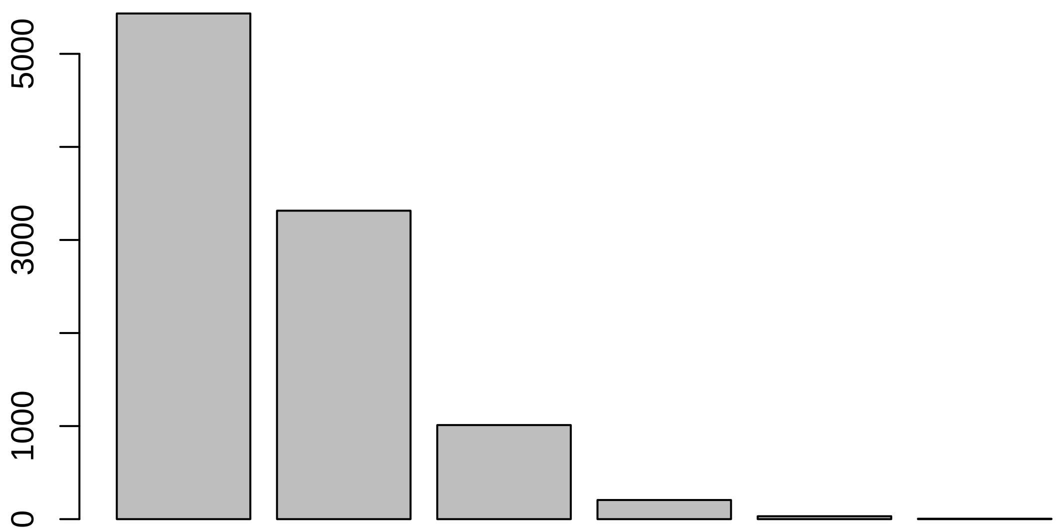
```
barplot(expected)
```




```
probs2 <- dpois(0:4, 0.61)
probs2 <- c(probs2, 1-ppois(4, 0.61))
expected2 <- 10000*probs2
expected2
```

```
## [1] 5433.508691 3314.440301 1010.904292  205.550539   31.346457    4.249719
```

```r
barplot(expected2)
```



Dobrow Chapter 4

4.6 E[X^2]=1, E[Y^2]=2, and E[XY]=3

E[$(X+Y)^2$] = E[$(X^2+2XY+Y^2)$]

E[$1^2+2(3)+2^2$]

E[1+6+4]

E[11]

4.16

If X and Y are independent random variables E[X/Y] = E[X]/E[Y].

Proof Let X and Y be indepdent random variables then any function f and g,

$E[f(X)/g(Y)] = E[f(X)]/E[g(Y)]$.

Let f and g be the identify function gives $E[X/Y] = E[X]/E[Y]$