

# Assignment 2

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## Dobrow Chapter 3

### 3.3

If a tree has 70% chance 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.

$$P(\text{Infected}|\text{Bark}) = (.7) * (.6) P(I|B) = 0.42$$

### 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%

$$.5 = (1/1000) * x \quad x = 500 \text{ Tickets}$$

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

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

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

$$=.111$$

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

$$=.05882353$$

### 3.16

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

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

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

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

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

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

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

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

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

### 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

$$P(Z) = 1 - P(Z < 5) = 1 - \sum P(Z=k) = 1 - \sum_{k=0}^4 \binom{5}{k} (.5)^k (.5)^{5-k}$$

$$n = 5 \quad p = .5 \quad a = 0.75$$

**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.  $\lambda = 206/104$ .  $206/104 = 1.98$

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

---

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 expec