Chapter 2 Notes and Exercises

Matthias Grenié

8 juillet 2016

This document are notes taken when reading *Statistical Rethinking* from Richard McElreath

Practice

answer questions

Easy

2E1

   (2) Pr(rain|Monday)

2E2

   (3) The probability that it is Monday, given that it is raining

2E3

Probability that it is Monday given that it is raining:

   (1) Pr(Monday|rain) and (4) (from Bayes' theorem)

$$\frac{\Pr(\text{rain|Monday})\Pr(\text{Monday})}{\Pr(\text{rain})} \tag{1}$$

Medium

2M1

```r
globe_water = function(n, number_W, size) {
  p_grid = seq(0, 1, length.out = n)

  prior = rep(1, n)

  likelihood = dbinom(number_W, size = size, prob = p_grid)

  non_std_post = likelihood * prior

  posterior = non_std_post / sum(non_std_post)

  cat("Most probable percentage of water is: ", p_grid[which.max(posterior)])

  plot(p_grid, posterior, type = "b", xlab = "Percentage of water",
```

```
      ylab = "Density")
}

par(mfrow = c(3, 1), mai = rep(0.3,4))

globe_water(50, 3, 3)
```
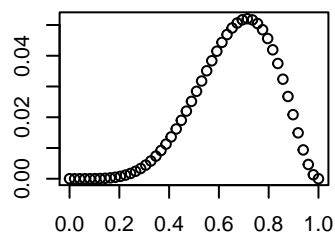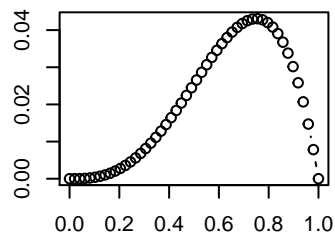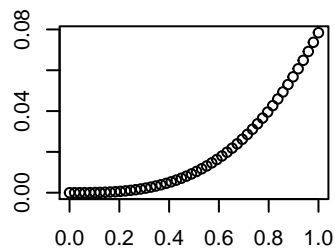
Most probable percentage of water is: 1

```
globe_water(50, 3, 4)
```

Most probable percentage of water is: 0.755102

```
globe_water(50, 5, 7)
```

Most probable percentage of water is: 0.7142857

2M2

Same question but changed prior

```r
globe_water2 = function(n, number_W, size) {
  p_grid = seq(0, 1, length.out = n)

  prior = c(rep(0, n/2), rep(1, n/2))

  likelihood = dbinom(number_W, size = size, prob = p_grid)

  non_std_post = likelihood * prior

  posterior = non_std_post / sum(non_std_post)

  cat("Most probable percentage of water is: ", p_grid[which.max(posterior)])

  plot(p_grid, posterior, type = "b", xlab = "Percentage of water",
       ylab = "Probability Density")
}

par(mfrow = c(3, 1), mai = rep(0.3,4))

globe_water2(50, 3, 3)
```
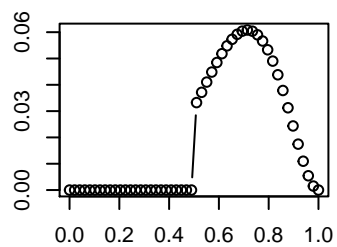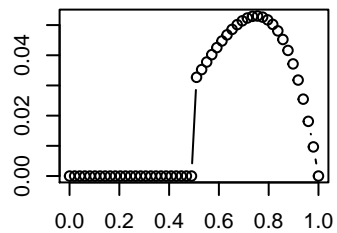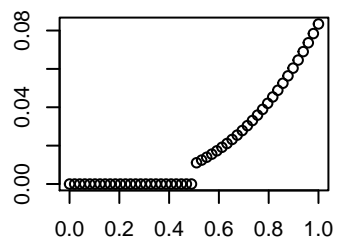
```
## Most probable percentage of water is:  1
```

```r
globe_water2(50, 3, 4)
```

```
## Most probable percentage of water is:  0.755102
```

```r
globe_water2(50, 5, 7)
```

```
## Most probable percentage of water is:  0.7142857
```

2M3

From Bayes' Theorem:

$$\text{Pr}(\text{Earth}|\text{land}) = \frac{\text{Pr}(\text{land}|\text{Earth})\text{Pr}(\text{Earth})}{\text{Pr}(\text{land})} \tag{2}$$

$$= \frac{0.3 \times 0.5}{\frac{1.3}{2}} \tag{3}$$

$$= 0.23 \tag{4}$$