Exercises: Chapter 3

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Monday, September 15, 2014

3-1 The running proportions plot.

```
# Goal: toss a coin N times and get the running proportion of heads
N <- 500
p.heads <- 0.8 # Assume biased coin

# Heads = 1, Tails=0
flipsequence <- sample(x=c(0,1), prob=c(1-p.heads,p.heads), size=N, replace=TRUE)

r <- cumsum(flipsequence)
n <- 1:N

runprop <- r/n
```

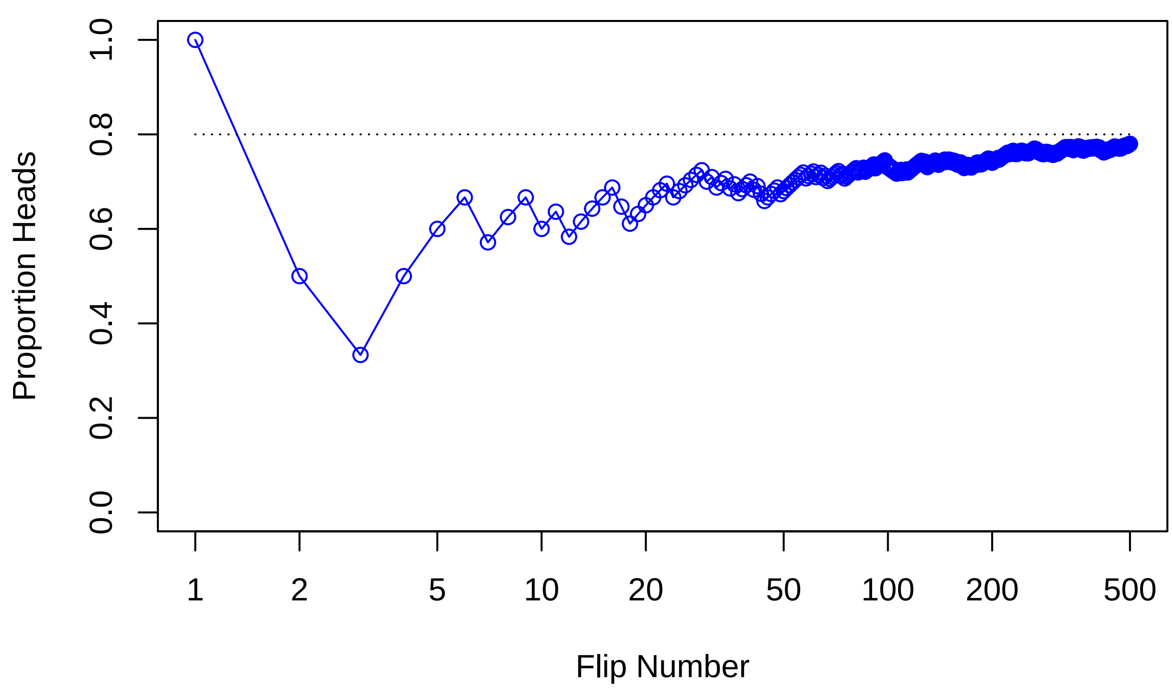

Figure 1: Running Proportions Plot, # of Heads

3-2 Detemine the probability of drawing a 10 from a pinochle deck (9-Ace, 6 of each).

To do this, we will randomly sample from the deck and see what proportion are tens.

```
cards <- c("9", "10", "Jack", "Queen", "King", "Ace")
suits <- c("Hearts", "Diamonds", "Spades", "Clubs")

draws <- cbind.data.frame(sample(cards, size=1000000, replace=TRUE),
                          sample(suits, size=1000000, replace=TRUE))

length(draws[which(draws[,1]=='10'),1])/length(draws[,1])
```

```
## [1] 0.1669
```

```
length(draws[which(draws[,1]=='10'|draws[,1]=='Jack'),1])/length(draws[,1])
```

```
## [1] 0.3346
```

Thus, we estimate that the probability of drawing a jack is 0.167 and the probability of drawing a 10 or a jack is 0.335.

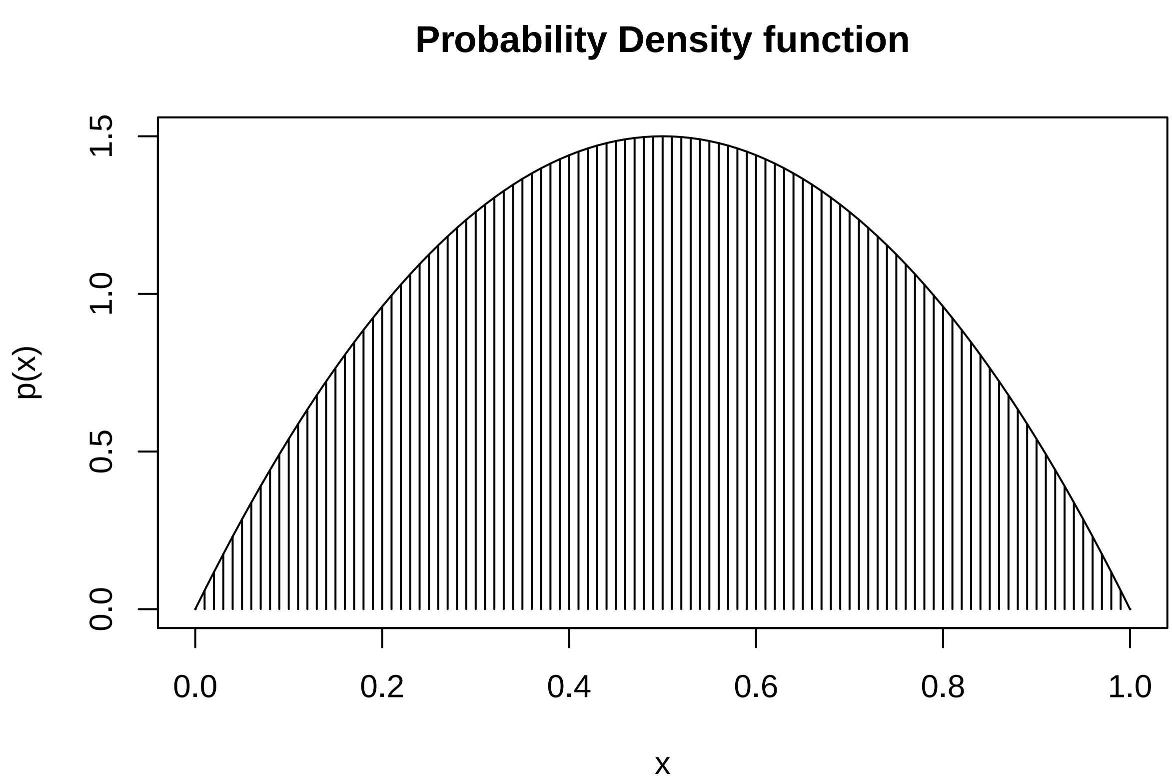

Figure 2: PDF - $6x(1-x)$

3-3 From this plot, we estimate that the area underneath the curve is

$$\sum_i^n p(x_i)\delta x$$

which is estimated numerically by `R` as 0.9999. Analytically, the solution is

$$\begin{aligned}
\int 6x(1-x)\delta x &= \int (6x - 6x^2)\delta x \\
&= \int 6x\delta x - \int 6x^2 \delta x \\
&= 3x^2|_0^1 - 2x^3|_0^1 \\
&= (3-2) - (0-0) \\
&= 1
\end{aligned}$$

Thus, because the area under the curve is 1, $p(x)$ is a probability density function, and satisfies $Equation 3.3$.

3-4

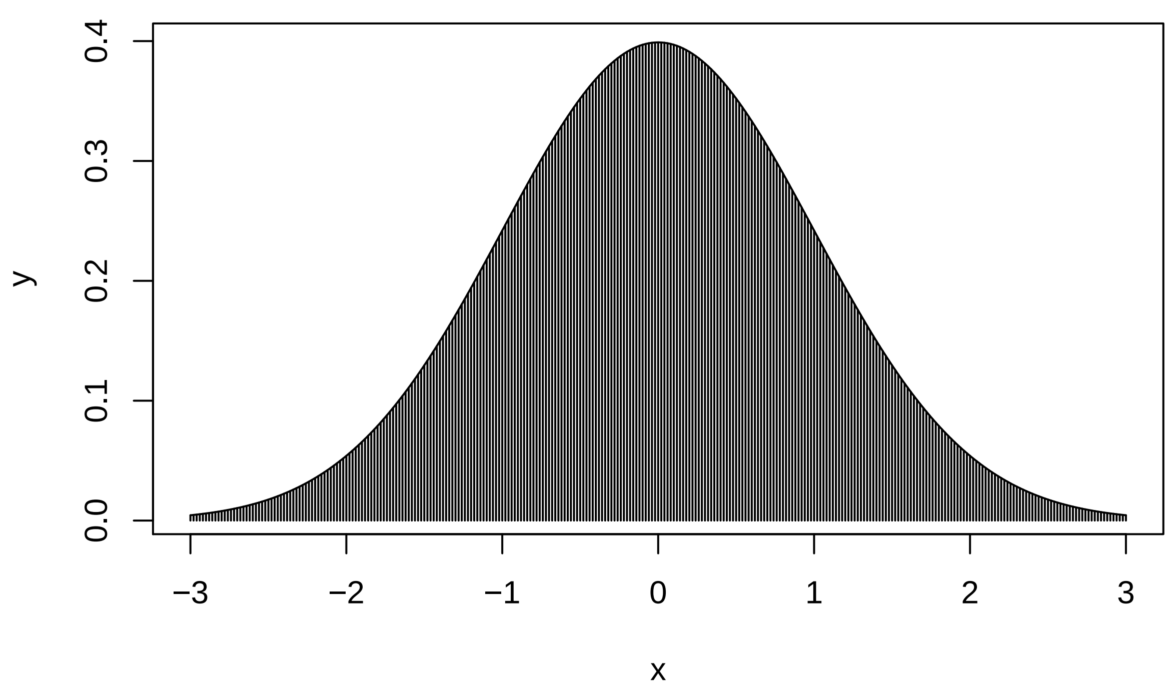

Figure 3: plot of chunk normal

A) This is the distribution $Y \sim N(0,1)$.

B) This statement is essentially that we believe 68% of women will fall within the range of 147cm and 177cm in height, with the average woman's height at 162cm.

	Ice	Fruit	French Fries
1st	.25	0.6	0.125
6th	0.5	0.3	0.125
11th	0.25	0.1	0.75

3-5 From this table, which represents $p(grade|snack)$, clearly shows that, given that ice cream is a favorite food, there is a 50% chance that the subject is a 6th grader. Given that fruit is the favorite food, there is a 60% chance that the subject is a 1st grader. And given that French Fries are the favorite food, there is a 75% that the subject is an 11th grader. Therefore, we conclude that these probabilities are not independent.