Homework 4

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3. .

```
y.monte <- runif(100000, 0, 1)
x.monte <- runif(100000, 0, 1)
monte <- x.monte^2 + y.monte^2 <= 1
area.monte <- (length(monte[monte]) / length(monte)) * 4
area.monte
```

```
## [1] 3.14108
```

1.

  a.

```
x0 <- 1009^2
x1 <- 180^2
x2 <- 324^2
x3 <- 1049^2
x4 <- 1004^2
x5 <- 80^2
x6 <- 64^2
x7 <- 40^2
x8 <- 16^2
x9 <- 2^2
c(1009,180,324,1049,1004,80,64,40,16,2)
```

```
##  [1] 1009  180  324 1049 1004   80   64   40   16    2
```

  b. is not a 4 digit seed

  c. We can see below that the middle-square puts itself in a loop from 6100,2100,4100,8100, then back to
     6100.

```
x0 <- 3043^2
x1 <- 2598^2
x2 <- 7496^2
x3 <- 1900^2
x4 <- 6100^2
x5 <- 2100^2
x6 <- 4100^2
x7 <- 8100^2
x8 <- 6100^2
x9 <- 2100^2
```

```
x10 <- 4100^2
x11 <- 8100^2
x12 <- 6100^2
x13 <- 2100^2
x14 <- 4100^2
```

d. There was cycling in (d), and (a) degenerated to 0 fairly quickly.

4 .

```
odds <- c(1/7,1/5,1/9,1/12,1/4,1/35,1/15,1/4)
sum(odds)
```

```
## [1] 1.13254
```

The sum is higher than 1, so let's adjust for 1.

```
odds <- odds / sum(odds)
```

Let's make a cumulative probabilty list, and race them 1000 times. The histogram is backwards, 8 is euler, 1 is dancin.

```
euler <- odds[1]
leapin <- sum(odds[1:2])
newton <- sum(odds[1:3])
count <- sum(odds[1:4])
pumped <- sum(odds[1:5])
loping <- sum(odds[1:6])
steamin <- sum(odds[1:7])
dancin <- sum(odds[1:8])
cumodds <- c(euler,leapin,newton,count,pumped,loping,steamin,dancin)

races <- runif(1000, 0, 1)
winners <- c()
for (i in races) {
  winners <- c(winners, sum(i < cumodds))
}
hist(winners, breaks=8)
```

Histogram of winners
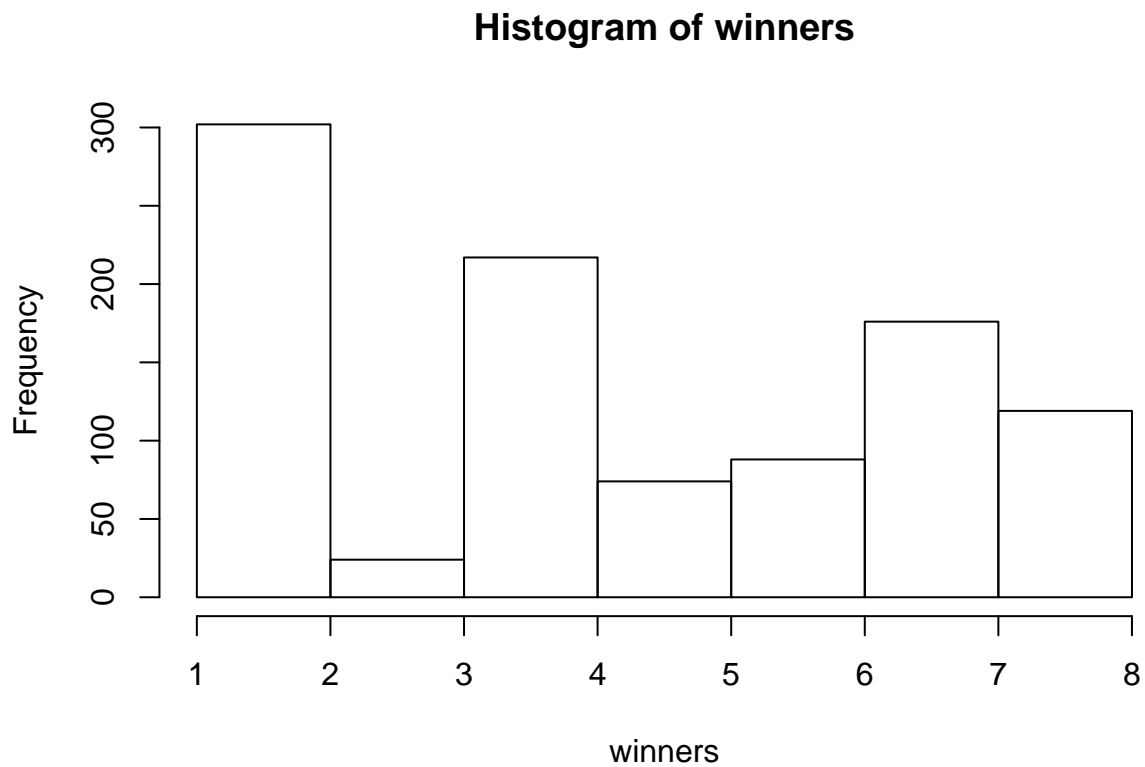

```r
lag2 <- 10/100
lag3 <- lag2 + 25/100
lag4 <- lag3 + 30/100
lag5 <- lag4 + 20/100
lag6 <- lag5 + 13/100
lag7 <- lag6 + 2/100
cumodds <- c(lag2,lag3,lag4,lag5,lag6,lag7)

trials <- runif(1000, 0, 1)
lags <- c()
for (i in trials) {
  lags <- c(lags, sum(i < cumodds))
}
hist(lags, breaks=6)
```

3 The simulation runs with lag time 2 being position 6, and lag time 7 being position 1.

Histogram of lags