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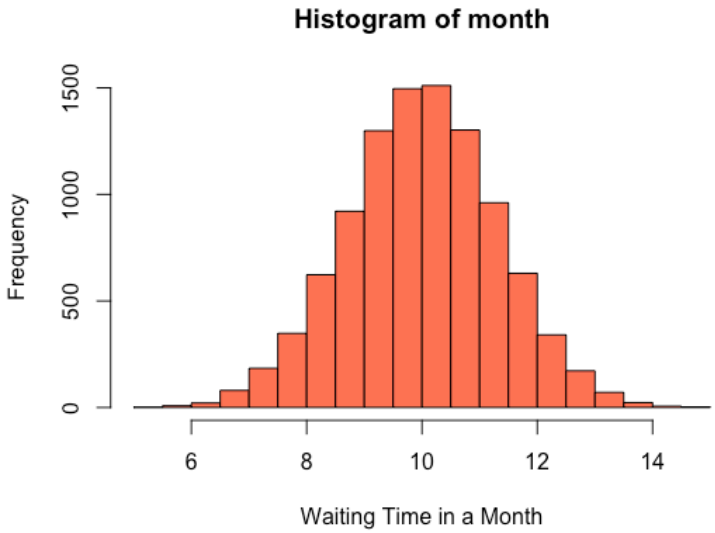
Math 6358

Exam 1 Take Home

```
1) set.seed(1234)
boxes <- vector(mode='numeric', length=10000)
for (n in 1:10000) {
  coupons <- c()
  repeat {
    coupons <- c(coupons, sample(1:10, 1))
    if (length(unique(coupons)) >= 10) {
      boxes[n] <- length(coupons)
      break
    }
  }
}

1a) set.seed(1234)
mean(boxes == 10)
#[1] 4e-04

1b) factorial(10)/(10^10)
#[1] 0.00036288

1c) 1 - mean(boxes<=20)
#[1] 0.786

1d) mean(boxes < 29.3)
#[1] 0.5936

1e) set.seed(1234)
mean(boxes)
# [1] 29.2406
sd(boxes)
# [1] 11.08631

1f) set.seed(1234)
boxes <- vector(mode='numeric', length=10000)
for (n in 1:10000) {
  coupons <- c()
  repeat {
```

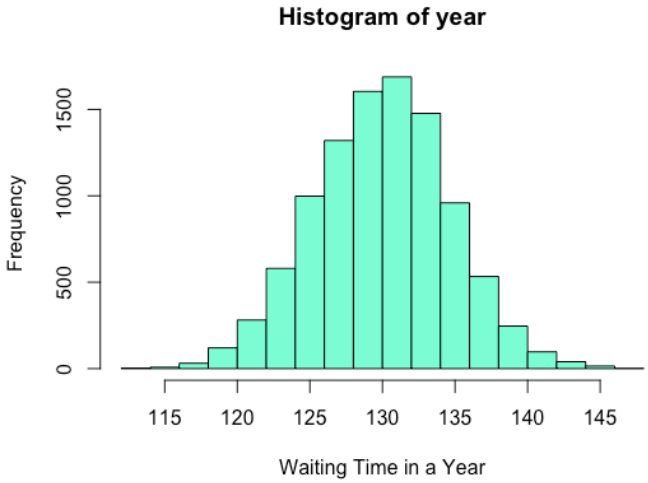
```
    coupons <- c(coupons, sample(1:20, 1))
    if (length(unique(coupons)) >= 20) {
      boxes[n] <- length(coupons)
      break
    }
  }
}

set.seed(1234)
mean(boxes)
# [1] 72.0325
sd(boxes)
# [1] 23.92146


2a) > pbinom(6,25,0.1) - pbinom(1,25,0.1)
#[1] 0.7193177

2b) > 100 * 0.1
#[1] 10
> 100*0.1 * (1-0.1)
#[1] 9
> sqrt(9)
#[1] 3

2c) > 1 - pbinom(6,25,0.1)
#[1] 0.009476361

2d) > pbinom(6,25,0.2)
#[1] 0.7800353

3a) #there is 20 waiting days in a month because 5days * 4wks
set.seed(1234)
month <- vector(mode="numeric", length = 10000)
for (i in 1:10000){
  wait.time <- runif(20)
  month[i] <- sum(wait.time)
}

3b)
hist(month, xlab = "Waiting Time in a Month", col = "coral1")
```



3c) mean(month)
#[1] 10.00059
sd(month)
#[1] 1.300857

3d) #there is 260 waiting days in a year because 5days*52wks
set.seed(1234)
year <- vector(mode="numeric", length = 10000)
for (i in 1:10000){
  wait.time <- runif(260)
  year[i] <- sum(wait.time)
}

hist(year, xlab = "Waiting Time in a Year", col = “aquamarine")



mean(year)
#[1] 129.9651
sd(year)
#[1] 4.648566

3e) for a month:
E[X] = n*μ = 20*0.5

> 20*0.5
[1] **10**

SD(X) = sqrt(20)*sqrt(1/12)
> sqrt(20)*sqrt(1/12)
[1] **1.290994**

For a year:
E[X] = n*μ = 260*0.5
> 260*0.5
[1] **130**

SD(X) = sqrt(260)*sqrt(1/12)
> sqrt(260)*sqrt(1/12)
[1] **4.654747**

The means and standard deviations seem to be close to the values calculated in the simulations.