

Question 3)

The startup company EZTABLE has an online restaurant reservation system that is accessible by mobile and web. Imagine that EZTABLE would like to start a promotion for new members to make their bookings earlier in the day.

a) What is the “average” booking time for new members making their first restaurant booking?(use minday, which is the absolute minute of the day from 0-1440)

```
mean(minday)
```

```
## [1] 942.4964
```

i) Use traditional statistical methods to estimate the population mean of minday, its standard error, and the 95% confidence interval (CI) of the sampling means

```
visualize_95_mean_ci <- function(sample) {  
  sample_means <- mean(sample)  
  sample_size <- length(sample)  
  sample_stdevs <- sd(sample)  
  sample_stderrs <- sample_stdevs/sqrt(sample_size)  
  ci95_low <- sample_means - sample_stderrs*1.96  
  ci95_high <- sample_means + sample_stderrs*1.96  
  cat("The 95% confidence interval (CI) is", mean(abs(ci95_high - ci95_low)));  
}
```

```
mean(minday)
```

```
## [1] 942.4964
```

```
std_error <- sd(minday)/sqrt(length(minday))  
std_error
```

```
## [1] 0.5997673
```

```
visualize_95_mean_ci(minday)
```

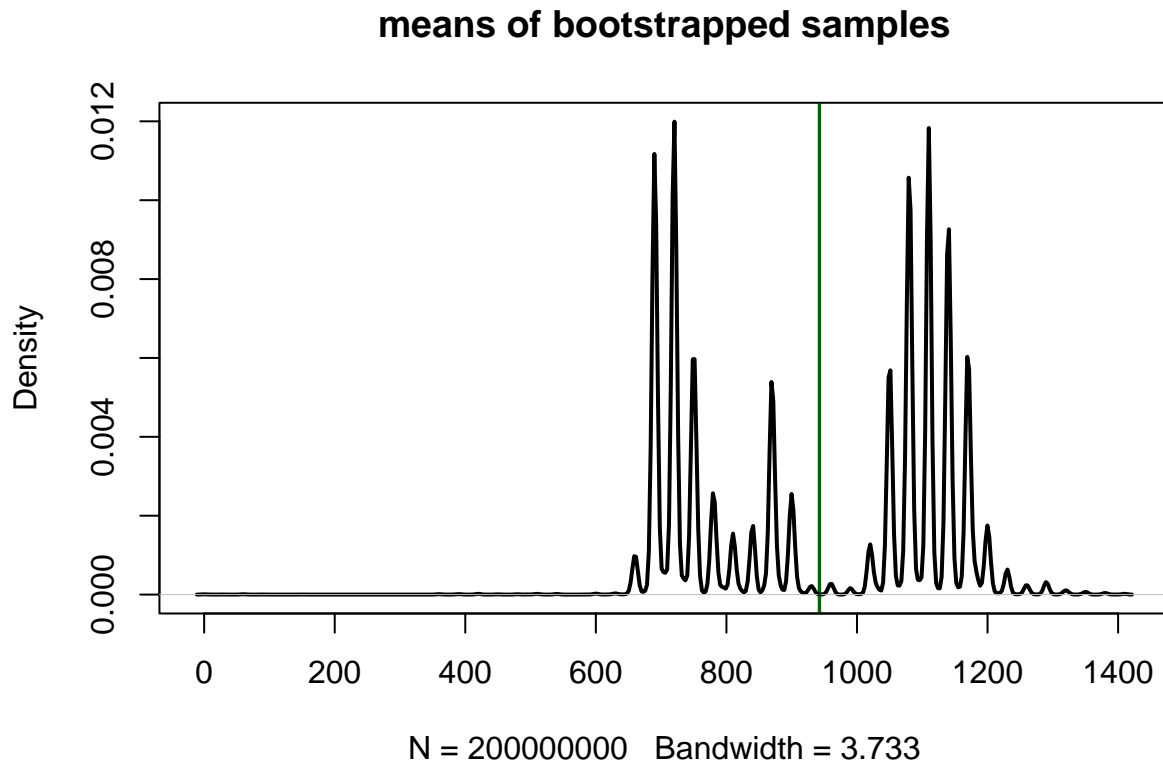
```
## The 95% confidence interval (CI) is 2.351088
```

ii) Bootstrap to produce 2000 new samples from the original sample

```
sample_size <- 2000
sample0 <- sample(minday, sample_size)
minday.reamples <- replicate(2000, sample(minday, length(minday), replace=TRUE))
```

iii) Visualize the means of the 2000 bootstrapped samples

```
plot(density(minday.reamples), lwd=2, main="means of bootstrapped samples")
plot_resample_mean<-function(sample_i) {
  abline(v=mean(sample_i), col=rgb(0.0, 0.4, 0.0, 0.01))
}
apply(minday.reamples , 2, FUN = plot_resample_mean)
```



NULL

iv) Estimate the 95% CI of the bootstrapped means.

```
sample_means <- apply(minday.reamples, 2, FUN=mean)
quantile(sample_means, probs = c(0.025, 0.975))
```

```
##      2.5%      97.5%  
## 941.3585 943.7056
```

b) By what time of day, have half the new members of the day already arrived at their restaurant?

```
hour <- round(median(minday)/60, 0)  
minute <- median(minday)%%60  
cat(hour, ":", minute)
```

```
## 17 : 20
```

i) Estimate the median of minday

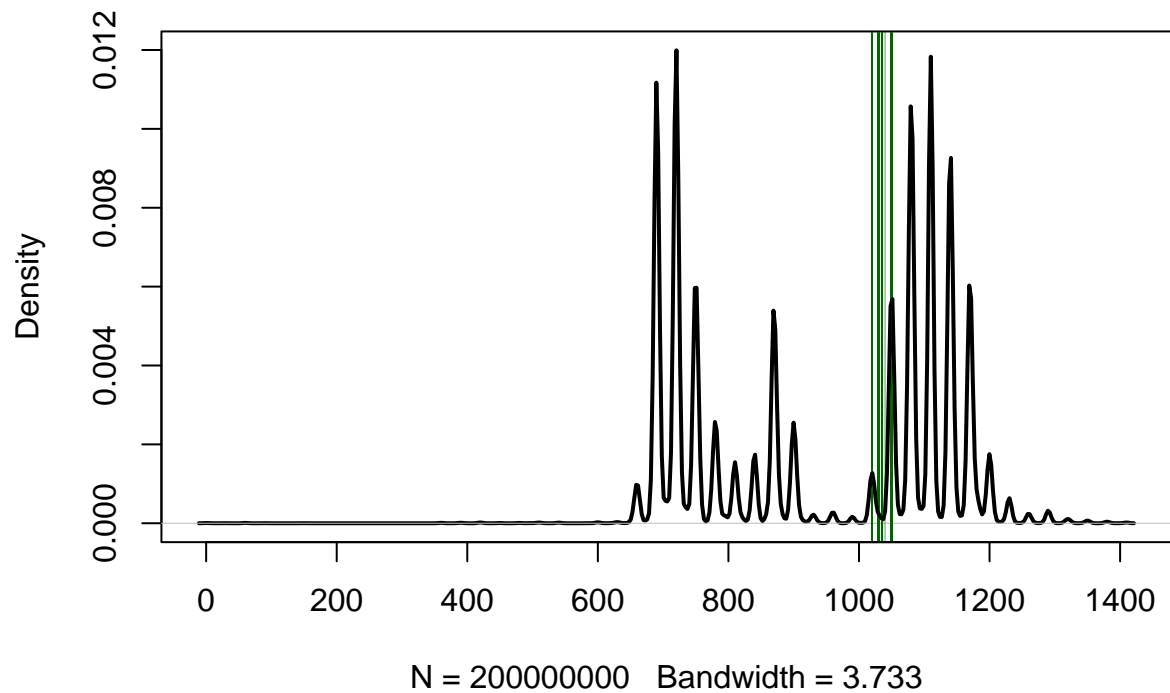
```
median(minday)
```

```
## [1] 1040
```

ii) Visualize the medians of the 2000 bootstrapped samples

```
plot(density(minday.resemples), lwd=2, main="medians of bootstrapped samples")  
plot_resample_median<-function(sample_i) {  
  abline(v=median(sample_i), col=rgb(0.0, 0.4, 0.0, 0.01))  
}  
apply(minday.resemples , 2, FUN = plot_resample_median)
```

medians of bootstrapped samples



```
## NULL
```

iii) Estimate the 95% CI of the bootstrapped medians.

```
sample_medians <- apply(minday.resemples, 2, FUN=median)
quantile(sample_medians, probs = c(0.025, 0.975))
```

```
## 2.5% 97.5%
## 1020 1050
```