Reproducible Research Project I

Introduction

It is now possible to collect a large amount of data about personal movement using activity monitoring devices such as a Fitbit, Nike Fuelband, or Jawbone Up. These type of devices are part of the "quantified self" movement - a group of enthusiasts who take measurements about themselves regularly to improve their health, to find patterns in their behavior, or because they are tech geeks. But these data remain under-utilized both because the raw data are hard to obtain and there is a lack of statistical methods and software for processing and interpreting the data.

This assignment makes use of data from a personal activity monitoring device. This device collects data at 5 minute intervals through out the day. The data consists of two months of data from an anonymous individual collected during the months of October and November, 2012 and include the number of steps taken in 5 minute intervals each day.

Loading and preprocessing the data

Loading the data

```
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 3.3.3
```

```
library(plyr)
```

```
## Warning: package 'plyr' was built under R version 3.3.3
```

```
library(dplyr)
```

```
## Warning: package 'dplyr' was built under R version 3.3.3
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:plyr':
##
##     arrange, count, desc, failwith, id, mutate, rename, summarise,
##     summarize
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

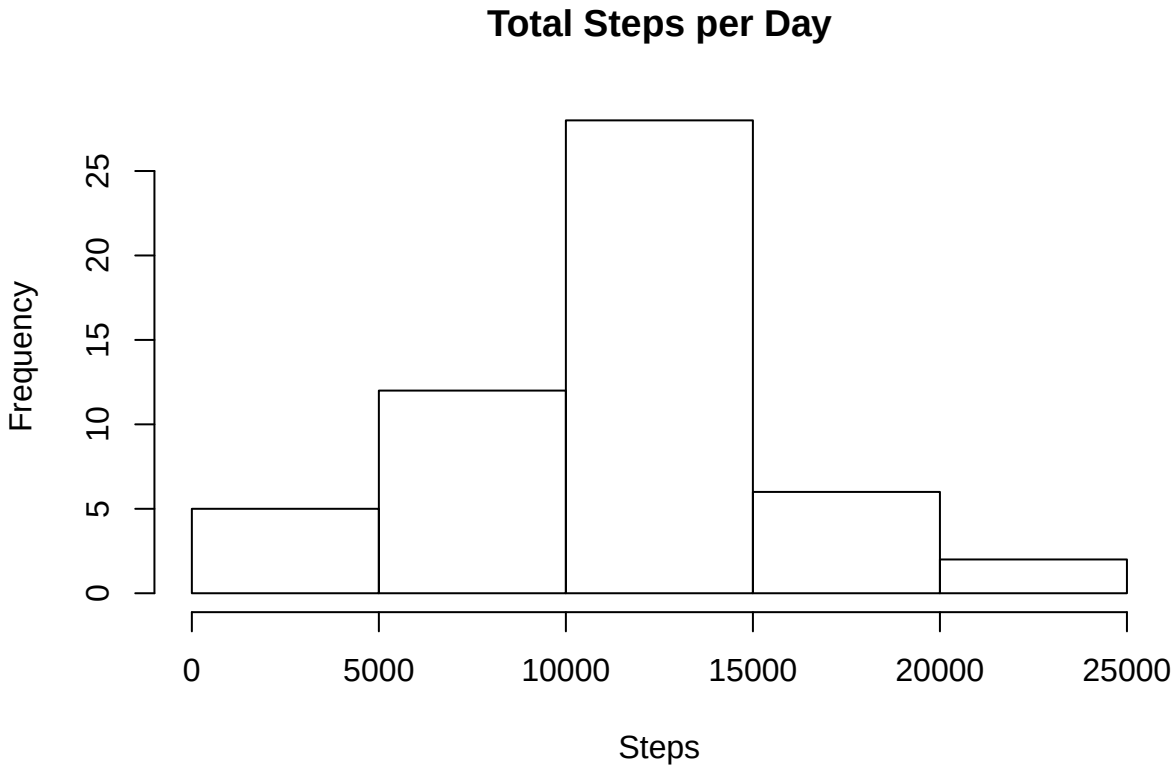
```
activity <- read.csv("c:/temp/activity.csv")
```

```
  activity$day <- weekdays(as.Date(activity$date))
  activity$DateTime<- as.POSIXct(activity$date, format="%Y-%m-%d")

  ##pulling data without na's
  clean <- activity[!is.na(activity$steps),]
```

What is mean total number of steps taken per day

Calculate the total number of steps taken per day

```
  ## summarizing total steps per date
  sumTable <- aggregate(activity$steps ~ activity$date, FUN = sum,)

  ## Creating the historgram of total steps per day
  colnames(sumTable)<- c("Date", "Steps")

  ## Creating the historgram of total steps per day
  hist(sumTable$Steps, breaks=5, xlab="Steps", main = "Total Steps per Day")
```



Calculate and report the mean and median of the total number of steps taken per day

```
  ## Mean of Steps
  as.integer(mean(sumTable$Steps))
```

```
## [1] 10766
```

```
  ## Median of Steps
  as.integer(median(sumTable$Steps))
```

```
## [1] 10765
```

```
  ## Median of Steps
  as.integer(median(sumTable$Steps))
```

```
## [1] 10765
```

The average number of steps taken each day was 10766 steps. The median number of steps taken each day was 10765 steps

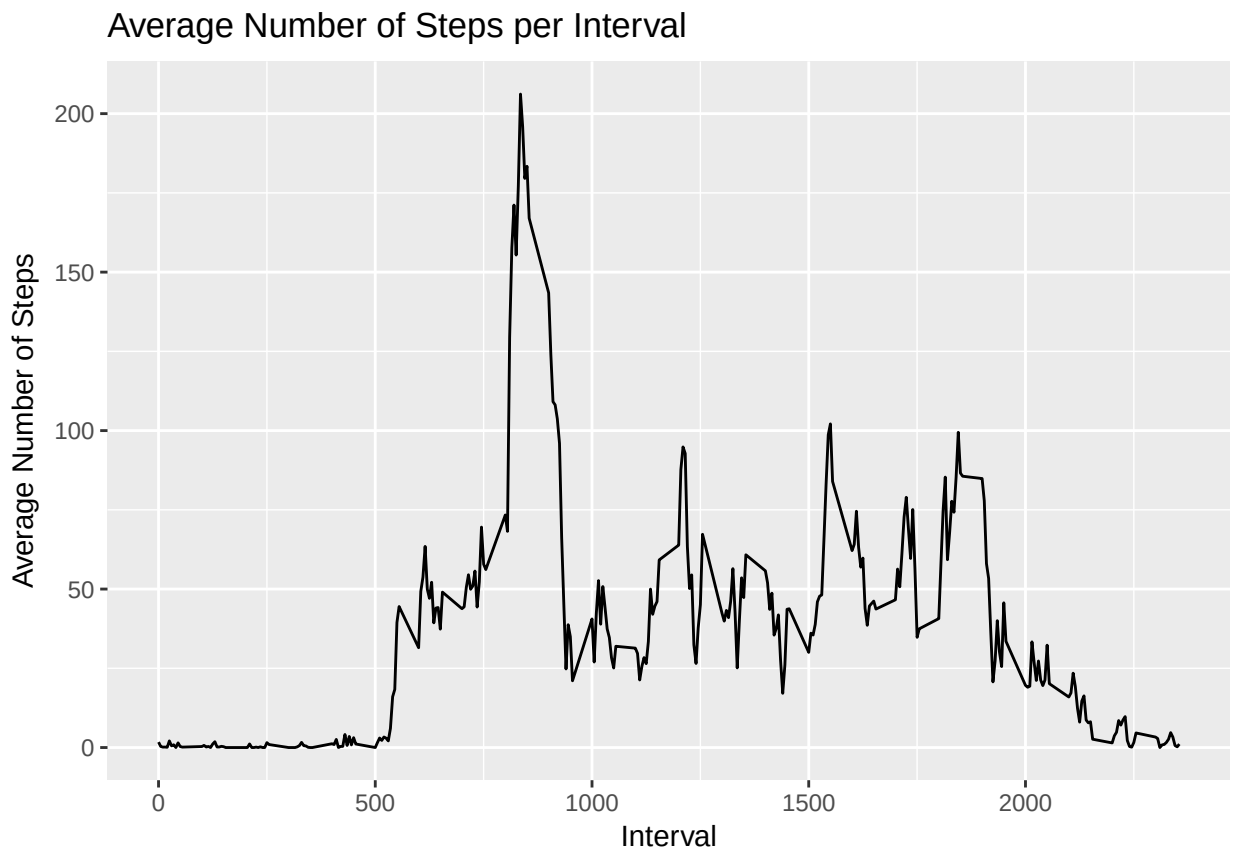
What is the average daily activity pattern?

Make a time series plot (i.e. type = "l") of the 5-minute interval (x-axis) and the average number of steps taken, averaged across all days (y-axis)

```
  ##create average number of steps per interval
  intervalTable <- ddply(clean, .(interval), summarize, Avg = mean(steps))

  ##Maximum steps by interval
  maxSteps <- max(intervalTable$Avg)

  ##Which interval contains the maximum average number of steps
  intervalTable[intervalTable$Avg==maxSteps,1]
```

```
## [1] 835
```

```
  ##Create line plot of average number of steps per interval
  p <- ggplot(intervalTable, aes(x=interval, y=Avg), xlab = "Interval", ylab="Average Number of Steps")
  p + geom_line()+xlab("Interval")+ylab("Average Number of Steps")+ggtitle("Average Number of Steps per
```



Which 5-minute interval, on average across all the days in the dataset, contains the maximum number of steps?

```
##Maximum steps by interval
maxSteps <- max(intervalTable$Avg)

##Which interval contains the maximum average number of steps
intervalTable[intervalTable$Avg==maxSteps,1]
```

```
## [1] 835
```

The maximum number of steps for a 5-minute interval was 206 steps. The 5-minute interval which had the maximum number of steps was the 835 interval.

Imputing Missing Values

Calculate and report the total number of missing values in the dataset (i.e. the total number of rows with NAs)

```
##Number of NAs in original data set
nrow(activity[is.na(activity$steps),])
```

```
## [1] 2304
```

My strategy for filling in NAs will be to substitute the missing steps with the average 5-minute interval based on the day of the week.

```
## Create the average number of steps per weekday and interval
avgTable <- ddply(clean, .(interval, day), summarize, Avg = mean(steps))

## Create dataset with all NAs for substitution
nadata<- activity[is.na(activity$steps),]

## Merge NA data with average weekday interval for substitution
newdata<-merge(nadata, avgTable, by=c("interval", "day"))
```

Create a new dataset that is equal to the original dataset but with the missing data filled in.

```
## Reorder the new substituded data in the same format as clean data set
newdata2<- newdata[,c(6,4,1,2,5)]
colnames(newdata2)<- c("steps", "date", "interval", "day", "DateTime")

##Merge the NA averages and non NA data together
mergeData <- rbind(clean, newdata2)
```

Make a histogram of the total number of steps taken each day and Calculate and report the mean and median total number of steps taken per day. Do these values differ from the estimates from the first part of the assignment? What is the impact of imputing missing data on the estimates of the total daily number of steps?

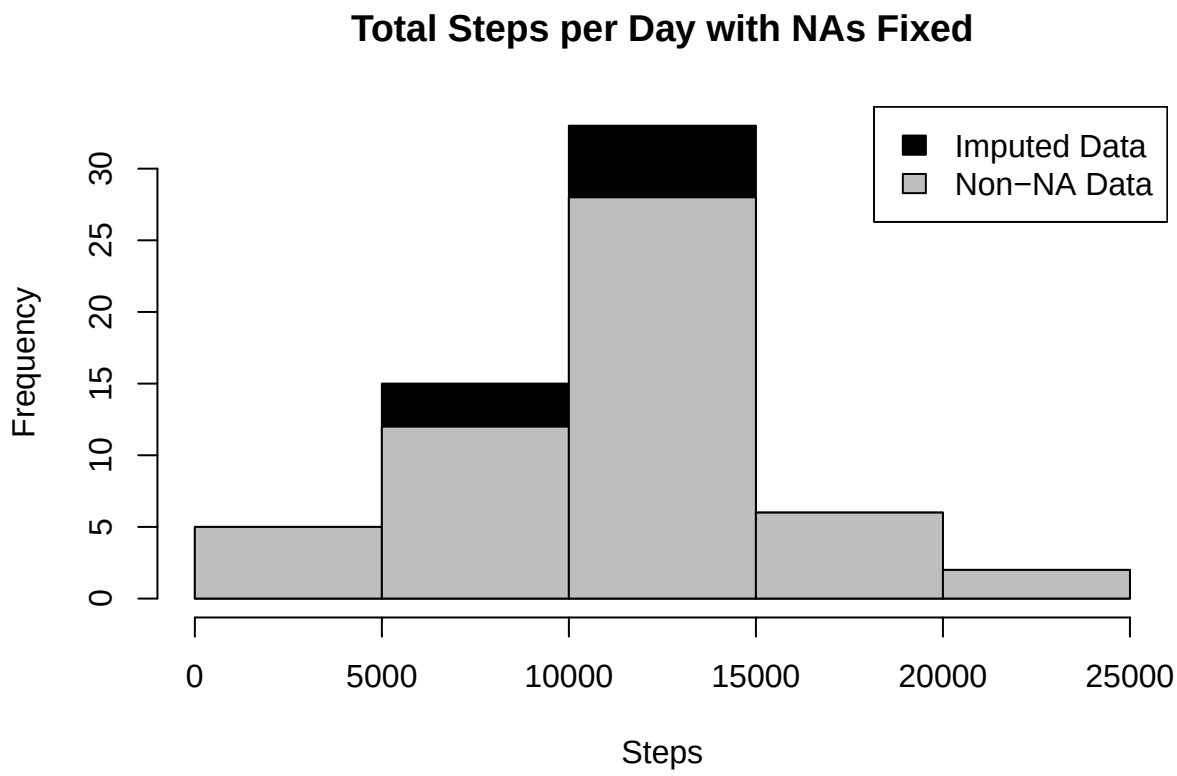
```
##Create sum of steps per date to compare with step 1
sumTable2 <- aggregate(mergeData$steps ~ mergeData$date, FUN=sum, )
colnames(sumTable2)<- c("Date", "Steps")

## Mean of Steps with NA data taken care of
as.integer(mean(sumTable2$Steps))
```

```
## [1] 10821
```

```
## Median of Steps with NA data taken care of
as.integer(median(sumTable2$Steps))
```

```
## [1] 11015
```

```
## Creating the histogram of total steps per day, categorized by data set to show impact
hist(sumTable2$Steps, breaks=5, xlab="Steps", main = "Total Steps per Day with NAs Fixed", col="Black")
hist(sumTable$Steps, breaks=5, xlab="Steps", main = "Total Steps per Day with NAs Fixed", col="Grey", ad
legend("topright", c("Imputed Data", "Non-NA Data"), fill=c("black", "grey") )
```



The new mean of the imputed data is 10821 steps compared to the old mean of 10766 steps. That creates a difference of 55 steps on average per day. The new median of the imputed data is 11015 steps compared to the old median of 10765 steps. That creates a difference of 250 steps for the median. However, the overall shape of the distribution has not changed.

Are there differences in activity patterns between weekdays and weekends?

Create a new factor variable in the dataset with two levels - "weekday" and "weekend" indicating whether a given date is a weekday or weekend day.

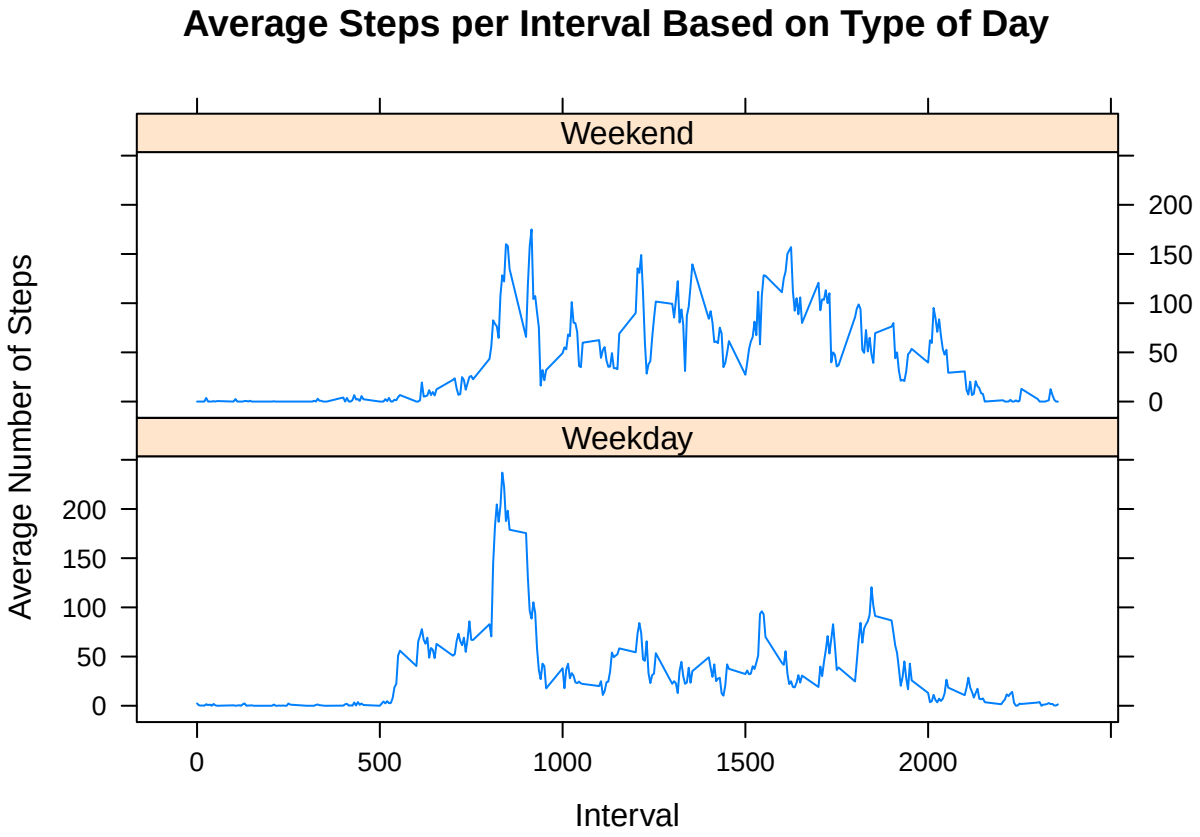
```
## Create new category based on the days of the week
mergeData$DayCategory <- ifelse(mergeData$day %in% c("Saturday", "Sunday"), "Weekend", "Weekday")
```

Make a panel plot containing a time series plot (i.e. type = "l") of the 5-minute interval (x-axis) and the average number of steps taken, averaged across all weekday days or weekend days (y-axis).

```
library(lattice)
```

```
## Warning: package 'lattice' was built under R version 3.3.3
```

```
## Warning: package 'lattice' was built under R version 3.1.3

## Summarize data by interval and type of day
intervalTable2 <- ddply(mergeData, .(interval, DayCategory), summarize, Avg = mean(steps))

##Plot data in a panel plot
xyplot(Avg~interval|DayCategory, data=intervalTable2, type="l",  layout = c(1,2),
       main="Average Steps per Interval Based on Type of Day",
       ylab="Average Number of Steps", xlab="Interval")
```



Yes, the step activity trends are different based on whether the day occurs on a weekend or not. This may be due to people having an increased opportunity for activity beyond normal work hours for those who work during the week.