Reproducible Research Project 1

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##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.

##Data Set The data for this assignment can be downloaded from the course web site: #Dataset: Activity monitoring data

##Assignment This assignment will be described in multiple parts. You will need to write a report that answers the questions detailed below. Ultimately, you will need to complete the entire assignment in a single R markdown document that can be processed by knitr and be transformed into an HTML file.

##Loading and preprocessing the data

```
# import data
activity <- read.csv("activity.csv")

# libraries
library(ggplot2)
library(dplyr)
```

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

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

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

```
library(knitr)
Sys.setlocale("LC_TIME", "C")
```

```
## [1] "C"
```

```
# variables info
str(activity)
```

```
## 'data.frame':    17568 obs. of  3 variables:
##  $ steps   : int  NA NA NA NA NA NA NA NA NA NA ...
```

```
##  $ date    : chr  "2012-10-01" "2012-10-01" "2012-10-01" "2012-10-01" ...
##  $ interval: int  0 5 10 15 20 25 30 35 40 45 ...
```

##What is mean total number of steps taken per day?

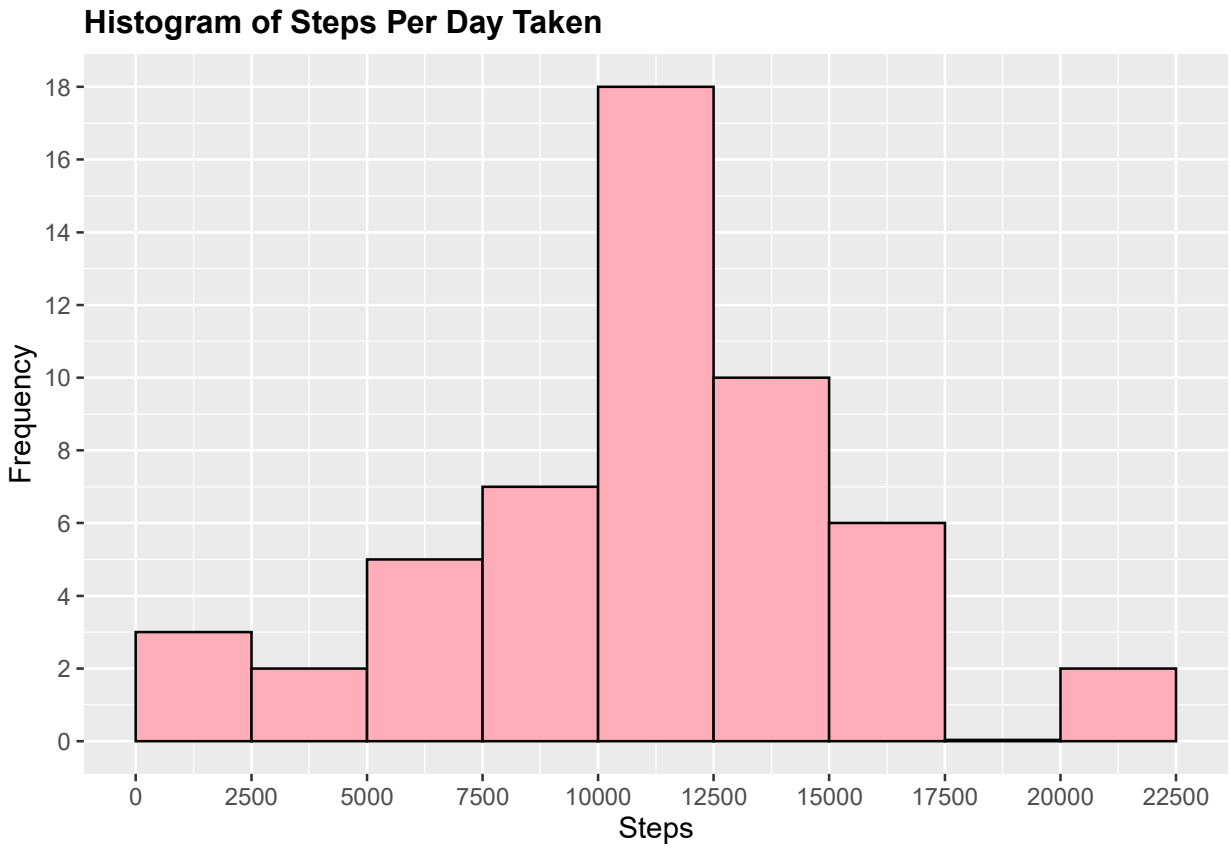
```
# create and print number of steps per day data set
StepsPerDay <- aggregate(activity$steps, list(activity$date), FUN=sum)
colnames(StepsPerDay) <- c("Date", "Steps")
StepsPerDay
```

```
##          Date Steps
## 1  2012-10-01    NA
## 2  2012-10-02   126
## 3  2012-10-03 11352
## 4  2012-10-04 12116
## 5  2012-10-05 13294
## 6  2012-10-06 15420
## 7  2012-10-07 11015
## 8  2012-10-08    NA
## 9  2012-10-09 12811
## 10 2012-10-10  9900
## 11 2012-10-11 10304
## 12 2012-10-12 17382
## 13 2012-10-13 12426
## 14 2012-10-14 15098
## 15 2012-10-15 10139
## 16 2012-10-16 15084
## 17 2012-10-17 13452
## 18 2012-10-18 10056
## 19 2012-10-19 11829
## 20 2012-10-20 10395
## 21 2012-10-21  8821
## 22 2012-10-22 13460
## 23 2012-10-23  8918
## 24 2012-10-24  8355
## 25 2012-10-25  2492
## 26 2012-10-26  6778
## 27 2012-10-27 10119
## 28 2012-10-28 11458
## 29 2012-10-29  5018
## 30 2012-10-30  9819
## 31 2012-10-31 15414
## 32 2012-11-01    NA
## 33 2012-11-02 10600
## 34 2012-11-03 10571
## 35 2012-11-04    NA
## 36 2012-11-05 10439
## 37 2012-11-06  8334
## 38 2012-11-07 12883
## 39 2012-11-08  3219
## 40 2012-11-09    NA
## 41 2012-11-10    NA
## 42 2012-11-11 12608
## 43 2012-11-12 10765
## 44 2012-11-13  7336
```

```
## 45 2012-11-14    NA
## 46 2012-11-15    41
## 47 2012-11-16  5441
## 48 2012-11-17 14339
## 49 2012-11-18 15110
## 50 2012-11-19  8841
## 51 2012-11-20  4472
## 52 2012-11-21 12787
## 53 2012-11-22 20427
## 54 2012-11-23 21194
## 55 2012-11-24 14478
## 56 2012-11-25 11834
## 57 2012-11-26 11162
## 58 2012-11-27 13646
## 59 2012-11-28 10183
## 60 2012-11-29  7047
## 61 2012-11-30    NA
```

```
# draw the histogram from hw requirment
g <- ggplot(StepsPerDay, aes(Steps))
g+geom_histogram(boundary=0, binwidth=2500, col="gray1", fill="lightpink1")+ggtitle("Histogram of Steps
```

```
## Warning: Removed 8 rows containing non-finite values (stat_bin).
```




```
# mean
mean(StepsPerDay$Steps, na.rm=TRUE)
```

```
## [1] 10766.19
```

```
# median
median(StepsPerDay$Steps, na.rm=TRUE)
```

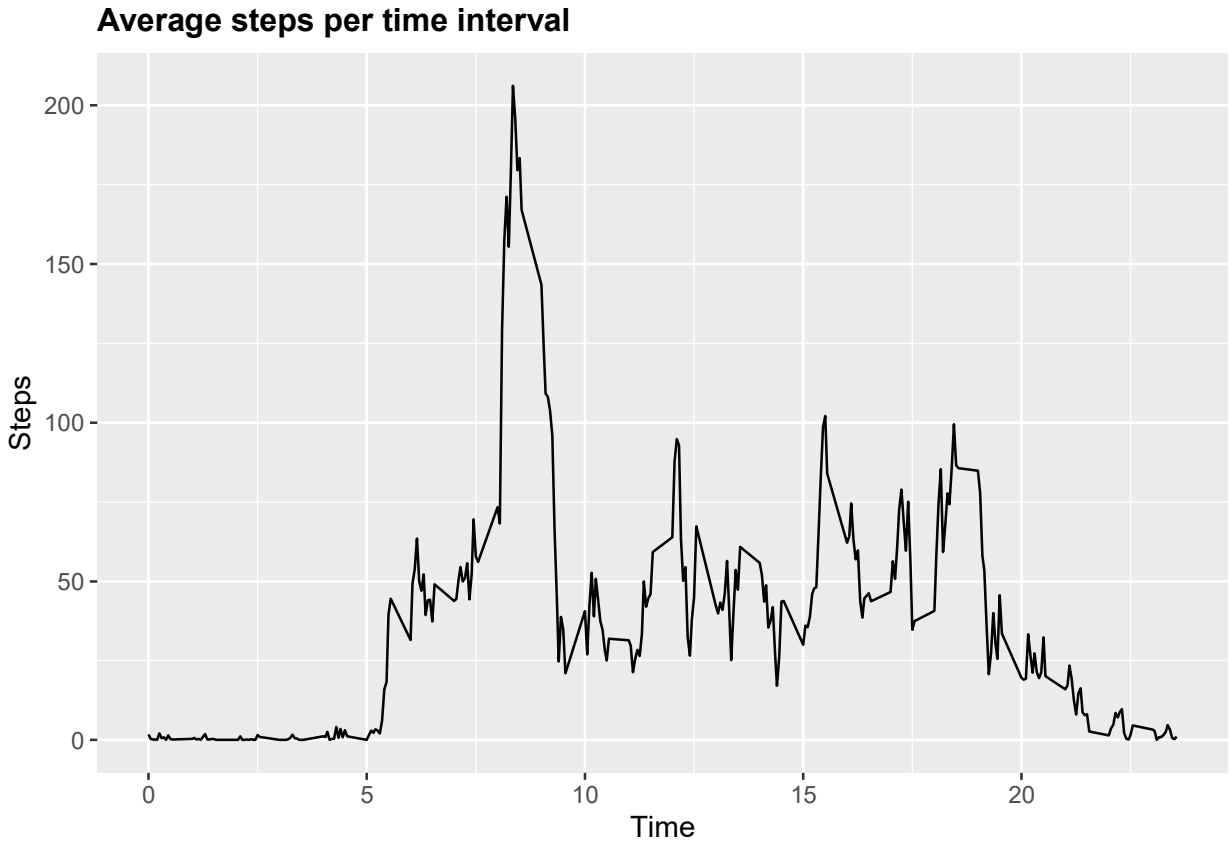
```
## [1] 10765
```

##What is the average daily activity pattern?

```
# create table with steps per time
StepsPerTime <- aggregate(steps~interval,data=activity,FUN=mean,na.action=na.omit)

# variable time
StepsPerTime$time <- StepsPerTime$interval/100

# draw the line plot
h <- ggplot(StepsPerTime, aes(time, steps))
h+geom_line(col="gray1")+ggtitle("Average steps per time interval")+xlab("Time")+ylab("Steps")+theme(pl
```




```
# table for dplyr
ST <- tbl_df(StepsPerTime)
```

```
## Warning: `tbl_df()` is deprecated as of dplyr 1.0.0.
## Please use `tibble::as_tibble()` instead.
## This warning is displayed once every 8 hours.
## Call `lifecycle::last_warnings()` to see where this warning was generated.
```

```
# find the column
ST %>% select(time, steps) %>% filter(steps==max(ST$steps))
```

```
## # A tibble: 1 x 2
```

```
##    time steps
##   <dbl> <dbl>
## 1  8.35  206.
```

##inputing missing values

```
# table for dplyr
ACT <- tbl_df(activity)
# find the column
ACT %>% filter(is.na(steps)) %>% summarize(missing_values = n())
```

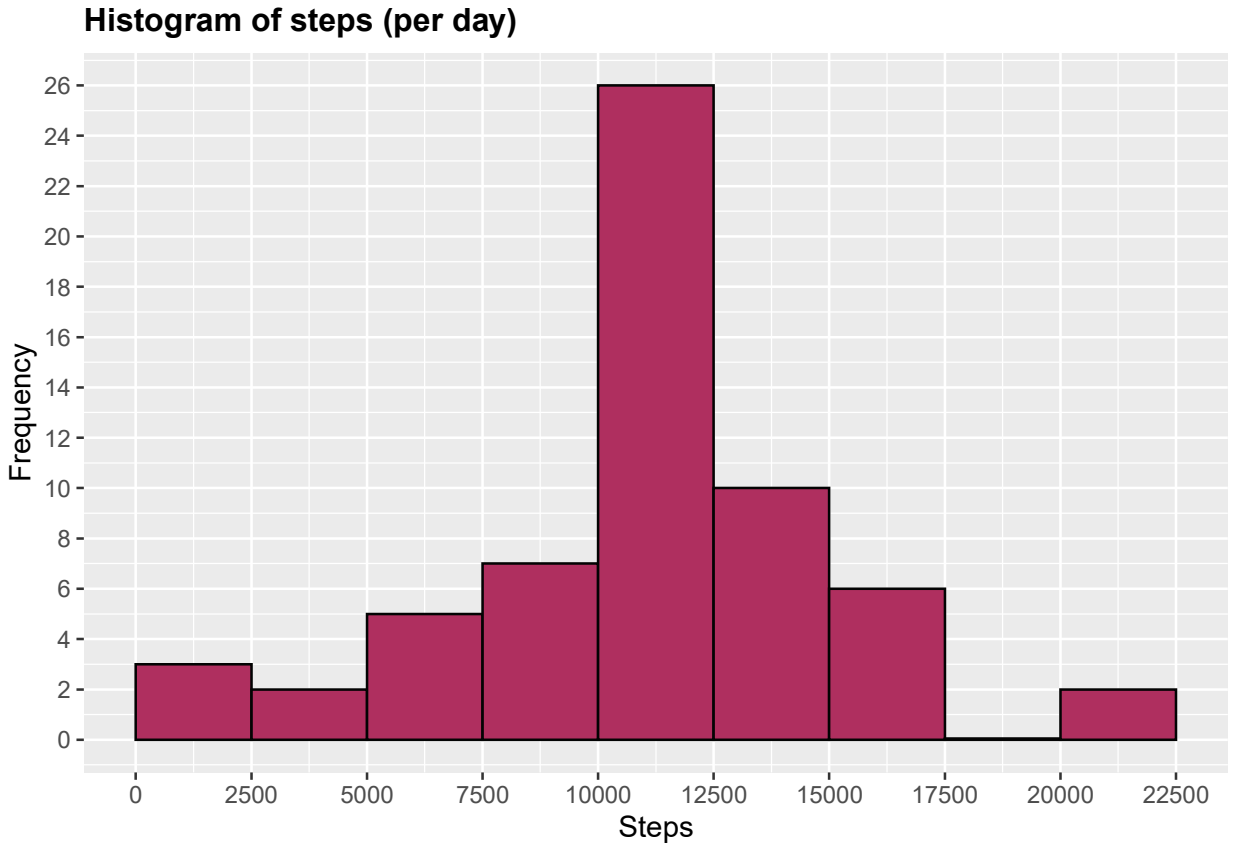
```
## # A tibble: 1 x 1
##   missing_values
##            <int>
## 1           2304
```

```
# values without NA are imputed in a new column
activity$CompleteSteps <- ifelse(is.na(activity$steps), round(StepsPerTime$steps[match(activity$interval

# new dataset activityFull
activityFull <- data.frame(steps=activity$CompleteSteps, interval=activity$interval, date=activity$date)
# see first 10 values of the new dataset
head(activityFull, n=10)
```

```
##    steps interval       date
## 1      2        0 2012-10-01
## 2      0        5 2012-10-01
## 3      0       10 2012-10-01
## 4      0       15 2012-10-01
## 5      0       20 2012-10-01
## 6      2       25 2012-10-01
## 7      1       30 2012-10-01
## 8      1       35 2012-10-01
## 9      0       40 2012-10-01
## 10     1       45 2012-10-01
```

```
# prepare data
StepsPerDayFull <- aggregate(activityFull$steps, list(activityFull$date), FUN=sum)
colnames(StepsPerDayFull) <- c("Date", "Steps")
# draw the histogram
g <- ggplot(StepsPerDayFull, aes(Steps))
g+geom_histogram(boundary=0, binwidth=2500, col="gray1", fill="maroon")+ggtitle("Histogram of steps (pe
```




```
# Mean
mean(StepsPerDayFull$Steps)
```

```
## [1] 10765.64
```

```
#Median
median(StepsPerDayFull$Steps)
```

```
## [1] 10762
```

##Are there differences in activity patterns between weekdays and weekends?

```
# Create variable with date in correct format
activityFull$RealDate <- as.Date(activityFull$date, format = "%Y-%m-%d")
# create a variable with weekdays name
activityFull$weekday <- weekdays(activityFull$RealDate)
# create a new variable indicating weekday or weekend
activityFull$DayType <- ifelse(activityFull$weekday=='Saturday' | activityFull$weekday=='Sunday', 'week
# see first 10 values
head(activityFull, n=10)
```

```
##    steps interval       date   RealDate weekday DayType
## 1      2        0 2012-10-01 2012-10-01  Monday weekday
## 2      0        5 2012-10-01 2012-10-01  Monday weekday
## 3      0       10 2012-10-01 2012-10-01  Monday weekday
## 4      0       15 2012-10-01 2012-10-01  Monday weekday
## 5      0       20 2012-10-01 2012-10-01  Monday weekday
## 6      2       25 2012-10-01 2012-10-01  Monday weekday
## 7      1       30 2012-10-01 2012-10-01  Monday weekday
```

```
## 8       1       35 2012-10-01 2012-10-01  Monday weekday
## 9       0       40 2012-10-01 2012-10-01  Monday weekday
## 10      1       45 2012-10-01 2012-10-01  Monday weekday
```

```r
# create table with steps per time across weekdaydays or weekend days
StepsPerTimeDT <- aggregate(steps~interval+DayType,data=activityFull,FUN=mean,na.action=na.omit)
# variable time (more comprensible for the graph axis)
StepsPerTimeDT$time <- StepsPerTime$interval/100
# draw the line plot
j <- ggplot(StepsPerTimeDT, aes(time, steps))
j+geom_line(col="darkred")+ggtitle("Average Steps (per time interval): Weekdays vs. Weekends")+xlab("Ti
```