Reproducible Research

Project 1 MZ

Total number of steps each day Transform data

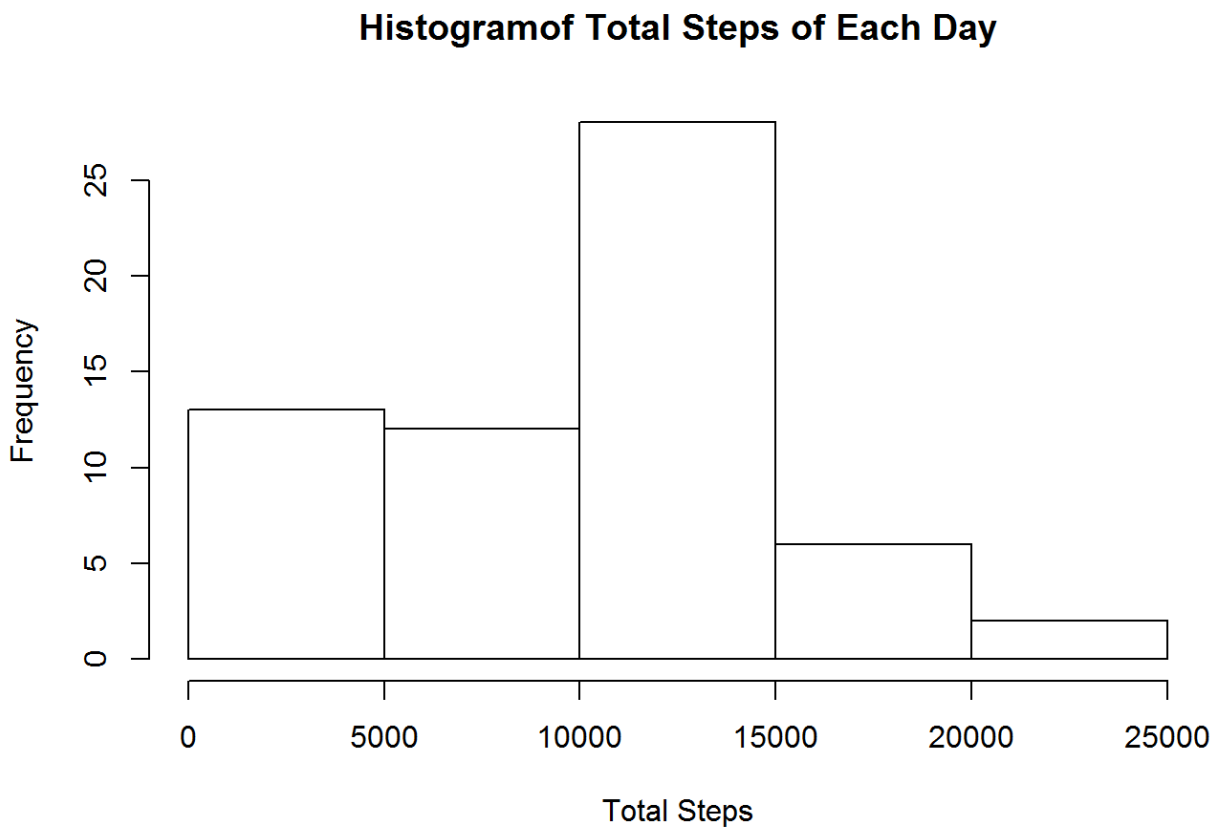
```
setwd("C:\\users\\zhuangmg\\Coursera\\Reproducible Research\\project 1")
ActivityTable01<-read.csv("activity.csv")
ActivityTable02<-aggregate(ActivityTable01$steps,by=list(ActivityTable01$date),
FUN=sum,na.rm=TRUE)
names(ActivityTable02)<-c("date","TotalSteps")
print(ActivityTable02)
```

```
##          date TotalSteps
## 1  2012-10-01          0
## 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          0
## 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          0
## 33 2012-11-02      10600
## 34 2012-11-03      10571
## 35 2012-11-04          0
## 36 2012-11-05      10439
## 37 2012-11-06       8334
## 38 2012-11-07      12883
## 39 2012-11-08       3219
## 40 2012-11-09          0
## 41 2012-11-10          0
## 42 2012-11-11      12608
## 43 2012-11-12      10765
## 44 2012-11-13       7336
## 45 2012-11-14          0
## 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          0
```

Total number of steps each day Construct histogram of total number of steps each day

```
hist(ActivityTable02$TotalSteps,main="Histogramof Total Steps of Each Day",xlab
="Total Steps")
```



Total number of steps each day Calculate mean & median

```
mean(ActivityTable02$TotalSteps)
```

```
## [1] 9354.23
```

```
median(ActivityTable02$TotalSteps)
```

```
## [1] 10395
```

Average daily activity pattern Transform data

```
ActivityTable03<-aggregate(ActivityTable01$steps,by=list(ActivityTable01$interv
al),FUN=mean,na.rm=TRUE)
names(ActivityTable03)<-c("interval","AverageSteps")
print(ActivityTable03)
```

```
##     interval AverageSteps
## 1          0    1.7169811
## 2          5    0.3396226
## 3         10    0.1320755
## 4         15    0.1509434
## 5         20    0.0754717
## 6         25    2.0943396
## 7         30    0.5283019
## 8         35    0.8679245
## 9         40    0.0000000
## 10        45    1.4716981
## 11        50    0.3018868
## 12        55    0.1320755
## 13       100    0.3207547
## 14       105    0.6792453
## 15       110    0.1509434
## 16       115    0.3396226
## 17       120    0.0000000
## 18       125    1.1132075
## 19       130    1.8301887
## 20       135    0.1698113
## 21       140    0.1698113
## 22       145    0.3773585
## 23       150    0.2641509
## 24       155    0.0000000
## 25       200    0.0000000
## 26       205    0.0000000
## 27       210    1.1320755
## 28       215    0.0000000
## 29       220    0.0000000
## 30       225    0.1320755
## 31       230    0.0000000
## 32       235    0.2264151
## 33       240    0.0000000
## 34       245    0.0000000
## 35       250    1.5471698
## 36       255    0.9433962
## 37       300    0.0000000
## 38       305    0.0000000
## 39       310    0.0000000
## 40       315    0.0000000
## 41       320    0.2075472
## 42       325    0.6226415
## 43       330    1.6226415
## 44       335    0.5849057
## 45       340    0.4905660
## 46       345    0.0754717
## 47       350    0.0000000
```

```
## 48       355    0.0000000
## 49       400    1.1886792
## 50       405    0.9433962
## 51       410    2.5660377
## 52       415    0.0000000
## 53       420    0.3396226
## 54       425    0.3584906
## 55       430    4.1132075
## 56       435    0.6603774
## 57       440    3.4905660
## 58       445    0.8301887
## 59       450    3.1132075
## 60       455    1.1132075
## 61       500    0.0000000
## 62       505    1.5660377
## 63       510    3.0000000
## 64       515    2.2452830
## 65       520    3.3207547
## 66       525    2.9622642
## 67       530    2.0943396
## 68       535    6.0566038
## 69       540   16.0188679
## 70       545   18.3396226
## 71       550   39.4528302
## 72       555   44.4905660
## 73       600   31.4905660
## 74       605   49.2641509
## 75       610   53.7735849
## 76       615   63.4528302
## 77       620   49.9622642
## 78       625   47.0754717
## 79       630   52.1509434
## 80       635   39.3396226
## 81       640   44.0188679
## 82       645   44.1698113
## 83       650   37.3584906
## 84       655   49.0377358
## 85       700   43.8113208
## 86       705   44.3773585
## 87       710   50.5094340
## 88       715   54.5094340
## 89       720   49.9245283
## 90       725   50.9811321
## 91       730   55.6792453
## 92       735   44.3207547
## 93       740   52.2641509
## 94       745   69.5471698
## 95       750   57.8490566
## 96       755   56.1509434
```

```
## 97       800   73.3773585
## 98       805   68.2075472
## 99       810  129.4339623
## 100      815  157.5283019
## 101      820  171.1509434
## 102      825  155.3962264
## 103      830  177.3018868
## 104      835  206.1698113
## 105      840  195.9245283
## 106      845  179.5660377
## 107      850  183.3962264
## 108      855  167.0188679
## 109      900  143.4528302
## 110      905  124.0377358
## 111      910  109.1132075
## 112      915  108.1132075
## 113      920  103.7169811
## 114      925   95.9622642
## 115      930   66.2075472
## 116      935   45.2264151
## 117      940   24.7924528
## 118      945   38.7547170
## 119      950   34.9811321
## 120      955   21.0566038
## 121     1000   40.5660377
## 122     1005   26.9811321
## 123     1010   42.4150943
## 124     1015   52.6603774
## 125     1020   38.9245283
## 126     1025   50.7924528
## 127     1030   44.2830189
## 128     1035   37.4150943
## 129     1040   34.6981132
## 130     1045   28.3396226
## 131     1050   25.0943396
## 132     1055   31.9433962
## 133     1100   31.3584906
## 134     1105   29.6792453
## 135     1110   21.3207547
## 136     1115   25.5471698
## 137     1120   28.3773585
## 138     1125   26.4716981
## 139     1130   33.4339623
## 140     1135   49.9811321
## 141     1140   42.0377358
## 142     1145   44.6037736
## 143     1150   46.0377358
## 144     1155   59.1886792
## 145     1200   63.8679245
```

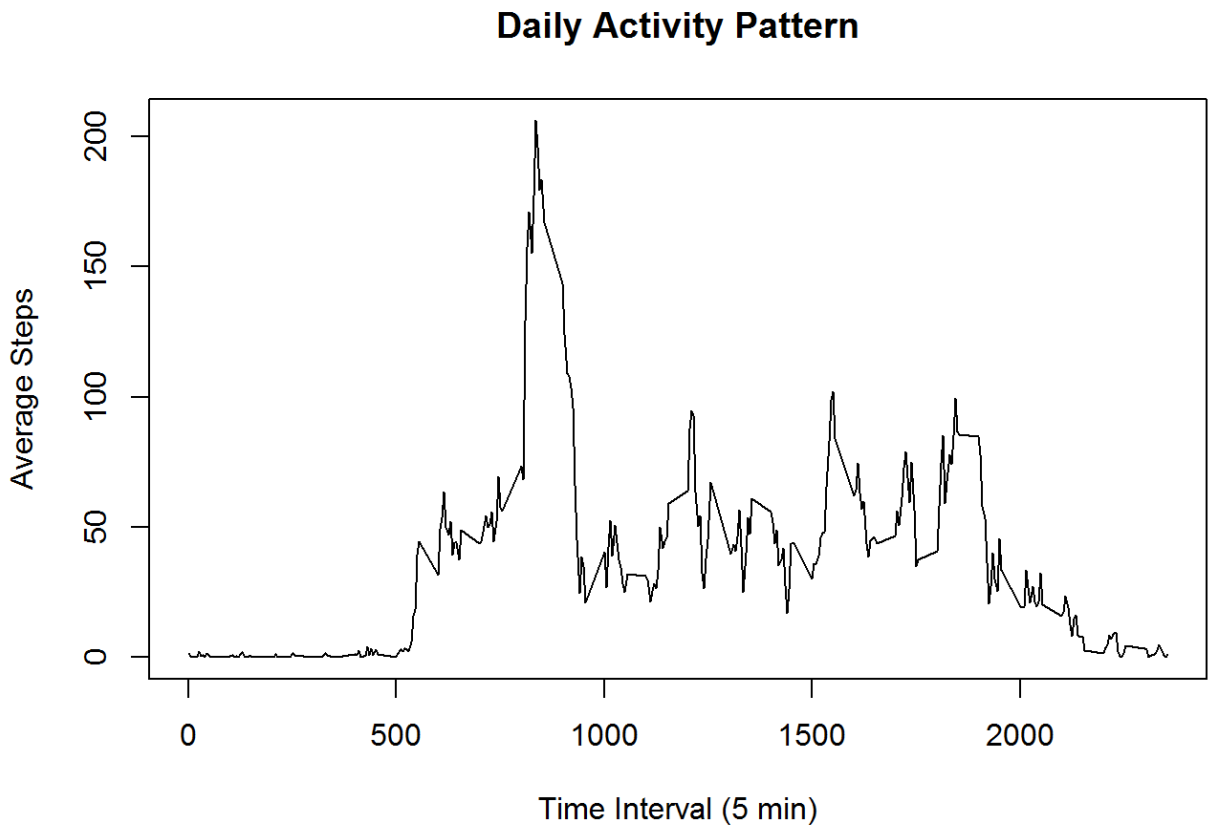
```
## 146     1205   87.6981132
## 147     1210   94.8490566
## 148     1215   92.7735849
## 149     1220   63.3962264
## 150     1225   50.1698113
## 151     1230   54.4716981
## 152     1235   32.4150943
## 153     1240   26.5283019
## 154     1245   37.7358491
## 155     1250   45.0566038
## 156     1255   67.2830189
## 157     1300   42.3396226
## 158     1305   39.8867925
## 159     1310   43.2641509
## 160     1315   40.9811321
## 161     1320   46.2452830
## 162     1325   56.4339623
## 163     1330   42.7547170
## 164     1335   25.1320755
## 165     1340   39.9622642
## 166     1345   53.5471698
## 167     1350   47.3207547
## 168     1355   60.8113208
## 169     1400   55.7547170
## 170     1405   51.9622642
## 171     1410   43.5849057
## 172     1415   48.6981132
## 173     1420   35.4716981
## 174     1425   37.5471698
## 175     1430   41.8490566
## 176     1435   27.5094340
## 177     1440   17.1132075
## 178     1445   26.0754717
## 179     1450   43.6226415
## 180     1455   43.7735849
## 181     1500   30.0188679
## 182     1505   36.0754717
## 183     1510   35.4905660
## 184     1515   38.8490566
## 185     1520   45.9622642
## 186     1525   47.7547170
## 187     1530   48.1320755
## 188     1535   65.3207547
## 189     1540   82.9056604
## 190     1545   98.6603774
## 191     1550  102.1132075
## 192     1555   83.9622642
## 193     1600   62.1320755
## 194     1605   64.1320755
```

```
## 195     1610   74.5471698
## 196     1615   63.1698113
## 197     1620   56.9056604
## 198     1625   59.7735849
## 199     1630   43.8679245
## 200     1635   38.5660377
## 201     1640   44.6603774
## 202     1645   45.4528302
## 203     1650   46.2075472
## 204     1655   43.6792453
## 205     1700   46.6226415
## 206     1705   56.3018868
## 207     1710   50.7169811
## 208     1715   61.2264151
## 209     1720   72.7169811
## 210     1725   78.9433962
## 211     1730   68.9433962
## 212     1735   59.6603774
## 213     1740   75.0943396
## 214     1745   56.5094340
## 215     1750   34.7735849
## 216     1755   37.4528302
## 217     1800   40.6792453
## 218     1805   58.0188679
## 219     1810   74.6981132
## 220     1815   85.3207547
## 221     1820   59.2641509
## 222     1825   67.7735849
## 223     1830   77.6981132
## 224     1835   74.2452830
## 225     1840   85.3396226
## 226     1845   99.4528302
## 227     1850   86.5849057
## 228     1855   85.6037736
## 229     1900   84.8679245
## 230     1905   77.8301887
## 231     1910   58.0377358
## 232     1915   53.3584906
## 233     1920   36.3207547
## 234     1925   20.7169811
## 235     1930   27.3962264
## 236     1935   40.0188679
## 237     1940   30.2075472
## 238     1945   25.5471698
## 239     1950   45.6603774
## 240     1955   33.5283019
## 241     2000   19.6226415
## 242     2005   19.0188679
## 243     2010   19.3396226
```

```
## 244     2015   33.3396226
## 245     2020   26.8113208
## 246     2025   21.1698113
## 247     2030   27.3018868
## 248     2035   21.3396226
## 249     2040   19.5471698
## 250     2045   21.3207547
## 251     2050   32.3018868
## 252     2055   20.1509434
## 253     2100   15.9433962
## 254     2105   17.2264151
## 255     2110   23.4528302
## 256     2115   19.2452830
## 257     2120   12.4528302
## 258     2125    8.0188679
## 259     2130   14.6603774
## 260     2135   16.3018868
## 261     2140    8.6792453
## 262     2145    7.7924528
## 263     2150    8.1320755
## 264     2155    2.6226415
## 265     2200    1.4528302
## 266     2205    3.6792453
## 267     2210    4.8113208
## 268     2215    8.5094340
## 269     2220    7.0754717
## 270     2225    8.6981132
## 271     2230    9.7547170
## 272     2235    2.2075472
## 273     2240    0.3207547
## 274     2245    0.1132075
## 275     2250    1.6037736
## 276     2255    4.6037736
## 277     2300    3.3018868
## 278     2305    2.8490566
## 279     2310    0.0000000
## 280     2315    0.8301887
## 281     2320    0.9622642
## 282     2325    1.5849057
## 283     2330    2.6037736
## 284     2335    4.6981132
## 285     2340    3.3018868
## 286     2345    0.6415094
## 287     2350    0.2264151
## 288     2355    1.0754717
```

Average daily activity pattern Plot time series data

```
plot(ActivityTable03$interval,ActivityTable03$AverageSteps,type = "l",main="Dai
ly Activity Pattern",xlab="Time Interval (5 min)", ylab="Average Steps")
```



Average daily activity pattern Find the interval that contains the maximum number of steps

```
ActivityTable03[which.max(ActivityTable03$AverageSteps),]
```

```
##     interval AverageSteps
## 104      835     206.1698
```

Imputing missing values calculate the total number of rows with missing values

```
nrow(ActivityTable01[!complete.cases(ActivityTable01),])
```

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

Imputing missing values Impute missing values using the mean value of that interval and create a new dataset

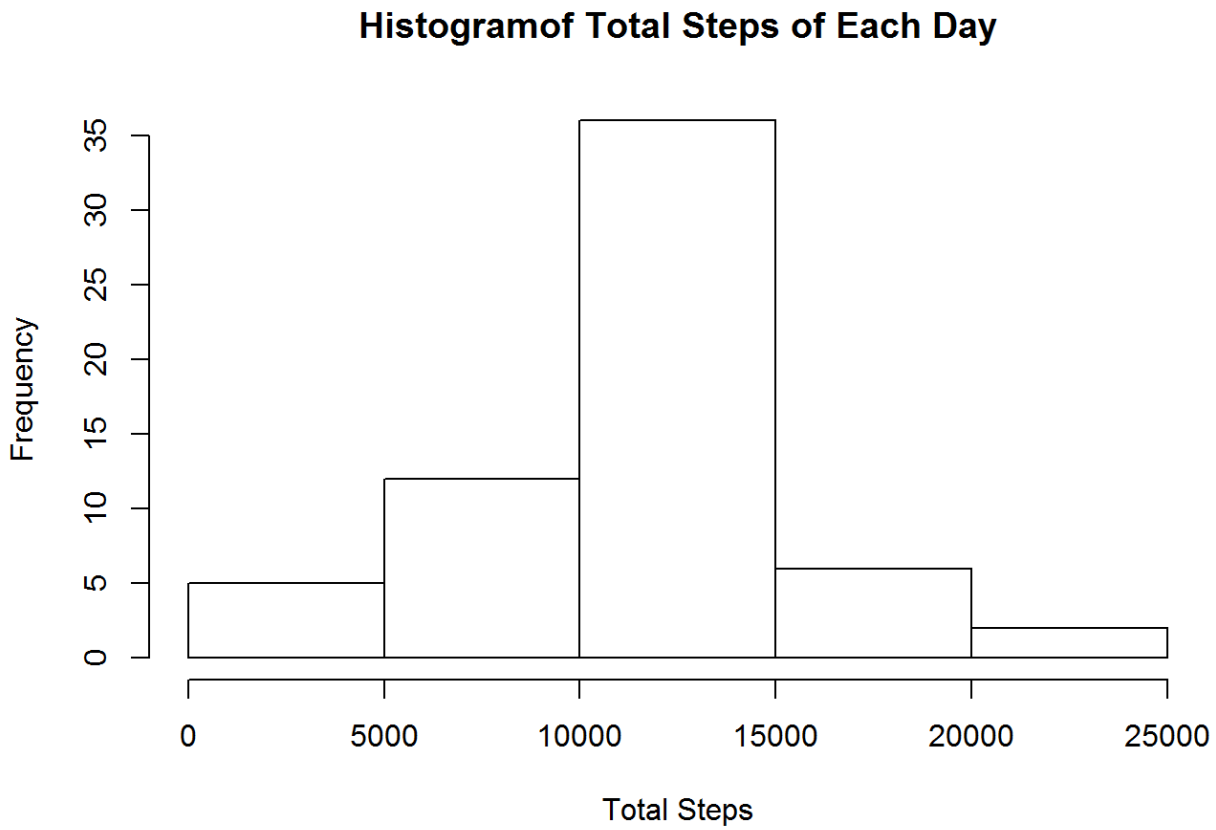
```
fillNA <- numeric()
for (i in 1:nrow(ActivityTable01)) {
    obs <- ActivityTable01[i, ]
    if (is.na(obs$steps)) {
        steps <- subset(ActivityTable03, interval == obs$interval)$AverageSteps
    } else {
        steps <- obs$steps
    }
    fillNA <- c(fillNA, steps)
}
ActivityTable04=ActivityTable01
ActivityTable04$steps=fillNA
nrow(ActivityTable04[!complete.cases(ActivityTable04),])
```

```
## [1] 0
```

Now ther is no missing values in the dataset

Imputing missing values Transform data, construct histogram of total number of steps each day, and compare with previous histogram

```
ActivityTable05<-aggregate(ActivityTable04$steps,by=list(ActivityTable04$date),
FUN=sum,na.rm=TRUE)
names(ActivityTable05)<-c("date","TotalSteps")
hist(ActivityTable05$TotalSteps,main="Histogramof Total Steps of Each Day",xlab
="Total Steps")
```



This second histogram is different because of the imputation of missing values.

Imputing missing values Calculate mean & median and compare with previous values

```
mean(ActivityTable05$TotalSteps)
```

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

```
median(ActivityTable05$TotalSteps)
```

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

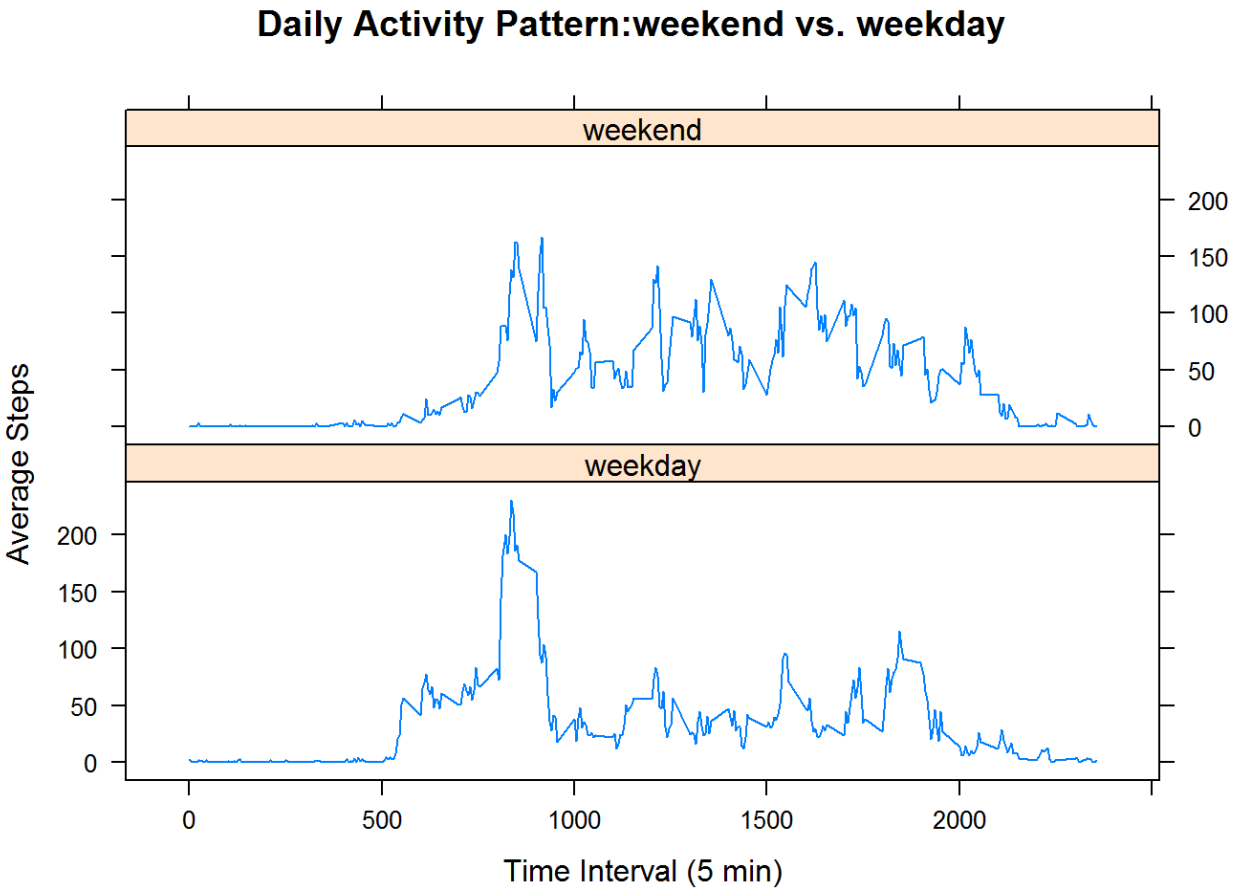
The mean and median are also different from previous values because of the imputation of missing values.

Differences between weekdays and weekends Create a new factor variable in the dataset with two levels - “weekday” and “weekend”

```
ActivityTable04$date <- as.Date(ActivityTable04$date, "%Y-%m-%d")
ActivityTable04$weekdays<-weekdays(ActivityTable04$date)
ActivityTable04weekdays<-as.factor(ActivityTable04$weekdays)
ActivityTable04$daylevel=ActivityTable04$weekdays
for (i in 1:nrow(ActivityTable04)){
      if (ActivityTable04$weekdays[i]=="Saturday"){
      ActivityTable04$daylevel[i]<-"weekend"
    } else if (ActivityTable04$weekdays[i]=="Sunday"){
      ActivityTable04$daylevel[i]<-"weekend"
    } else {
      ActivityTable04$daylevel[i]<-"weekday"
    }
}
ActivityTable06 <- aggregate(steps~interval+daylevel,FUN=mean,data=ActivityTabl
e04)
names(ActivityTable06)<-c("interval","daylevel","AverageSteps")
```

Differences between weekdays and weekends

```
library(lattice)
xyplot(AverageSteps ~ interval | daylevel,ActivityTable06, type = "l", layout
= c(1, 2), main="Daily Activity Pattern:weekend vs. weekday",xlab="Time Interva
l (5 min)", ylab="Average Steps")
```



The patterns of weekday and weekend are slightly different.