HW#4

Natalia

13 April 2019

```
set.seed(42)

setwd("C:\\Users\\Natalia\\Desktop\\ITMO\\R\\R_task#4")
raw_df = readRDS("weather.rds")
```

Exploring dataset

```
summary(raw_df)
```

```
##        X               year          month           measure
##  Min.   :  1.00   Min.   :2014   Min.   : 1.000   Length:286
##  1st Qu.: 72.25   1st Qu.:2015   1st Qu.: 4.000   Class :character
##  Median :143.50   Median :2015   Median : 7.000   Mode  :character
##  Mean   :143.50   Mean   :2015   Mean   : 6.923
##  3rd Qu.:214.75   3rd Qu.:2015   3rd Qu.:10.000
##  Max.   :286.00   Max.   :2015   Max.   :12.000
##       X1                 X2                 X3
##  Length:286         Length:286         Length:286
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##
##       X4                 X5                 X6
##  Length:286         Length:286         Length:286
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##
##       X7                 X8                 X9
##  Length:286         Length:286         Length:286
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##
##      X10                X11                X12
##  Length:286         Length:286         Length:286
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##
##      X13                X14                X15
##  Length:286         Length:286         Length:286
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##
##      X16                X17                X18
##  Length:286         Length:286         Length:286
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##
##      X19                X20                X21
##  Length:286         Length:286         Length:286
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##
##      X22                X23                X24
##  Length:286         Length:286         Length:286
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##
##      X25                X26                X27
##  Length:286         Length:286         Length:286
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##
##      X28                X29                X30
##  Length:286         Length:286         Length:286
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##
##      X31
##  Length:286
##  Class :character
##  Mode  :character
##
##
##
```

```r
head(raw_df)
```

```
##   X year month           measure X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12
## 1 1 2014    12  Max.TemperatureF 64 42 51 43 42 45 38 29 49  48  39  39
## 2 2 2014    12 Mean.TemperatureF 52 38 44 37 34 42 30 24 39  43  36  35
## 3 3 2014    12  Min.TemperatureF 39 33 37 30 26 38 21 18 29  38  32  31
## 4 4 2014    12    Max.Dew.PointF 46 40 49 24 37 45 36 28 49  45  37  28
## 5 5 2014    12    MeanDew.PointF 40 27 42 21 25 40 20 16 41  39  31  27
## 6 6 2014    12     Min.DewpointF 26 17 24 13 12 36 -3  3 28  37  27  25
##   X13 X14 X15 X16 X17 X18 X19 X20 X21 X22 X23 X24 X25 X26 X27 X28 X29 X30
## 1  42  45  42  44  49  44  37  36  36  44  47  46  59  50  52  52  41  30
## 2  37  39  37  40  45  40  33  32  33  39  45  44  52  44  45  46  36  26
## 3  32  33  32  35  41  36  29  27  30  33  42  41  44  37  38  40  30  22
## 4  28  29  33  42  46  34  25  30  30  39  45  46  58  31  34  42  26  10
## 5  26  27  29  36  41  30  22  24  27  34  42  44  43  29  31  35  20   4
## 6  24  25  27  30  32  26  20  20  25  25  37  41  29  28  29  27  10  -6
##   X31
## 1  30
## 2  25
## 3  20
## 4   8
## 5   5
## 6   1
```

```
str(raw_df)
```

```
## 'data.frame':    286 obs. of  35 variables:
##  $ X      : int  1 2 3 4 5 6 7 8 9 10 ...
##  $ year   : int  2014 2014 2014 2014 2014 2014 2014 2014 2014 2014 ...
##  $ month  : int  12 12 12 12 12 12 12 12 12 12 ...
##  $ measure: chr  "Max.TemperatureF" "Mean.TemperatureF" "Min.TemperatureF" "Max.Dew.PointF" ...
##  $ X1     : chr  "64" "52" "39" "46" ...
##  $ X2     : chr  "42" "38" "33" "40" ...
##  $ X3     : chr  "51" "44" "37" "49" ...
##  $ X4     : chr  "43" "37" "30" "24" ...
##  $ X5     : chr  "42" "34" "26" "37" ...
##  $ X6     : chr  "45" "42" "38" "45" ...
##  $ X7     : chr  "38" "30" "21" "36" ...
##  $ X8     : chr  "29" "24" "18" "28" ...
##  $ X9     : chr  "49" "39" "29" "49" ...
##  $ X10    : chr  "48" "43" "38" "45" ...
##  $ X11    : chr  "39" "36" "32" "37" ...
##  $ X12    : chr  "39" "35" "31" "28" ...
##  $ X13    : chr  "42" "37" "32" "28" ...
##  $ X14    : chr  "45" "39" "33" "29" ...
##  $ X15    : chr  "42" "37" "32" "33" ...
##  $ X16    : chr  "44" "40" "35" "42" ...
##  $ X17    : chr  "49" "45" "41" "46" ...
##  $ X18    : chr  "44" "40" "36" "34" ...
##  $ X19    : chr  "37" "33" "29" "25" ...
##  $ X20    : chr  "36" "32" "27" "30" ...
##  $ X21    : chr  "36" "33" "30" "30" ...
##  $ X22    : chr  "44" "39" "33" "39" ...
##  $ X23    : chr  "47" "45" "42" "45" ...
##  $ X24    : chr  "46" "44" "41" "46" ...
##  $ X25    : chr  "59" "52" "44" "58" ...
##  $ X26    : chr  "50" "44" "37" "31" ...
##  $ X27    : chr  "52" "45" "38" "34" ...
##  $ X28    : chr  "52" "46" "40" "42" ...
##  $ X29    : chr  "41" "36" "30" "26" ...
##  $ X30    : chr  "30" "26" "22" "10" ...
##  $ X31    : chr  "30" "25" "20" "8" ...
```

```r
View(raw_df)
```

Problems of the dataset:

1) “X” collumn is just an index which is not needed for further analysis - have to be deleted.
2) It is better to assign our samples as [Year+month+day] from X number of columns.
3) Split [measure] column into multiple columns

```r
# Packages included
library(tidyr)
library(stringr)
# Get rid of [X] column
tidy_df = raw_df[,-1]
head(tidy_df)
```

```
##   year month           measure X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12 X13
## 1 2014    12  Max.TemperatureF 64 42 51 43 42 45 38 29 49  48  39  39  42
## 2 2014    12 Mean.TemperatureF 52 38 44 37 34 42 30 24 39  43  36  35  37
## 3 2014    12  Min.TemperatureF 39 33 37 30 26 38 21 18 29  38  32  31  32
## 4 2014    12    Max.Dew.PointF 46 40 49 24 37 45 36 28 49  45  37  28  28
## 5 2014    12    MeanDew.PointF 40 27 42 21 25 40 20 16 41  39  31  27  26
## 6 2014    12     Min.DewpointF 26 17 24 13 12 36 -3  3 28  37  27  25  24
##   X14 X15 X16 X17 X18 X19 X20 X21 X22 X23 X24 X25 X26 X27 X28 X29 X30 X31
## 1  45  42  44  49  44  37  36  36  44  47  46  59  50  52  52  41  30  30
## 2  39  37  40  45  40  33  32  33  39  45  44  52  44  45  46  36  26  25
## 3  33  32  35  41  36  29  27  30  33  42  41  44  37  38  40  30  22  20
## 4  29  33  42  46  34  25  30  30  39  45  46  58  31  34  42  26  10   8
## 5  27  29  36  41  30  22  24  27  34  42  44  43  29  31  35  20   4   5
## 6  25  27  30  32  26  20  20  25  25  37  41  29  28  29  27  10  -6   1
```

```r
# Make dataframe from wide to long
tidy_df = gather(tidy_df, day, value, X1:X31)
# Make dataframe from long to wide
tidy_df = spread(tidy_df, measure, value)
# Assign [Year+month+day] as samples names
tidy_df$day = str_sub(tidy_df$day, 2, 3)
tidy_df = unite(tidy_df, Date, year, month, day, sep = '_')
head(tidy_df)
```

```
##         Date CloudCover    Events Max.Dew.PointF Max.Gust.SpeedMPH
## 1  2014_12_1          6      Rain             46                29
## 2 2014_12_10          8      Rain             45                29
## 3 2014_12_11          8 Rain-Snow             37                28
## 4 2014_12_12          7      Snow             28                21
## 5 2014_12_13          5                       28                23
## 6 2014_12_14          4                       29                20
##   Max.Humidity Max.Sea.Level.PressureIn Max.TemperatureF
## 1           74                    30.45               64
## 2          100                    29.58               48
## 3           92                    29.81               39
## 4           85                    29.88               39
## 5           75                    29.86               42
## 6           82                    29.91               45
##   Max.VisibilityMiles Max.Wind.SpeedMPH Mean.Humidity
## 1                  10                22            63
## 2                  10                23            95
## 3                  10                21            87
## 4                  10                16            75
## 5                  10                17            65
## 6                  10                15            68
##   Mean.Sea.Level.PressureIn Mean.TemperatureF Mean.VisibilityMiles
## 1                     30.13                52                   10
## 2                      29.5                43                    3
## 3                     29.61                36                    7
## 4                     29.85                35                   10
## 5                     29.82                37                   10
## 6                     29.83                39                   10
##   Mean.Wind.SpeedMPH MeanDew.PointF Min.DewpointF Min.Humidity
## 1                 13             40            26           52
## 2                 13             39            37           89
## 3                 13             31            27           82
## 4                 11             27            25           64
## 5                 12             26            24           55
## 6                 10             27            25           53
##   Min.Sea.Level.PressureIn Min.TemperatureF Min.VisibilityMiles
## 1                    30.01               39                  10
## 2                    29.43               38                   1
## 3                    29.44               32                   1
## 4                    29.81               31                   7
## 5                    29.78               32                  10
## 6                    29.78               33                  10
##   PrecipitationIn WindDirDegrees
## 1            0.01            268
## 2            0.28            357
## 3            0.02            230
## 4               T            286
## 5               T            298
## 6            0.00            306
```

3) Then it was noticed that some samples have all NAs data because of unexisting days (February 30, etc). Also, the measurements in the end of the table are NAs as well.

```
tidy_df = na.omit(tidy_df)
```

4) Formatting of the columns:

```
tidy_df$PrecipitationIn = as.numeric(tidy_df$PrecipitationIn, na.string='T')
```

```
## Warning: NAs introduced by coercion
```

```
# Make columns with values as numbers numeric
tidy_df[,c(2,4:23)] = lapply(tidy_df[,c(2,4:23)], as.numeric)
# Check the dataframe after formatting
row.names(tidy_df) = 1:nrow(tidy_df)
summary(tidy_df)
```

```
##      Date              CloudCover       Events           Max.Dew.PointF
##  Length:360         Min.   :0.000   Length:360         Min.   :-6.00
##  Class :character   1st Qu.:3.000   Class :character   1st Qu.:31.00
##  Mode  :character   Median :5.000   Mode  :character   Median :47.00
##                     Mean   :4.733                      Mean   :45.33
##                     3rd Qu.:7.000                      3rd Qu.:61.00
##                     Max.   :8.000                      Max.   :75.00
##
##  Max.Gust.SpeedMPH  Max.Humidity     Max.Sea.Level.PressureIn
##  Min.   : 0.00     Min.   :  39.00   Min.   :29.58
##  1st Qu.:21.00     1st Qu.:  73.00   1st Qu.:30.00
##  Median :25.50     Median :  86.00   Median :30.14
##  Mean   :26.99     Mean   :  85.64   Mean   :30.16
##  3rd Qu.:31.25     3rd Qu.:  93.00   3rd Qu.:30.31
##  Max.   :94.00     Max.   :1000.00   Max.   :30.88
##
##  Max.TemperatureF Max.VisibilityMiles Max.Wind.SpeedMPH Mean.Humidity
##  Min.   :18.00    Min.   : 2.000      Min.   : 8.00     Min.   :28.00
##  1st Qu.:42.00    1st Qu.:10.000      1st Qu.:16.00     1st Qu.:56.00
##  Median :60.00    Median :10.000      Median :20.00     Median :66.00
##  Mean   :58.75    Mean   : 9.906      Mean   :20.71     Mean   :65.97
##  3rd Qu.:76.00    3rd Qu.:10.000      3rd Qu.:24.00     3rd Qu.:76.25
##  Max.   :96.00    Max.   :10.000      Max.   :38.00     Max.   :98.00
##
##  Mean.Sea.Level.PressureIn Mean.TemperatureF Mean.VisibilityMiles
##  Min.   :29.49             Min.   : 8.00     Min.   :-1.000
##  1st Qu.:29.87             1st Qu.:36.00     1st Qu.: 8.000
##  Median :30.03             Median :53.00     Median :10.000
##  Mean   :30.04             Mean   :51.23     Mean   : 8.847
##  3rd Qu.:30.19             3rd Qu.:68.00     3rd Qu.:10.000
##  Max.   :30.77             Max.   :84.00     Max.   :10.000
##
##  Mean.Wind.SpeedMPH MeanDew.PointF   Min.DewpointF     Min.Humidity
##  Min.   : 4.00      Min.   :-11.00   Min.   :-18.00   Min.   :16.00
##  1st Qu.: 8.00      1st Qu.: 24.00   1st Qu.: 16.00   1st Qu.:35.00
##  Median :10.00      Median : 40.50   Median : 35.00   Median :46.00
##  Mean   :10.72      Mean   : 38.76   Mean   : 31.99   Mean   :48.28
##  3rd Qu.:13.00      3rd Qu.: 56.00   3rd Qu.: 51.00   3rd Qu.:60.25
##  Max.   :22.00      Max.   : 71.00   Max.   : 68.00   Max.   :96.00
##
##  Min.Sea.Level.PressureIn Min.TemperatureF Min.VisibilityMiles
##  Min.   :29.16            Min.   :-3.00    Min.   : 0.000
##  1st Qu.:29.76            1st Qu.:30.00    1st Qu.: 2.000
##  Median :29.94            Median :45.00    Median :10.000
##  Mean   :29.92            Mean   :43.15    Mean   : 6.689
##  3rd Qu.:30.09            3rd Qu.:60.00    3rd Qu.:10.000
##  Max.   :30.64            Max.   :74.00    Max.   :10.000
##
##  PrecipitationIn  WindDirDegrees
##  Min.   :0.0000   Min.   :  1.0
##  1st Qu.:0.0000   1st Qu.:114.0
##  Median :0.0000   Median :223.0
##  Mean   :0.1195   Mean   :201.4
##  3rd Qu.:0.0700   3rd Qu.:275.5
##  Max.   :2.9000   Max.   :360.0
##  NA's   :49
```

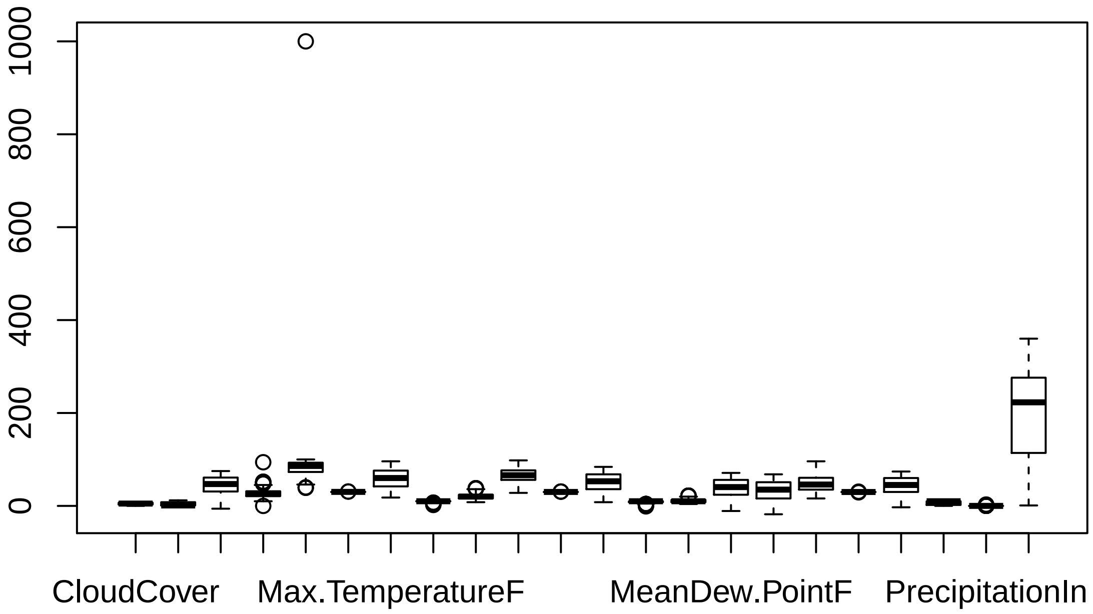
```r
# Make [Events] column  as factor
tidy_df$Events = as.factor(tidy_df$Events)
```

```r
levels(tidy_df$Events)[1] = "Ordinary day"
head(tidy_df)
```

```
##         Date CloudCover       Events Max.Dew.PointF Max.Gust.SpeedMPH
## 1  2014_12_1          6         Rain             46                29
## 2 2014_12_10          8         Rain             45                29
## 3 2014_12_11          8    Rain-Snow             37                28
## 4 2014_12_12          7         Snow             28                21
## 5 2014_12_13          5 Ordinary day             28                23
## 6 2014_12_14          4 Ordinary day             29                20
##   Max.Humidity Max.Sea.Level.PressureIn Max.TemperatureF
## 1           74                    30.45               64
## 2          100                    29.58               48
## 3           92                    29.81               39
## 4           85                    29.88               39
## 5           75                    29.86               42
## 6           82                    29.91               45
##   Max.VisibilityMiles Max.Wind.SpeedMPH Mean.Humidity
## 1                  10                22            63
## 2                  10                23            95
## 3                  10                21            87
## 4                  10                16            75
## 5                  10                17            65
## 6                  10                15            68
##   Mean.Sea.Level.PressureIn Mean.TemperatureF Mean.VisibilityMiles
## 1                     30.13                52                   10
## 2                     29.50                43                    3
## 3                     29.61                36                    7
## 4                     29.85                35                   10
## 5                     29.82                37                   10
## 6                     29.83                39                   10
##   Mean.Wind.SpeedMPH MeanDew.PointF Min.DewpointF Min.Humidity
## 1                 13             40            26           52
## 2                 13             39            37           89
## 3                 13             31            27           82
## 4                 11             27            25           64
## 5                 12             26            24           55
## 6                 10             27            25           53
##   Min.Sea.Level.PressureIn Min.TemperatureF Min.VisibilityMiles
## 1                    30.01               39                  10
## 2                    29.43               38                   1
## 3                    29.44               32                   1
## 4                    29.81               31                   7
## 5                    29.78               32                  10
## 6                    29.78               33                  10
##   PrecipitationIn WindDirDegrees
## 1            0.01            268
## 2            0.28            357
## 3            0.02            230
## 4              NA            286
## 5              NA            298
## 6            0.00            306
```

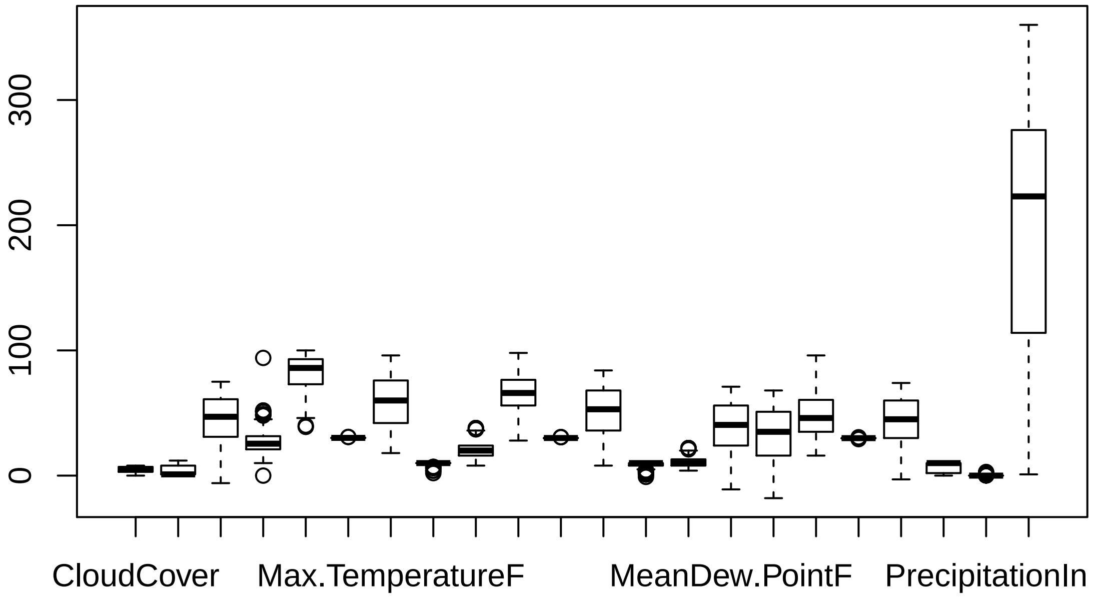
5) Plot the numeric columns data

```
boxplot(tidy_df[, c(2, 3:23)])
```



6) Obvious outlier was detected - the [Humidity] was 1000% at one point of measurements that seems to be unreal data (extra "0" was added mistakenly) and should be changed for more realistic value = 100%.

```
tidy_df[135,6] = 100
# Check the plot after additing
boxplot(tidy_df[, c(2, 3:23)])
```



Finally, the dataset seems to be clear and tidy after processing and ready for further analysis.

Difference between “raw” and “tidy” dataframes.

```
head(raw_df)
```

```
##   X year month           measure X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12
## 1 1 2014    12  Max.TemperatureF 64 42 51 43 42 45 38 29 49  48  39  39
## 2 2 2014    12 Mean.TemperatureF 52 38 44 37 34 42 30 24 39  43  36  35
## 3 3 2014    12  Min.TemperatureF 39 33 37 30 26 38 21 18 29  38  32  31
## 4 4 2014    12    Max.Dew.PointF 46 40 49 24 37 45 36 28 49  45  37  28
## 5 5 2014    12    MeanDew.PointF 40 27 42 21 25 40 20 16 41  39  31  27
## 6 6 2014    12     Min.DewpointF 26 17 24 13 12 36 -3  3 28  37  27  25
##   X13 X14 X15 X16 X17 X18 X19 X20 X21 X22 X23 X24 X25 X26 X27 X28 X29 X30
## 1  42  45  42  44  49  44  37  36  36  44  47  46  59  50  52  52  41  30
## 2  37  39  37  40  45  40  33  32  33  39  45  44  52  44  45  46  36  26
## 3  32  33  32  35  41  36  29  27  30  33  42  41  44  37  38  40  30  22
## 4  28  29  33  42  46  34  25  30  30  39  45  46  58  31  34  42  26  10
## 5  26  27  29  36  41  30  22  24  27  34  42  44  43  29  31  35  20   4
## 6  24  25  27  30  32  26  20  20  25  25  37  41  29  28  29  27  10  -6
##   X31
## 1  30
## 2  25
## 3  20
## 4   8
## 5   5
## 6   1
```

```
head(tidy_df)
```

```
##         Date CloudCover       Events Max.Dew.PointF Max.Gust.SpeedMPH
## 1  2014_12_1          6         Rain             46                29
## 2 2014_12_10          8         Rain             45                29
## 3 2014_12_11          8    Rain-Snow             37                28
## 4 2014_12_12          7         Snow             28                21
## 5 2014_12_13          5 Ordinary day             28                23
## 6 2014_12_14          4 Ordinary day             29                20
##   Max.Humidity Max.Sea.Level.PressureIn Max.TemperatureF
## 1           74                    30.45               64
## 2          100                    29.58               48
## 3           92                    29.81               39
## 4           85                    29.88               39
## 5           75                    29.86               42
## 6           82                    29.91               45
##   Max.VisibilityMiles Max.Wind.SpeedMPH Mean.Humidity
## 1                  10                22            63
## 2                  10                23            95
## 3                  10                21            87
## 4                  10                16            75
## 5                  10                17            65
## 6                  10                15            68
##   Mean.Sea.Level.PressureIn Mean.TemperatureF Mean.VisibilityMiles
## 1                     30.13                52                   10
## 2                     29.50                43                    3
## 3                     29.61                36                    7
## 4                     29.85                35                   10
## 5                     29.82                37                   10
## 6                     29.83                39                   10
##   Mean.Wind.SpeedMPH MeanDew.PointF Min.DewpointF Min.Humidity
## 1                 13             40            26           52
## 2                 13             39            37           89
## 3                 13             31            27           82
## 4                 11             27            25           64
## 5                 12             26            24           55
## 6                 10             27            25           53
##   Min.Sea.Level.PressureIn Min.TemperatureF Min.VisibilityMiles
## 1                    30.01               39                  10
## 2                    29.43               38                   1
## 3                    29.44               32                   1
## 4                    29.81               31                   7
## 5                    29.78               32                  10
## 6                    29.78               33                  10
##   PrecipitationIn WindDirDegrees
## 1            0.01            268
## 2            0.28            357
## 3            0.02            230
## 4              NA            286
## 5              NA            298
## 6            0.00            306
```