

# Project One Data Preparation

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# 1 Data Input

We begin our project by bringing in the 2019 Australian daily weather in Canberra.

```
dat <- NULL
current.month <- 12
for (i in 1:current.month){
  i0 <- ifelse(i<10, paste("0", i, sep=""), i)
  mth <- paste("2019", i0, sep="")
  bom <- paste("http://www.bom.gov.au/climate/dwo/", mth,
    "/text/IDCJDW2801.", mth, ".csv", sep="")
  dat.i <- read.csv(bom, skip=6, check.names=FALSE,
    na.strings = c("NA", "", " "))
  dat.i[, 1] <- toupper(month.abb[i])
  dat <- rbind(dat, dat.i)
}
dim(dat)
```

```
## [1] 365 22
```

Along the way we used `month.name()` to obtain full month names. From the output, we see that we have obtained 22 measurements for 365 days. The first few lines of data are displayed below with the `head()` command.

```
head(dat)
```

```
##           Date Minimum temperature (°C) Maximum temperature (°C) Rainfall (mm)
## 1 JAN 2019-01-1                13.7                35.3                0
## 2 JAN 2019-01-2                18.0                35.9                0
## 3 JAN 2019-01-3                18.4                35.3                0
## 4 JAN 2019-01-4                17.2                38.1                0
## 5 JAN 2019-01-5                21.1                36.7                0
## 6 JAN 2019-01-6                13.4                25.0                7
##   Evaporation (mm) Sunshine (hours) Direction of maximum wind gust
## 1                NA                NA                E
## 2                NA                NA                ENE
## 3                NA                NA                NE
## 4                NA                NA                NW
## 5                NA                NA                NNW
## 6                NA                NA                E
##   Speed of maximum wind gust (km/h) Time of maximum wind gust
## 1                35                19:21
## 2                52                17:01
## 3                37                19:10
## 4                46                12:43
## 5                74                12:40
```

```

## 6                                43                                19:17
## 9am Temperature (°C) 9am relative humidity (%) 9am cloud amount (oktas)
## 1                23.8                        49                        NA
## 2                25.1                        57                        NA
## 3                23.4                        64                        7
## 4                26.2                        51                        NA
## 5                31.1                        36                        NA
## 6                17.0                        70                        7
## 9am wind direction 9am wind speed (km/h) 9am MSL pressure (hPa)
## 1                NNW                        4                        1012.7
## 2                NNW                        4                        1011.1
## 3                ESE                        6                        1013.4
## 4                NW                         2                        1013.2
## 5                NW                        30                        1008.6
## 6                SE                        15                        1015.9
## 3pm Temperature (°C) 3pm relative humidity (%) 3pm cloud amount (oktas)
## 1                33.7                        26                        NA
## 2                33.8                        24                        NA
## 3                32.3                        32                        NA
## 4                36.3                        24                        2
## 5                32.6                        29                        8
## 6                24.3                        44                        1
## 3pm wind direction 3pm wind speed (km/h) 3pm MSL pressure (hPa)
## 1                W                         17                        1009.1
## 2                WNW                        26                        1007.7
## 3                NE                         11                        1009.8
## 4                WNW                        20                        1008.8
## 5                WNW                        35                        1004.9
## 6                ENE                        22                        1015.2

```

## 2 Data Cleaning and Preparation

After completing the project in the order requested, we decided to perform the tasks in a slightly different manner. The reason begin the variable names are very long and when we print the results the output was a little long and we found that renaming the variables made the output easier to read. As a result, first, the variable “Time of maximum wind gust” will be removed since it is not useful for weather forecast purposes, and afterwards we will rename the variables. Lastly, we will go back to the task as assigned beginning with inspecting the variables for suspicious or problematic records.

## 2.1 Removing a Variable

We will use the code provided to remove the variable `Time` of maximum wind gust.

```
dat <- dat[, -c(10)]
```

## 2.2 Renaming Variables

As noted in the project assignment, the variable names are too long. Therefore, we will modify the code to rename the measurements in `dat`.

```
colnames(dat) <- c("Month", "Date", "MinTemp", "MaxTemp", "Rainfall",
  "Evaporation", "Sunshine", "WindGustDir", "WindGustSpeed",
  "Temp9am", "Humidity9am", "Cloud9am", "WindDir9am",
  "WindSpeed9am", "Pressure9am", "Temp3pm", "Humidity3pm",
  "Cloud3pm", "WindDir3pm", "WindSpeed3pm", "Pressure3pm")
dim(dat)
```

```
## [1] 365 21
```

We see that the number of variables has decreased by one, and now we double-check that the new variable names were created as intended.

```
names(dat)
```

## [1]	"Month"	"Date"	"MinTemp"	"MaxTemp"
## [5]	"Rainfall"	"Evaporation"	"Sunshine"	"WindGustDir"
## [9]	"WindGustSpeed"	"Temp9am"	"Humidity9am"	"Cloud9am"
## [13]	"WindDir9am"	"WindSpeed9am"	"Pressure9am"	"Temp3pm"
## [17]	"Humidity3pm"	"Cloud3pm"	"WindDir3pm"	"WindSpeed3pm"
## [21]	"Pressure3pm"			

## 2.3 Inspecting the Variables

We now begin inspecting the variables by looking at the number of missing values for each of the variables, the data type for each variable, and the number of unique instances for each variable. The code below provides us with a table of this summary.

```
vnames <- colnames(dat)
n <- nrow(dat)
out <- NULL
for (j in 1:ncol(dat)){
  vname <- colnames(dat)[j]
  x <- as.vector(dat[,j])
  nmiss <- sum(is.na(x))
  ncomplete <- n-nmiss
```

```

    out <- rbind(out, c(col.num=j, v.name=vname,
                        mode=mode(x), n.level=length(unique(x)),
                        ncom=ncomplete, miss.prop=nmiss/n))
  }
out <- as.data.frame(out)
row.names(out) <- NULL
out

```

##	col.num	v.name	mode	n.level	ncom	miss.prop
## 1	1	Month	character	12	365	0
## 2	2	Date	character	365	365	0
## 3	3	MinTemp	numeric	197	365	0
## 4	4	MaxTemp	numeric	211	365	0
## 5	5	Rainfall	numeric	38	365	0
## 6	6	Evaporation	logical	1	0	1
## 7	7	Sunshine	logical	1	0	1
## 8	8	WindGustDir	character	16	365	0
## 9	9	WindGustSpeed	numeric	40	365	0
## 10	10	Temp9am	numeric	195	365	0
## 11	11	Humidity9am	numeric	76	365	0
## 12	12	Cloud9am	numeric	9	169	0.536986301369863
## 13	13	WindDir9am	character	17	314	0.13972602739726
## 14	14	WindSpeed9am	character	23	365	0
## 15	15	Pressure9am	numeric	203	365	0
## 16	16	Temp3pm	numeric	206	365	0
## 17	17	Humidity3pm	numeric	73	365	0
## 18	18	Cloud3pm	numeric	9	178	0.512328767123288
## 19	19	WindDir3pm	character	17	362	0.00821917808219178
## 20	20	WindSpeed3pm	character	28	365	0
## 21	21	Pressure3pm	numeric	202	365	0

We can now analyze the results! First, we see that `WindSpeed9am` is for some reason classified as a character when we know it should be numeric. We will address this below. Likewise, we also note that `Evaporation` and `Sunshine` are missing recordings for every day in 2019.

We then print each variable out with the following code to take a closer look at its recorded values.

```

apply(dat, 2, FUN = function(x){table(x, useNA = 'ifany')})

```

Indeed using the code above we can confirm that both `Evaporation` and `Sunshine` do not have any recordings for 2019, and that there are 51 instances in which `WindSpeed9am` was recorded as `Calm`. Since these variables have no recordings, we remove `Evaporation` and `Sunshine` from the data.

```

dat <- dat[, -c(6,7)]

```

## 2.4 Recoding Variables

Recall from the previous section that there was some issues with `WindSpeed9am`, since 51 of the recordings were recorded as `Calm` while all of the others were numeric. We fix this issue by changing all values of `Calm` to 0, and then changing the vector type of `WindSpeed9am` from character to numeric.

```
dat[dat$WindSpeed9am == "Calm",]$WindSpeed9am <- 0
dat$WindSpeed9am <- as.numeric(dat$WindSpeed9am)
```

Next, we define a variable `RainToday` based on `Rainfall` so that `RainToday` is 1 if `Rainfall` is greater than 1mm and 0 otherwise.

```
RainToday <- NULL
for (i in 1:length(dat$Rainfall)){
  if (dat$Rainfall[i] < 1 | is.na(dat$Rainfall[i]))
    RainToday[i] <- 0
  else
    RainToday[i] <- 1
}
dat$RainToday <- RainToday
```

Lastly, we define `RainTomorrow` by shifting `RainToday` one day forward.

```
dat$RainTomorrow <- c(dat$RainToday[2:nrow(dat)], NA)
```

## 2.5 Saving Cleaned Data

We now save this data as a csv file as instructed.

```
write.csv(dat, file='SolisR_Project01_Data.csv')
```

## 3 Exploratory Data Analysis

Since we're interested in `RainTomorrow`, let us look at it's association with all of the other variables. Therefore, we perform a  $\chi^2$  test with `RainTomorrow` and each other categorical variable. The code used to accomplish this task is listed below.

```
for (k in 1:ncol(dat)) {
  vname <- colnames(dat)[k]
  print(k)
  print(vname)
  x <- as.vector(dat[,k])
  tab <- table(dat$RainTomorrow, x, useNA='no')
  print(tab)
```

```
print(chisq.test(tab))
}
```

We find that there were variables that were significant at the  $\alpha = 0.05$  significance level: Month, Rainfall, WindGustSpeed, and RainToday

Variable	$\chi^2$	df	p-value
Month	29.337	11	0.0020
Rainfall	75.797	37	0.0002
WindGustSpeed	73.972	39	0.0006
RainToday	7.2891	1	0.0069

These variables seem reasonable to include in the model seeking to predict whether or not it will rain on day  $n + 1$  given it rained on day  $n$ . We see that there was alot of rainy days in January. We also see this in August and September. There was not much rain in June or July.

## 4 Appendix

This appendix contains all of the R code and is organized by problem.

### 4.1 Code for Data Input

```
# READ DAILY WEATHER DATA IN 2019
dat <- NULL
current.month <- 12
for (i in 1:current.month){
  i0 <- ifelse(i<10, paste("0", i, sep=""), i)
  mth <- paste("2019", i0, sep="")
  bom <- paste("http://www.bom.gov.au/climate/dwo/", mth,
"/text/IDCJDW2801.", mth, ".csv", sep="")
  dat.i <- read.csv(bom, skip=6, check.names=FALSE,
na.strings = c("NA", "", " "))
# USE month.name() TO GET FULL MONTH NAMES
  dat.i[, 1] <- toupper(month.abb[i])
  dat <- rbind(dat, dat.i)
}
dim(dat); head(dat); tail(dat)
```

## 4.2 Code for Data Cleaning and Preparation

```

dat <- dat[, -c(10)]
colnames(dat) <- c("Month", "Date", "MinTemp", "MaxTemp", "Rainfall",
  "Evaporation", "Sunshine", "WindGustDir", "WindGustSpeed",
  "Temp9am", "Humidity9am", "Cloud9am", "WindDir9am",
  "WindSpeed9am", "Pressure9am", "Temp3pm", "Humidity3pm",
  "Cloud3pm", "WindDir3pm", "WindSpeed3pm", "Pressure3pm")

dim(dat)
names(dat)
vnames <- colnames(dat)
n <- nrow(dat)
out <- NULL # Start building dataframe for variable summaries
for (j in 1:ncol(dat)){
  vname <- colnames(dat)[j]
  x <- as.vector(dat[,j])
  nmiss <- sum(is.na(x))
  ncomplete <- n-nmiss
  out <- rbind(out, c(col.num=j, v.name=vname,
    mode=mode(x), n.level=length(unique(x)),
    ncom=ncomplete, miss.prop=nmiss/n))
}
out <- as.data.frame(out)
row.names(out) <- NULL # End building
out # Print variable types, proportion missing, etc
# Nextline prints all variables and their recordings
apply(dat, 2, FUN=function(x){table(x, useNA='ifany')})
dat <- dat[, -c(6,7)] # Remove Sunshine and Evaporation
dat[dat$WindSpeed9am == "Calm",]$WindSpeed9am <- 0
dat$WindSpeed9am <- as.numeric(dat$WindSpeed9am)
RainToday <- NULL
for (i in 1:length(dat$Rainfall)){
  if (dat$Rainfall[i] < 1 | is.na(dat$Rainfall[i]))
    RainToday[i] <- 0
  else
    RainToday[i] <- 1
}
dat$RainToday <- RainToday
dat$RainTomorrow <- c(dat$RainToday[2:nrow(dat)], NA)
write.csv(dat, file='SolisR_Project012_Data.csv')

```



### 4.3 Code for Exploratory Data Analysis

```
# Perform and print results for a chi-squared test on each variable
for (k in 1:ncol(dat)) {
  vname <- colnames(dat)[k]
  print(k)
  print(vname)
  x <- as.vector(dat[,k])
  tab <- table(dat$RainTomorrow, x, useNA='no')
  print(tab)
  print(chisq.test(tab))
}
```

```
## [1] 1
## [1] "Month"
##      x
##      APR AUG DEC FEB JAN JUL JUN MAR MAY NOV OCT SEP
##  0   29  26  30  24  20  30  26  25  25  29  27  27
##  1    1   5   0   4  11   1   4   6   6   1   4   3
##
##  Pearson's Chi-squared test
##
## data:  tab
## X-squared = 29.337, df = 11, p-value = 0.002012
##
## [1] 2
## [1] "Date"
##      x
##  2019-01-1 2019-01-10 2019-01-11 2019-01-12 2019-01-13 2019-01-14 2019-01-15
##  0           1           1           0           1           1           1
##  1           0           0           1           0           0           0
##      x
##  2019-01-16 2019-01-17 2019-01-18 2019-01-19 2019-01-2 2019-01-20 2019-01-21
##  0           1           0           0           1           1           1
##  1           0           1           1           0           0           0
##      x
##  2019-01-22 2019-01-23 2019-01-24 2019-01-25 2019-01-26 2019-01-27
##  0           0           0           1           1           0           1
##  1           1           1           0           0           1           0
##      x
##  2019-01-28 2019-01-29 2019-01-3 2019-01-30 2019-01-31 2019-01-4 2019-01-5
##  0           0           0           1           1           1           0
##  1           1           1           0           0           0           1
##      x
```

```

##      2019-01-6 2019-01-7 2019-01-8 2019-01-9 2019-02-1 2019-02-10 2019-02-11
## 0          1          0          0          1          1          1
## 1          0          1          1          0          0          0
## x
##      2019-02-12 2019-02-13 2019-02-14 2019-02-15 2019-02-16 2019-02-17
## 0          1          1          1          1          1
## 1          0          0          0          0          0
## x
##      2019-02-18 2019-02-19 2019-02-2 2019-02-20 2019-02-21 2019-02-22 2019-02-23
## 0          1          1          1          1          1          1
## 1          0          0          0          0          0          0
## x
##      2019-02-24 2019-02-25 2019-02-26 2019-02-27 2019-02-28 2019-02-3 2019-02-4
## 0          1          1          1          1          1          0
## 1          0          0          0          0          0          1
## x
##      2019-02-5 2019-02-6 2019-02-7 2019-02-8 2019-02-9 2019-03-1 2019-03-10
## 0          0          1          1          0          1          1
## 1          1          0          0          1          0          0
## x
##      2019-03-11 2019-03-12 2019-03-13 2019-03-14 2019-03-15 2019-03-16
## 0          1          1          1          1          1
## 1          0          0          0          0          0
## x
##      2019-03-17 2019-03-18 2019-03-19 2019-03-2 2019-03-20 2019-03-21 2019-03-22
## 0          0          1          1          1          1          0
## 1          1          0          0          0          0          1
## x
##      2019-03-23 2019-03-24 2019-03-25 2019-03-26 2019-03-27 2019-03-28
## 0          1          1          1          1          1
## 1          0          0          0          0          0
## x
##      2019-03-29 2019-03-3 2019-03-30 2019-03-31 2019-03-4 2019-03-5 2019-03-6
## 0          0          1          0          1          1          0
## 1          1          0          1          0          0          1
## x
##      2019-03-7 2019-03-8 2019-03-9 2019-04-1 2019-04-10 2019-04-11 2019-04-12
## 0          1          1          1          1          1          1
## 1          0          0          0          0          0          0
## x
##      2019-04-13 2019-04-14 2019-04-15 2019-04-16 2019-04-17 2019-04-18
## 0          1          1          1          1          1
## 1          0          0          0          0          0
## x
##      2019-04-19 2019-04-2 2019-04-20 2019-04-21 2019-04-22 2019-04-23 2019-04-24

```

```

##      0      1      1      1      1      0      1      1
##      1      0      0      0      0      1      0      0
##      x
##      2019-04-25 2019-04-26 2019-04-27 2019-04-28 2019-04-29 2019-04-30 2019-04-30
##      0      1      1      1      1      1      1      1
##      1      0      0      0      0      0      0      0
##      x
##      2019-04-4 2019-04-5 2019-04-6 2019-04-7 2019-04-8 2019-04-9 2019-05-1
##      0      1      1      1      1      1      1
##      1      0      0      0      0      0      0
##      x
##      2019-05-10 2019-05-11 2019-05-12 2019-05-13 2019-05-14 2019-05-15
##      0      0      1      1      1      1
##      1      1      0      0      0      0
##      x
##      2019-05-16 2019-05-17 2019-05-18 2019-05-19 2019-05-20 2019-05-21 2019-05-21
##      0      1      1      1      1      0      1
##      1      0      0      0      0      1      0
##      x
##      2019-05-22 2019-05-23 2019-05-24 2019-05-25 2019-05-26 2019-05-27
##      0      1      1      1      0      1      1
##      1      0      0      0      1      0      0
##      x
##      2019-05-28 2019-05-29 2019-05-30 2019-05-31 2019-05-31 2019-05-4 2019-05-5
##      0      0      0      1      1      1      1
##      1      1      1      0      0      0      0
##      x
##      2019-05-6 2019-05-7 2019-05-8 2019-05-9 2019-06-1 2019-06-10 2019-06-11
##      0      1      0      1      1      1      0
##      1      0      1      0      0      0      1
##      x
##      2019-06-12 2019-06-13 2019-06-14 2019-06-15 2019-06-16 2019-06-17
##      0      0      1      1      1      1      1
##      1      1      0      0      0      0      0
##      x
##      2019-06-18 2019-06-19 2019-06-20 2019-06-21 2019-06-22 2019-06-23 2019-06-23
##      0      1      1      1      1      1      1
##      1      0      0      0      0      0      0
##      x
##      2019-06-24 2019-06-25 2019-06-26 2019-06-27 2019-06-28 2019-06-29 2019-06-30
##      0      1      1      1      1      1      0
##      1      0      0      0      0      0      1
##      x
##      2019-06-30 2019-06-4 2019-06-5 2019-06-6 2019-06-7 2019-06-8 2019-06-9
##      0      1      1      1      1      1      1

```

```

##      1          0          0          0          0          0          0          0
##      x
##      2019-07-1 2019-07-10 2019-07-11 2019-07-12 2019-07-13 2019-07-14 2019-07-15
##      0          1          1          1          0          1          1          1
##      1          0          0          0          1          0          0          0
##      x
##      2019-07-16 2019-07-17 2019-07-18 2019-07-19 2019-07-20 2019-07-21
##      0          1          1          1          1          1          1          1
##      1          0          0          0          0          0          0          0
##      x
##      2019-07-22 2019-07-23 2019-07-24 2019-07-25 2019-07-26 2019-07-27
##      0          1          1          1          1          1          1          1
##      1          0          0          0          0          0          0          0
##      x
##      2019-07-28 2019-07-29 2019-07-30 2019-07-31 2019-07-4 2019-07-5
##      0          1          1          1          1          1          1          1
##      1          0          0          0          0          0          0          0
##      x
##      2019-07-6 2019-07-7 2019-07-8 2019-07-9 2019-08-1 2019-08-10 2019-08-11
##      0          1          1          1          1          1          0          1
##      1          0          0          0          0          0          1          0
##      x
##      2019-08-12 2019-08-13 2019-08-14 2019-08-15 2019-08-16 2019-08-17
##      0          1          1          1          1          1          1          1
##      1          0          0          0          0          0          0          0
##      x
##      2019-08-18 2019-08-19 2019-08-20 2019-08-21 2019-08-22 2019-08-23
##      0          0          1          1          1          1          1          1
##      1          1          0          0          0          0          0          0
##      x
##      2019-08-24 2019-08-25 2019-08-26 2019-08-27 2019-08-28 2019-08-29 2019-08-3
##      0          1          1          1          1          1          1          1
##      1          0          0          0          0          0          0          0
##      x
##      2019-08-30 2019-08-31 2019-08-4 2019-08-5 2019-08-6 2019-08-7 2019-08-8
##      0          1          1          1          1          1          0          0
##      1          0          0          0          0          0          1          1
##      x
##      2019-08-9 2019-09-1 2019-09-10 2019-09-11 2019-09-12 2019-09-13 2019-09-14
##      0          0          1          1          1          1          1          1
##      1          1          0          0          0          0          0          0
##      x
##      2019-09-15 2019-09-16 2019-09-17 2019-09-18 2019-09-19 2019-09-20
##      0          1          0          1          1          1          1          1
##      1          0          1          0          0          0          0          0

```

```

##      x
##      2019-09-21 2019-09-22 2019-09-23 2019-09-24 2019-09-25 2019-09-26
## 0          0          1          1          1          1
## 1          1          0          0          0          0
##      x
##      2019-09-27 2019-09-28 2019-09-29 2019-09-30 2019-09-4 2019-09-5
## 0          1          1          1          1          1
## 1          0          0          0          0          0
##      x
##      2019-09-6 2019-09-7 2019-09-8 2019-09-9 2019-10-1 2019-10-10 2019-10-11
## 0          0          1          1          1          1          1
## 1          1          0          0          0          0          0
##      x
##      2019-10-12 2019-10-13 2019-10-14 2019-10-15 2019-10-16 2019-10-17
## 0          1          1          1          1          0          1
## 1          0          0          0          0          1          0
##      x
##      2019-10-18 2019-10-19 2019-10-20 2019-10-21 2019-10-22 2019-10-23
## 0          1          1          1          1          1          1
## 1          0          0          0          0          0          0
##      x
##      2019-10-24 2019-10-25 2019-10-26 2019-10-27 2019-10-28 2019-10-29 2019-10-3
## 0          1          0          1          1          1          1
## 1          0          1          0          0          0          0
##      x
##      2019-10-30 2019-10-31 2019-10-4 2019-10-5 2019-10-6 2019-10-7 2019-10-8
## 0          1          1          0          1          1          0
## 1          0          0          1          0          0          1
##      x
##      2019-10-9 2019-11-1 2019-11-10 2019-11-11 2019-11-12 2019-11-13 2019-11-14
## 0          1          1          1          1          1          1
## 1          0          0          0          0          0          0
##      x
##      2019-11-15 2019-11-16 2019-11-17 2019-11-18 2019-11-19 2019-11-2 2019-11-20
## 0          1          1          1          1          1          1
## 1          0          0          0          0          0          0
##      x
##      2019-11-21 2019-11-22 2019-11-23 2019-11-24 2019-11-25 2019-11-26
## 0          1          1          1          1          1          1
## 1          0          0          0          0          0          0
##      x
##      2019-11-27 2019-11-28 2019-11-29 2019-11-3 2019-11-30 2019-11-4 2019-11-5
## 0          1          1          1          0          1          1
## 1          0          0          0          1          0          0
##      x

```

```

##      2019-11-6 2019-11-7 2019-11-8 2019-11-9 2019-12-1 2019-12-10 2019-12-11
## 0          1          1          1          1          1          1
## 1          0          0          0          0          0          0
##      x
##      2019-12-12 2019-12-13 2019-12-14 2019-12-15 2019-12-16 2019-12-17
## 0          1          1          1          1          1
## 1          0          0          0          0          0
##      x
##      2019-12-18 2019-12-19 2019-12-2 2019-12-20 2019-12-21 2019-12-22 2019-12-23
## 0          1          1          1          1          1
## 1          0          0          0          0          0
##      x
##      2019-12-24 2019-12-25 2019-12-26 2019-12-27 2019-12-28 2019-12-29 2019-12-3
## 0          1          1          1          1          1
## 1          0          0          0          0          0
##      x
##      2019-12-30 2019-12-31 2019-12-4 2019-12-5 2019-12-6 2019-12-7 2019-12-8
## 0          1          0          1          1          1
## 1          0          0          0          0          0
##      x
##      2019-12-9
## 0          1
## 1          0
##
## Pearson's Chi-squared test
##
## data:  tab
## X-squared = NaN, df = 364, p-value = NA
##
## [1] 3
## [1] "MinTemp"
##      x
##      -5.2 -5.1 -5 -4.9 -4.7 -4.4 -4.1 -3.9 -3.8 -3.6 -3.5 -3.3 -3.2 -3.1 -2.9
## 0      2      1 0      1      2      1      1      1      2      1      0      1      1      2      1
## 1      0      0 1      0      0      0      0      0      0      0      1      0      0      0      0
##      x
##      -2.8 -2.7 -2.5 -2.4 -2.3 -2.2 -2.1 -1.8 -1.7 -1.6 -1.5 -1.4 -1.3 -1.2 -1.1
## 0      3      2      1      2      1      2      1      1      1      4      1      2      1      1      1
## 1      0      0      0      0      0      0      0      0      1      0      0      0      0      0      1
##      x
##      -0.9 -0.8 -0.7 -0.5 -0.4 -0.3 -0.2 -0.1 0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8
## 0      3      2      2      2      1      2      1      2 2      2      4      3      3      3      2      3      2
## 1      0      0      0      0      0      0      0      0 1      0      0      0      0      0      1      0      1
##      x
##      0.9 1 1.1 1.3 1.4 1.5 1.6 1.7 1.8 2 2.2 2.3 2.5 2.6 2.7 2.9 3 3.1 3.2 3.3

```

```

## 0 1 3 2 1 1 2 5 1 2 2 2 1 1 1 1 1 1 2 1 1
## 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0
## x
## 3.4 3.6 3.7 3.8 3.9 4 4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.9 5 5.1 5.4 5.5 5.6 5.7
## 0 1 2 4 1 1 1 0 3 2 5 0 5 1 1 3 1 0 1 4 2
## 1 1 0 0 0 0 0 1 1 0 0 1 0 0 0 0 0 1 0 0 2
## x
## 5.8 5.9 6 6.1 6.3 6.5 6.6 6.7 6.8 6.9 7 7.1 7.2 7.3 7.4 7.6 7.7 7.8 7.9 8
## 0 6 1 1 1 2 1 2 1 4 2 1 1 3 1 1 1 1 1 1 2
## 1 0 0 0 0 0 1 0 0 1 0 0 0 0 0 0 1 1 0 0
## x
## 8.1 8.3 8.4 8.5 8.6 8.8 8.9 9 9.1 9.2 9.5 9.6 9.8 9.9 10 10.1 10.2 10.4
## 0 1 1 4 2 4 3 1 1 0 1 2 2 2 2 3 2 1 2
## 1 0 0 1 0 0 1 0 0 1 0 0 0 0 0 0 1 0 0
## x
## 10.5 10.6 10.7 10.9 11.1 11.2 11.3 11.4 11.5 11.6 11.7 11.8 12.1 12.2 12.3
## 0 2 2 1 2 2 1 2 2 1 1 0 2 2 4 1
## 1 0 0 0 0 0 0 0 0 0 0 0 1 0 0 1 0
## x
## 12.4 12.5 12.6 12.7 12.8 12.9 13 13.2 13.3 13.4 13.6 13.7 13.8 13.9 14 14.1
## 0 1 1 2 3 3 2 1 2 1 1 3 4 1 2 3 2
## 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0
## x
## 14.5 14.6 14.7 14.8 14.9 15.1 15.2 15.3 15.4 15.5 15.6 15.7 15.8 15.9 16
## 0 1 1 4 0 2 2 1 3 1 1 1 2 2 1 2
## 1 0 1 0 1 0 0 0 0 0 0 0 0 1 2 0
## x
## 16.4 16.5 16.7 16.8 16.9 17.1 17.2 17.3 17.6 17.8 18 18.4 18.7 19 19.1 19.3
## 0 1 1 0 1 2 2 1 0 1 0 2 1 1 1 0 0
## 1 0 0 1 1 1 1 0 1 1 1 0 0 0 0 1 1
## x
## 19.6 19.7 19.8 20 20.1 20.5 21.1 21.2 21.4 22.2
## 0 1 0 0 0 1 0 0 1 1 1
## 1 0 1 0 1 0 2 1 0 0 0
##
## Pearson's Chi-squared test
##
## data: tab
## X-squared = NaN, df = 196, p-value = NA
##
## [1] 4
## [1] "MaxTemp"
## x
## 8.6 8.7 8.8 9.1 9.4 9.8 10.2 10.4 10.6 10.7 10.8 11 11.1 11.2 11.3 11.4
## 0 1 1 0 1 1 0 1 0 1 1 2 2 1 1 2 2

```

```

## 1 0 1 1 0 0 1 0 1 0 0 0 1 0 0 0 1
## x
## 11.5 11.8 11.9 12 12.3 12.5 12.6 12.7 12.8 12.9 13 13.1 13.2 13.3 13.4 13.5
## 0 1 1 2 2 1 2 0 2 1 1 2 1 3 3 2 1
## 1 0 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0
## x
## 13.6 13.7 13.8 14 14.1 14.2 14.3 14.4 14.5 14.6 14.7 15 15.1 15.2 15.3 15.5
## 0 4 4 1 1 1 1 1 2 2 2 1 2 1 2 2 0
## 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1
## x
## 15.6 15.7 15.8 15.9 16 16.1 16.2 16.3 16.4 16.5 16.6 16.7 16.9 17 17.1 17.2
## 0 3 2 2 5 2 2 2 3 0 1 2 3 2 2 1 2
## 1 0 0 0 0 1 0 0 0 1 0 1 0 0 0 0 0
## x
## 17.3 17.4 17.5 17.8 17.9 18.1 18.2 18.3 18.5 18.7 18.8 18.9 19 19.1 19.2
## 0 2 3 1 1 1 2 2 2 1 0 1 1 4 2 6
## 1 0 1 0 0 0 0 0 0 0 2 0 1 0 0 0
## x
## 19.4 19.7 19.8 20 20.1 20.2 20.4 20.5 20.7 20.8 20.9 21 21.1 21.2 21.3 21.5
## 0 5 1 2 0 2 1 2 1 2 4 2 2 1 2 1 2
## 1 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0
## x
## 21.7 21.8 22.2 22.3 22.5 22.6 22.7 22.9 23 23.1 23.2 23.3 23.4 23.7 23.8
## 0 1 2 2 1 2 3 2 2 1 0 1 1 1 4 1
## 1 0 0 0 0 1 1 0 0 0 1 0 0 0 0 1
## x
## 23.9 24 24.1 24.3 24.4 24.5 24.6 24.7 24.8 24.9 25 25.1 25.2 25.5 25.7 25.8
## 0 1 3 1 1 1 1 3 2 1 5 1 1 1 1 3 1
## 1 0 0 1 0 0 0 0 1 1 0 1 1 0 0 0 1
## x
## 26 26.1 26.4 26.6 26.7 27 27.1 27.2 27.3 27.4 27.5 27.7 27.8 28 28.1 28.2
## 0 2 1 1 1 2 2 1 1 2 1 2 1 1 3 0 1
## 1 0 1 1 0 0 1 0 0 0 0 0 0 0 0 1 0
## x
## 28.3 28.4 28.5 28.6 28.8 28.9 29 29.1 29.2 29.3 29.4 29.5 29.6 29.7 29.9
## 0 1 2 1 1 2 3 2 1 1 1 1 3 3 1 2
## 1 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0
## x
## 30.2 30.3 30.4 30.5 30.7 30.9 31.1 31.2 31.3 31.4 31.5 31.7 32 32.2 32.3
## 0 1 2 1 1 1 1 1 2 1 1 1 1 2 1 1
## 1 0 0 0 0 1 0 1 1 0 0 0 0 0 0 0
## x
## 32.4 32.5 32.6 32.7 32.9 33.1 33.3 33.6 34.1 34.2 34.3 34.9 35 35.1 35.2
## 0 1 3 2 1 1 2 1 0 1 1 1 2 1 1 1
## 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0

```



```

##      x
##      35.3 35.4 35.7 35.8 35.9 36 36.1 36.4 36.7 36.8 37.1 37.7 38 38.1 38.4 39
##      0      2      0      0      0      1 2      1      1      0      2      1      1 0      2      0 2
##      1      0      1      1      1      0 0      0      0      1      0      0      0 0      0      1 0
##      x
##      39.3 39.4 39.8 40.1 41.1 41.4 41.5 41.6
##      0      1      1      1      1      1      0      0      1
##      1      0      0      0      1      0      1      1      0
##
## Pearson's Chi-squared test
##
## data:  tab
## X-squared = NaN, df = 210, p-value = NA
##
## [1] 5
## [1] "Rainfall"
##      x
##      0 0.2 0.4 0.6 0.8      1 1.2 1.6 1.8      2 2.2 2.4 2.6 2.8      3 3.2 3.6 3.8      4
##      0 252 22  4  4  2  2  0  1  3  0  2  1  1  3  0  0  1  2  1
##      1 31  0  3  0  0  1  1  0  0  1  1  0  0  0  1  2  0  0  0
##      x
##      4.2 4.8 5.4 6.6      7 7.2 7.4 7.6      8 9.4 9.8 10 10.4 11.2 12.4 15.8 20.8
##      0  1  1  1  0  1  1  1  1  1  1  1  1  1  1  1  1  1
##      1  0  0  0  1  0  0  0  0  0  0  0  0  0  2  0  0  0
##      x
##      32 45.2
##      0  1  0
##      1  1  1
##
## Pearson's Chi-squared test
##
## data:  tab
## X-squared = 75.797, df = 37, p-value = 0.0001756
##
## [1] 6
## [1] "WindGustDir"
##      x
##      E ENE ESE  N NE NNE NNW NW  S SE SSE SSW SW  W WNW WSW
##      0 35 21  8 27 13  5 53 64 8 10  6  7 2 16 36  7
##      1 2  1  1 2  1  0 15 11 2  1  0  2 1 3  4  0
##
## Pearson's Chi-squared test
##
## data:  tab
## X-squared = 15.628, df = 15, p-value = 0.4072

```

```
##
## [1] 7
## [1] "WindGustSpeed"
##      x
##      15 17 19 20 22 24 26 28 30 31 33 35 37 39 41 43 44 46 48 50 52 54 56 57 59
##      0  2  5  9  6  1  5 10 14 16 18 16 18 12 20 12 19 12 17 13 16 12 13  8  9  5
##      1  0  0  0  0  0  0  2  1  0  0  1  0  1  2  2  1  3  3  2  1  6  3  0  2  0
##      x
##      61 63 65 67 69 70 72 74 76 78 80 81 83 89 91
##      0  5  5  2  1  8  2  1  0  1  2  1  1  0  1  0
##      1  1  3  0  1  4  2  1  2  0  0  0  0  1  0  1
##
## Pearson's Chi-squared test
##
## data:  tab
## X-squared = 73.972, df = 39, p-value = 0.0006093
##
## [1] 8
## [1] "Temp9am"
##      x
##      -0.5 0.6 0.9 1.4 1.5 1.6 1.9 2 2.2 2.4 2.5 2.6 2.7 3 3.3 3.5 3.9 4 4.1 4.2
##      0    1  2  1  1  1  1  2 1  1  2  2  1  1  1  3  1  1  2  3  1
##      1    0  0  0  0  0  0  0 0  0  0  0  0  0  1  0  1  0  0  0  0
##      x
##      4.4 4.6 4.7 4.8 4.9 5 5.4 5.5 5.6 5.7 5.8 5.9 6 6.1 6.3 6.4 6.5 6.6 6.8 6.9
##      0  1  3  2  2  5 1  1  3  1  1  2  1  1  1  1  3  1  1  2
##      1  1  0  0  0  1 1  0  1  0  1  1  0  0  0  0  0  1  0  0
##      x
##      7 7.1 7.3 7.5 7.6 7.7 7.8 7.9 8 8.1 8.3 8.4 8.5 8.6 8.7 8.9 9 9.1 9.3 9.4
##      0 2  1  3  1  2  2  4  1 2  1  2  3  3  1  1  2 2  1  3  2
##      1 0  0  0  0  2  0  0  0 0  0  0  1  0  0  1  0 0  0  0  0
##      x
##      9.5 9.6 9.8 10 10.1 10.2 10.3 10.4 10.5 10.6 10.9 11.1 11.2 11.3 11.4 11.5
##      0  2  4  2  3  3  3  2  1  2  1  5  3  1  2  1  1
##      1  0  0  0  0  1  0  0  0  0  0  1  0  0  0  0  0
##      x
##      11.7 11.8 11.9 12 12.1 12.2 12.3 12.4 12.7 12.8 13 13.1 13.2 13.3 13.4 13.5
##      0  5  2  1  2  2  1  1  1  3  1  1  1  3  1  3
##      1  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0
##      x
##      13.6 13.8 13.9 14.1 14.2 14.3 14.4 14.5 14.7 14.8 14.9 15 15.1 15.2 15.3
##      0  2  2  2  3  0  1  0  1  1  3  5  2  3  2  3
##      1  0  0  0  0  1  0  1  0  0  1  0  0  0  0  0
##      x
##      15.4 15.6 15.7 15.8 15.9 16 16.1 16.2 16.3 16.4 16.5 16.6 16.7 16.8 16.9 17
```

```

##      0      3      1      2      2      2      4      2      4      3      1      1      2      4      0      4      1
##      1      0      0      0      0      0      0      1      0      0      1      0      0      0      0      1      1      0
##      x
##      17.2 17.3 17.4 17.6 17.8 18 18.1 18.2 18.3 18.4 18.5 18.6 18.7 18.8 18.9 19
##      0      2      1      1      1      1      3      1      1      2      2      2      3      3      2      1      1
##      1      0      1      0      0      0      0      1      0      0      0      0      0      0      1      1      0
##      x
##      19.1 19.3 19.4 19.5 19.6 19.7 19.8 20 20.2 20.3 20.4 20.5 20.7 20.8 20.9 21
##      0      2      1      0      1      1      1      3      0      0      1      2      2      2      2      1      1
##      1      0      0      1      0      0      0      0      1      2      0      0      0      0      0      1      1
##      x
##      21.2 21.3 21.4 21.5 21.7 21.8 21.9 22 22.1 22.2 22.3 22.4 22.5 22.7 22.9 23
##      0      0      1      1      3      1      0      1      1      3      1      2      1      1      1      0      1
##      1      2      0      0      0      0      1      0      1      0      0      0      0      1      0      1      0
##      x
##      23.2 23.3 23.4 23.6 23.8 24.1 24.3 24.5 24.6 24.7 25 25.1 25.7 26.1 26.2
##      0      1      1      1      1      1      2      1      1      0      1      1      1      1      0      1
##      1      1      0      0      0      0      0      0      0      1      0      0      1      0      1      0
##      x
##      26.5 27 27.7 27.8 28.1 29.5 30.9 31.1 31.6
##      0      1      1      1      1      1      1      0      0      0
##      1      0      0      1      0      0      0      1      1      0
##
##      Pearson's Chi-squared test
##
##      data:  tab
##      X-squared = NaN, df = 194, p-value = NA
##
##      [1] 9
##      [1] "Humidity9am"
##      x
##      14 17 19 22 24 26 27 30 31 32 33 34 35 36 37 38 40 41 42 43 44 45 46 47 48
##      0 0 0 2 1 3 1 2 1 1 2 1 3 1 0 4 1 4 2 7 5 2 2 1 4 6
##      1 0 1 0 0 0 0 0 0 0 0 2 0 0 1 1 1 0 0 0 0 0 0 0 0 0
##      x
##      49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73
##      0 4 3 5 4 5 1 5 7 7 8 2 5 4 8 9 6 7 7 12 7 8 10 6 7 3
##      1 0 0 0 0 1 0 2 0 0 0 0 0 1 0 0 1 2 0 3 0 2 2 2 1 0
##      x
##      74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 95 96 97 98 99
##      0 3 5 5 5 5 4 4 1 5 5 5 4 4 4 3 5 5 1 1 5 4 3 2 3 19
##      1 2 0 2 0 0 1 0 0 0 0 2 1 1 2 0 3 1 0 0 2 0 0 0 1 4
##      x
##      100
##      0      2

```

```
## 1 1
##
## Pearson's Chi-squared test
##
## data: tab
## X-squared = NaN, df = 75, p-value = NA
##
## [1] 10
## [1] "Cloud9am"
## x
## 1 2 3 4 5 6 7 8
## 0 18 9 4 5 4 10 21 68
## 1 2 2 0 2 2 3 3 16
##
## Pearson's Chi-squared test
##
## data: tab
## X-squared = 4.0493, df = 7, p-value = 0.7741
##
## [1] 11
## [1] "WindDir9am"
## x
## E ENE ESE N NE NNE NNW NW S SE SSE SSW SW W WNW WSW
## 0 9 6 20 23 5 8 37 28 21 39 17 13 12 9 20 6
## 1 1 2 1 5 1 1 8 5 2 2 3 2 1 2 2 2
##
## Pearson's Chi-squared test
##
## data: tab
## X-squared = 8.9424, df = 15, p-value = 0.8805
##
## [1] 12
## [1] "WindSpeed9am"
## x
## 0 2 4 6 7 9 11 13 15 17 19 20 22 24 26 28 30 31 33 35 37 39 46
## 0 45 17 26 34 43 30 13 18 14 10 15 10 6 9 6 3 5 6 1 2 1 4 0
## 1 6 1 3 5 7 5 3 3 1 2 1 1 0 1 0 1 1 2 0 1 1 0 1
##
## Pearson's Chi-squared test
##
## data: tab
## X-squared = 18.01, df = 22, p-value = 0.7054
##
## [1] 13
## [1] "Pressure9am"
```

```

##      x
##      992.3 998.3 999 1000.2 1001.8 1002 1002.2 1002.3 1002.4 1004.6 1004.7
##      0      1      1      0      1      1      0      1      0      1      0      0
##      1      0      0      1      0      0      1      0      1      0      1      1
##      x
##      1004.8 1004.9 1005.1 1005.5 1005.9 1006 1006.1 1006.2 1006.3 1007.2 1007.7
##      0      1      1      0      1      1      2      1      1      1      1      0
##      1      0      0      1      0      0      0      0      0      0      0      0
##      x
##      1007.8 1008 1008.2 1008.3 1008.4 1008.6 1008.7 1009 1009.1 1009.2 1009.3
##      0      0      1      1      1      1      1      1      1      2      1      1
##      1      1      0      0      0      0      1      0      1      0      0      0
##      x
##      1009.4 1010.1 1010.3 1010.9 1011.1 1011.3 1011.4 1011.5 1011.7 1011.8
##      0      0      1      1      1      1      0      1      1      2      2
##      1      1      0      0      0      0      1      0      0      0      0
##      x
##      1011.9 1012.1 1012.2 1012.3 1012.4 1012.5 1012.6 1012.7 1012.8 1012.9 1013
##      0      2      1      2      0      1      1      3      2      1      1      3
##      1      0      0      1      3      0      0      0      0      1      0      1
##      x
##      1013.2 1013.4 1013.6 1013.7 1013.8 1013.9 1014.1 1014.2 1014.3 1014.5
##      0      1      4      1      2      1      2      1      4      0      3
##      1      1      0      1      0      2      2      0      0      1      0
##      x
##      1014.6 1014.7 1014.9 1015 1015.1 1015.3 1015.4 1015.5 1015.6 1015.7 1015.8
##      0      1      3      2      1      3      2      2      1      2      1      0
##      1      0      0      0      0      0      0      0      0      2      0      1
##      x
##      1015.9 1016 1016.1 1016.2 1016.3 1016.5 1016.6 1016.7 1016.8 1016.9 1017
##      0      3      1      1      2      1      1      2      1      2      1      4
##      1      1      0      1      1      0      0      0      0      0      0      0
##      x
##      1017.1 1017.2 1017.3 1017.4 1017.5 1017.7 1017.8 1017.9 1018 1018.1 1018.2
##      0      0      1      3      3      1      1      2      2      2      4      1
##      1      1      0      0      0      2      0      0      0      0      0      1
##      x
##      1018.4 1018.6 1018.7 1019 1019.1 1019.2 1019.3 1019.4 1019.5 1019.6 1019.8
##      0      1      2      1      1      3      2      3      2      2      2      3
##      1      0      1      0      0      1      1      0      0      0      0      0
##      x
##      1019.9 1020.1 1020.2 1020.3 1020.4 1020.5 1020.6 1020.7 1020.8 1020.9 1021
##      0      0      4      1      1      2      2      2      3      1      1      1
##      1      1      1      0      1      0      0      1      0      0      0      0
##      x

```

```

##      1021.1 1021.2 1021.3 1021.4 1021.6 1022 1022.1 1022.2 1022.3 1022.6 1022.8
## 0      1      2      1      2      2      3      3      2      1      1      5
## 1      0      0      0      0      1      0      0      0      0      0      0
##      x
##      1023 1023.1 1023.3 1023.4 1023.5 1023.6 1023.7 1023.8 1024 1024.1 1024.2
## 0      2      2      2      3      1      1      3      2      1      3      1
## 1      0      0      0      1      1      0      0      0      0      0      0
##      x
##      1024.3 1024.4 1024.5 1024.6 1024.8 1024.9 1025.2 1025.3 1025.5 1025.8
## 0      3      1      2      2      1      3      1      4      3      1
## 1      0      0      0      0      0      0      0      0      0      0
##      x
##      1025.9 1026 1026.2 1026.3 1026.4 1026.5 1026.6 1026.8 1026.9 1027 1027.1
## 0      1      3      1      2      5      2      2      1      2      3      3
## 1      0      0      0      0      0      0      1      0      0      0      0
##      x
##      1027.5 1027.7 1027.8 1028 1028.3 1028.4 1028.6 1028.9 1029 1029.1 1029.3
## 0      1      2      2      3      1      2      1      2      1      1      4
## 1      0      0      1      0      0      0      0      0      0      0      0
##      x
##      1029.4 1029.5 1029.7 1029.8 1029.9 1030.1 1030.6 1030.9 1031 1031.1 1031.3
## 0      1      2      2      1      1      2      1      3      2      2      1
## 1      0      0      0      0      0      0      0      0      0      0      0
##      x
##      1031.5 1031.7 1032 1032.3 1032.6 1032.8 1033 1033.1 1033.4 1034.1 1034.2
## 0      1      1      1      1      2      1      1      1      1      1      1
## 1      0      0      0      0      0      0      0      0      0      0      0
##      x
##      1034.6 1036.6 1037.7 1038 1038.1 1038.4 1038.7 1039.2
## 0      1      1      1      1      1      1      1      1
## 1      0      0      0      0      0      0      0      0
##
## Pearson's Chi-squared test
##
## data:  tab
## X-squared = NaN, df = 202, p-value = NA
##
## [1] 14
## [1] "Temp3pm"
##      x
##      6.1 6.9 7 7.2 7.4 8.5 8.7 8.8 9 9.1 9.2 9.5 9.7 9.8 9.9 10.2 10.3 10.5 10.6
## 0      1      0 0      0      2      2      0      1 1      1      0      2      1      1      1      1      2      1
## 1      0      1 2      1      0      0      1      0 0      0      1      0      0      0      0      0      1      0      1
##      x
##      10.8 10.9 11 11.1 11.2 11.4 11.5 11.6 11.8 11.9 12 12.2 12.3 12.4 12.5 12.7

```

```

##      0      2      1  5      2      2      1      1      1      2      2  1      3      4      1      1      3
##      1      0      0  0      0      0      0      0      0      0      0  0      0      1      0      0      1
##      x
##      12.8 12.9 13 13.1 13.2 13.3 13.4 13.6 13.7 13.9 14 14.1 14.2 14.3 14.4 14.5
##      0      2      1  1      1      3      2      1      1      1      2  1      3      2      1      2      3
##      1      0      0  0      0      0      0      0      0      0      1  1      0      0      0      2      0
##      x
##      14.6 14.7 14.8 14.9 15 15.1 15.2 15.3 15.5 15.7 15.8 15.9 16 16.1 16.2 16.4
##      0      1      2      2      4  2      0      2      1      3      1      3      2  1      2      3      1
##      1      0      0      0      0  0      1      0      0      0      0      0      0  1      0      1      0
##      x
##      16.5 16.6 16.7 16.8 16.9 17 17.2 17.3 17.4 17.5 17.6 17.7 17.8 17.9 18 18.1
##      0      2      3      2      2      1  1      2      1      0      0      1      1      1      3  1      2
##      1      0      0      0      0  0      0      0      0      1      1      0      0      0      0      0      0
##      x
##      18.2 18.3 18.4 18.5 18.6 18.7 18.8 18.9 19.1 19.2 19.4 19.5 19.7 19.8 19.9
##      0      1      1      1      2      4      1      3      3      4      1      3      1      2      1      1
##      1      0      0      1      1      0      0      0      0      0      0      0      1      0      0      0
##      x
##      20.1 20.2 20.3 20.4 20.5 20.7 20.8 21.1 21.2 21.3 21.4 21.5 21.6 21.7 21.8
##      0      2      2      2      2      1      0      1      2      2      2      3      0      1      1      2
##      1      0      0      0      0      0      1      0      0      0      0      1      1      0      0      0
##      x
##      21.9 22.2 22.3 22.4 22.5 22.6 22.7 22.9 23 23.1 23.2 23.3 23.5 23.7 23.9 24
##      0      0      3      2      1      1      2      2      3  3      0      0      1      2      1      2  1
##      1      1      0      0      1      0      0      0      0      0      1      1      0      1      0      0      0
##      x
##      24.2 24.3 24.4 24.5 24.9 25.1 25.2 25.3 25.5 25.6 25.7 25.9 26 26.2 26.4
##      0      1      5      3      2      1      1      2      1      2      4      2      2  1      3      1
##      1      1      0      0      1      1      1      0      0      0      0      1      0      0      0      0
##      x
##      26.5 27 27.2 27.3 27.4 27.5 27.8 27.9 28 28.3 28.5 28.6 28.7 28.8 28.9 29
##      0      3  1      5      2      1      1      1      3  1      1      1      1      1      2      2  1
##      1      0  0      0      0      0      0      0      0      0      1      0      0      0      0      0      0
##      x
##      29.1 29.3 29.6 29.7 29.8 29.9 30 30.1 30.2 30.3 30.6 30.7 30.8 31 31.5 31.9
##      0      1      1      2      2      1      2  1      0      2      2      1      2      2  2      1      1
##      1      0      0      1      0      0      1  0      1      0      0      0      0      0      0      0      0
##      x
##      32.1 32.2 32.3 32.5 32.6 33.3 33.4 33.5 33.7 33.8 33.9 34 34.1 34.8 35.2
##      0      1      2      1      1      1      1      2      1      1      1      2  1      1      0      1
##      1      0      0      0      0      1      0      1      0      0      0      0      0      0      1      0
##      x
##      35.3 35.4 35.6 36.3 36.6 36.7 37.2 37.5 37.6 38.2 38.5 39 39.6 40.1 40.7
##      0      1      1      1      2      0      0      2      1      1      1      1      1      1      1      0

```

```
## 1 0 0 0 0 1 0 0 0 0 0 0 1 1 0 1
##
## Pearson's Chi-squared test
##
## data: tab
## X-squared = NaN, df = 205, p-value = NA
##
## [1] 15
## [1] "Humidity3pm"
## x
## 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
## 0 1 1 5 0 5 2 5 3 2 2 1 6 7 5 3 6 2 4 11 7 8 4 9 11 6
## 1 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 1 0 0 0 1 0 1 2 2 0
## x
## 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55
## 0 9 7 7 10 11 4 7 3 5 5 0 8 3 8 5 10 4 9 10 5 8 11 2 5 9
## 1 0 1 0 0 0 1 2 0 0 0 2 0 0 2 0 1 0 1 0 0 1 0 2 0 1
## x
## 56 57 58 59 60 61 62 63 64 66 67 68 69 70 73 75 77 78 79 82 84 85 94
## 0 2 4 2 4 5 3 1 0 3 2 0 2 2 2 2 1 0 1 1 0 0 0 0
## 1 1 2 1 1 2 0 0 3 3 0 1 0 0 0 1 0 2 0 0 1 1 2 1
##
## Pearson's Chi-squared test
##
## data: tab
## X-squared = NaN, df = 72, p-value = NA
##
## [1] 16
## [1] "Cloud3pm"
## x
## 1 2 3 4 5 6 7 8
## 0 31 13 8 6 8 12 11 51
## 1 3 2 1 1 2 3 3 22
##
## Pearson's Chi-squared test
##
## data: tab
## X-squared = 8.0069, df = 7, p-value = 0.332
##
## [1] 17
## [1] "WindDir3pm"
## x
## E ENE ESE N NE NNE NNW NW S SE SSE SSW SW W WNW WSW
## 0 7 10 10 17 12 7 66 58 7 8 4 4 4 23 72 6
## 1 1 0 0 3 1 0 12 13 0 2 0 1 1 3 7 2
```



```
##
## Pearson's Chi-squared test
##
## data:  tab
## X-squared = 11.542, df = 15, p-value = 0.7133
##
## [1] 18
## [1] "WindSpeed3pm"
##      x
##      11 13 15 17 19  2 20 22 24 26 28 30 31 33 35 37 39 41 43 44 46 48 52  6 61
##      0 24 32 13 30 17  2 22 15 14 17 22 16 16 12 12  9  1  4  1  1  2  0  1  5  0
##      1  3  0  2  3  1  0  4  6  4  4  0  3  5  2  3  1  0  0  0  0  1  1  0  1  1
##      x
##      7  9 Calm
##      0 12 15  3
##      1  0  1  0
##
## Pearson's Chi-squared test
##
## data:  tab
## X-squared = 39.02, df = 27, p-value = 0.06309
##
## [1] 19
## [1] "Pressure3pm"
##      x
##      994.8 994.9 997.6 998.8 1000.2 1000.7 1001 1001.6 1002 1002.1 1002.2 1003.2
##      0      1      1      1      1      0      0      0      1      0      0      1      1
##      1      0      0      0      0      1      1      1      0      1      1      0      0
##      x
##      1003.5 1004.3 1004.4 1004.9 1005 1005.1 1005.2 1005.4 1005.8 1006 1006.3
##      0      2      0      0      1      2      2      1      0      1      1      2
##      1      0      1      1      1      0      0      1      0      0      0      0
##      x
##      1006.4 1006.9 1007 1007.4 1007.5 1007.6 1007.7 1007.8 1007.9 1008.2 1008.3
##      0      1      2      1      1      0      1      2      2      1      1      1
##      1      0      0      0      0      1      0      1      0      1      1      0
##      x
##      1008.4 1008.6 1008.7 1008.8 1008.9 1009.1 1009.2 1009.3 1009.5 1009.8
##      0      0      2      2      1      1      2      3      3      1      6
##      1      1      0      0      0      1      0      0      0      0      0
##      x
##      1009.9 1010.1 1010.2 1010.3 1010.4 1010.5 1010.6 1010.7 1010.8 1010.9
##      0      4      1      1      2      0      1      2      1      0      0
##      1      1      0      0      0      1      0      0      0      1      3
##      x
```

```

##      1011.1 1011.2 1011.3 1011.4 1011.6 1011.7 1011.8 1011.9 1012 1012.3 1012.5
## 0      1      0      2      2      1      1      2      1      1      2
## 1      1      2      1      0      1      0      1      0      0      0
##      x
##      1012.6 1012.7 1012.9 1013 1013.2 1013.3 1013.4 1013.5 1013.6 1013.7 1013.8
## 0      1      1      2      3      2      2      4      1      1      2
## 1      1      0      0      0      0      0      0      2      0      0
##      x
##      1013.9 1014 1014.1 1014.2 1014.3 1014.4 1014.5 1014.6 1014.7 1014.8 1014.9
## 0      2      1      3      2      2      2      3      1      1      1
## 1      0      0      0      0      0      0      0      2      0      0
##      x
##      1015 1015.1 1015.2 1015.3 1015.4 1015.5 1015.6 1015.7 1015.8 1016 1016.1
## 0      1      1      3      2      1      2      5      1      6      3
## 1      0      0      1      1      1      0      0      0      1      1
##      x
##      1016.2 1016.3 1016.5 1016.6 1016.7 1016.8 1016.9 1017.1 1017.3 1017.4
## 0      1      1      1      5      1      0      1      1      2      2
## 1      0      1      0      0      0      2      0      0      0      0
##      x
##      1017.5 1017.6 1017.7 1017.8 1018 1018.1 1018.2 1018.3 1018.4 1018.8 1018.9
## 0      1      2      2      1      2      1      1      1      2      2
## 1      0      0      0      1      0      0      0      0      0      0
##      x
##      1019 1019.1 1019.2 1019.3 1019.4 1019.5 1019.7 1019.8 1020 1020.2 1020.3
## 0      2      2      1      2      2      1      2      5      1      1
## 1      0      0      0      0      0      1      1      0      0      0
##      x
##      1020.4 1020.5 1020.6 1020.7 1020.9 1021 1021.1 1021.2 1021.3 1021.7 1021.8
## 0      1      1      1      2      2      4      1      3      8      2
## 1      0      0      0      0      0      0      0      0      0      0
##      x
##      1022 1022.1 1022.2 1022.3 1022.4 1022.5 1022.6 1022.7 1022.8 1022.9 1023
## 0      2      2      3      2      1      5      1      1      2      2
## 1      0      1      0      0      0      1      0      0      0      0
##      x
##      1023.1 1023.2 1023.5 1023.6 1023.7 1023.8 1023.9 1024 1024.2 1024.4 1024.5
## 0      2      5      1      1      1      1      1      1      1      4
## 1      0      0      0      0      0      0      0      0      0      0
##      x
##      1024.6 1024.8 1024.9 1025 1025.1 1025.3 1025.4 1025.5 1025.6 1026 1026.2
## 0      3      1      1      1      2      1      1      1      1      1
## 1      0      0      0      0      0      0      0      0      0      0
##      x
##      1026.5 1026.6 1026.7 1026.9 1027 1027.1 1027.2 1027.3 1027.4 1027.8 1028

```

```

##      0      3      1      1      2      2      1      1      1      2      1      1
##      1      0      0      0      0      0      0      0      0      0      0      0
##      x
##      1028.3 1028.7 1029 1029.3 1029.4 1029.8 1030.5 1030.7 1031.2 1032.5 1033.6
##      0      1      2      2      4      1      1      1      1      1      1      1
##      1      0      0      0      0      0      0      0      0      0      0      0
##      x
##      1033.7 1034.5 1034.9 1035.6 1036 1036.7
##      0      1      1      1      1      1      1
##      1      0      0      0      0      0      0
##
##      Pearson's Chi-squared test
##
##      data:  tab
##      X-squared = NaN, df = 201, p-value = NA
##
##      [1] 20
##      [1] "RainToday"
##      x
##      0      1
##      0 284  34
##      1  34  12
##
##      Pearson's Chi-squared test with Yates' continuity correction
##
##      data:  tab
##      X-squared = 7.2891, df = 1, p-value = 0.006938
##
##      [1] 21
##      [1] "RainTomorrow"
##      x
##      0      1
##      0 318  0
##      1  0  46
##
##      Pearson's Chi-squared test with Yates' continuity correction
##
##      data:  tab
##      X-squared = 355, df = 1, p-value < 2.2e-16

```