# Data Cleaning in R

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# Common Tasks

- Data class
- Creating dataframes
- Updating column names
- Combining columns
- Transposing
- Rownames/column names
- Concatenating
- Creating lists
- Subsetting (indices, logic, which)
- Merging
- Reclassification
- Dealing with NA values w/ logic
- Strings
- Functions
- lapply

# Basic background

- dataframe$column
- read.csv("data.csv")
- write.csv(object, "object.csv")
- head()
- str()
- colnames()
- summary()
- unique()
- class()
- levels()
- nrow(), length()
- dataframe[row, column]

# Structure

as.Date, as.String, as.Numeric, as.Factor use class() to find type

```
class(sales$event_dt)
```

```
[1] "factor"
```

```
sales$event_dt <- as.Date(sales$event_dt)
class(sales$event_dt)
```

```
[1] "Date"
```

# Splitting columns

```
sales$event_dt[1:3]
```

```
[1] "2015-09-12" "2009-09-04" "2006-04-21"
```

```
strsplit(as.character(sales$event_dt[1:3]), "-")
```

```
[[1]]
[1] "2015" "09"   "12"

[[2]]
[1] "2009" "09"   "04"

[[3]]
[1] "2006" "04"   "21"
```

# Creating new dataframes

```
new.df <- data.frame(matrix(nrow=5, ncol=3))
```

# Updating column names

```
colnames(new.df) <- c("column.1", "column.2", "column.3")
new.df$column.1 <- c(1,2,3,4,5)
new.df$column.2 <- c("a", "b", "c", "d", "e")
new.df
```

```
  column.1 column.2 column.3
1        1        a       NA
2        2        b       NA
3        3        c       NA
4        4        d       NA
5        5        e       NA
```

# Renaming singular column

```
colnames(new.df[colnames(new.df) == "column.2"])
         <- "whatever"
```

# Combining columns

```
new.df$column.3 <- paste(new.df$column.1,
                         new.df$column.2, sep="")
new.df$column.3
```

```
[1] "1a" "2b" "3c" "4d" "5e"
```

# Transposing

`t()` returns a nested list. A dataframe must be specified if you want a dataframe.

```
new.df.t <- as.data.frame(t(new.df))
new.df.t
```

```
         V1 V2 V3 V4 V5
column.1  1  2  3  4  5
column.2  a  b  c  d  e
column.3 1a 2b 3c 4d 5e
```

# Rownames/colnames

```
require(tibble)
rownames_to_column(new.df.t)
```

```
   rowname V1 V2 V3 V4 V5
1 column.1  1  2  3  4  5
2 column.2  a  b  c  d  e
3 column.3 1a 2b 3c 4d 5e
```

# Concatenating dataframes

```
new.df.2 <- new.df
rbind(new.df, new.df.2)
```

```
   column.1 column.2 column.3
1         1        a       1a
2         2        b       2b
3         3        c       3c
4         4        d       4d
5         5        e       5e
6         1        a       1a
7         2        b       2b
8         3        c       3c
9         4        d       4d
10        5        e       5e
```

# Creating new lists

```
mylist <- rep(NA, nrow(sales)/500)

mylist
```

```
 [1] NA NA NA NA NA NA NA NA NA NA
```

# Subsetting by indices

R makes use of the [row,column] notation

```
sales[5:10, c(3,9)]
```

```
          primary_act_id major_cat_name
5  91c03a34b562436efa3c            MISC
6  ac4b847b3fde66f2117e            MISC
7  a14232befff04be1e2f3            MISC
8  91c03a34b562436efa3c            MISC
9  0efaba7ce3f0d7466b42            MISC
10 f6425a3223e73ea6de5a         CONCERTS
```

# Subsetting by >=, ==, <=, !=

R accepts logical statements within a [row, column] subsetting argument

```
sales[sales$age_yr>70 & !is.na(sales$age_yr),
      c(34,14,15)]
```

| | age_yr | tickets_purchased_qty | trans_face_val_amt |
|---|---|---|---|
| 11 | 80 | 1 | 20 |
| 428 | 82 | 1 | 20 |
| 1220 | 80 | 1 | 20 |
| 1314 | 76 | 1 | 30 |
| 1701 | 72 | 2 | 30 |
| 3830 | 72 | 1 | 22 |
| 4188 | 90 | 1 | 15 |
| 4328 | 94 | 1 | 9 |
| 4975 | 78 | 1 | 20 |

# Subsetting by %in%

```
sales[sales$venue_state %in% c("RHODE ISLAND",
                               "MANITOBA"), c(18,26)]
```

```
      event_dt  venue_state
732  2015-08-08 RHODE ISLAND
1860 2015-09-17     MANITOBA
2046 2016-02-19     MANITOBA
2177 2015-12-16 RHODE ISLAND
2832 2015-09-17     MANITOBA
3304 2015-09-17     MANITOBA
4064 2016-01-27     MANITOBA
4119 2015-09-17     MANITOBA
4308 2015-11-16     MANITOBA
4935 2016-01-15     MANITOBA
```

# Subsetting by which

If you have 500 columns, you may not know which column index to subset by in the previous example. Here the age column is extracted using `which`.

```
sales[sales$age_yr>70 & !is.na(sales$age_yr),
      c(which(colnames(sales) %in%
                c("age_yr","tickets_purchased_qty")))]
```

```
     tickets_purchased_qty age_yr
11                       1     80
428                      1     82
1220                     1     80
1314                     1     76
1701                     2     72
3830                     1     72
4188                     1     90
4328                     1     94
4975                     1     78
```

# Which.max, which.min

`which.max` and `which.min` are useful for removing known outliers.

```
sales[-c(which.max(sales$income_amt)),]
```

# Merging

```
merged <- merge(x1, x2, by.x="column.x", by.y="column.y")
```

# Reclassifying

```
levels(cut(sales$trans_face_val_amt, 5))
```

```
[1] "(-0.52,305]"          "(305,609]"            "(609,913]"
[4] "(913,1.22e+03]"       "(1.22e+03,1.52e+03]"
```

# Removing NA values

```
new.df[2,3] <- NA
new.df[1,2] <- NA
new.df[1,3] <- NA
new.df
```

```
  column.1 column.2 column.3
1        1     <NA>     <NA>
2        2        b     <NA>
3        3        c       3c
4        4        d       4d
5        5        e       5e
```

# Na.omit

```
na.omit(new.df)
```

```
  column.1 column.2 column.3
3        3        c       3c
4        4        d       4d
5        5        e       5e
```

# Column NAs

```
new.df[, colSums(is.na(new.df)) <= 1]
```

```
  column.1 column.2
1        1     <NA>
2        2        b
3        3        c
4        4        d
5        5        e
```

# Row NAs

```
new.df[rowSums(is.na(new.df)) <= 1,]
```

```
  column.1 column.2 column.3
2        2        b     <NA>
3        3        c       3c
4        4        d       4d
5        5        e       5e
```

# Converting date/time

lubridate package

```
year()
month()
day()
week()
as_date()
as_datetime()
time_length()
```

# Lubridate examples

```
library(lubridate)
dates <- as.Date(sales$event_dt[1:3])
dates
```

```
[1] "2015-09-12" "2009-09-04" "2006-04-21"
```

```
year(dates)
```

```
[1] 2015 2009 2006
```

```
month(dates)
```

```
[1] 9 9 4
```

```
week(dates)
```

```
[1] 37 36 16
```

# More examples

```
floor_date(dates, "month")
```

```
[1] "2015-09-01" "2009-09-01" "2006-04-01"
```

```
ceiling_date(dates, "season")
```

```
[1] "2015-12-01" "2009-12-01" "2006-06-01"
```

```
date1 <- "2009-08-03 12:01:59"
as.Date(date1) # uh-oh
```

```
[1] "2009-08-03"
```

```
as_datetime(date1)
```

```
[1] "2009-08-03 12:01:59 UTC"
```

# Strings

grepl returns a logical TRUE/FALSE

```
files <- files[grepl('name', files) == TRUE]
```

```
gsub("hello","goodbye",files)
```

# Creating functions

```
myfunction <- function(x) {
  z <- x + 1
  return(z)
}

myfunction(3)
```

```
[1] 4
```

# Function to calculate percentage of NA in columns

```
calc.na <- function(x, data) {
    calc <- sum(is.na(data[[x]])/nrow(data))
    return(unlist(calc))
}

calc.na("onsale_dt", sales)
```

```
[1] 0.0202
```

# What about the amount of every column?

## Option 1: For loop

Problem 1: results duplicated Problem 2: returns list indices as column names, which cannot be iterated over or used in the future.

```
results <- rep(NA, length(colnames(sales)))

for (i in colnames(sales)) {
  results[i] <- calc.na(i, sales)
}

results[60]
```

```
tickets_purchased_qty
                    0
```

# Option 2: lapply

```
unlist(lapply(colnames(sales), calc.na, sales))
```

```
 [1] 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.682
[11] 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000
[21] 0.0008 0.0000 0.0848 0.0000 0.0000 0.0000 0.0000 0.484
[31] 0.0000 0.0000 0.9646 0.9664 0.9692 0.9722 0.9776 0.982
[41] 0.9740 0.9724 0.9842 0.9846 0.9874 0.9354
```

# Function - example 2

```
toMatch <- c("x", "y", "z", "...")
sentences <- c("sentence 1", "sentence 2", "...")

subset_sentences <- function(Match, sentences){
    sentences[grep(Match,sentences)]
}

subsetted <- lapply(toMatch, subset_sentences, sentences)
```

# Examples

# Example 1

Example of creating list of dates to loop over

```
dates <- seq(ymd_hms('2018-03-08 00:00:00'),
             ymd_hms('2018-03-12 23:00:00'),
             by="1 hour")

dates <- as.character(dates)

for (i in seq_along(dates)) {
  dates[i] <- gsub(" ", "T", dates[i])
}

dates[1:5]
```

```
[1] "2018-03-08T00:00:00" "2018-03-08T01:00:00" "2018-03-08
[4] "2018-03-08T03:00:00" "2018-03-08T04:00:00"
```

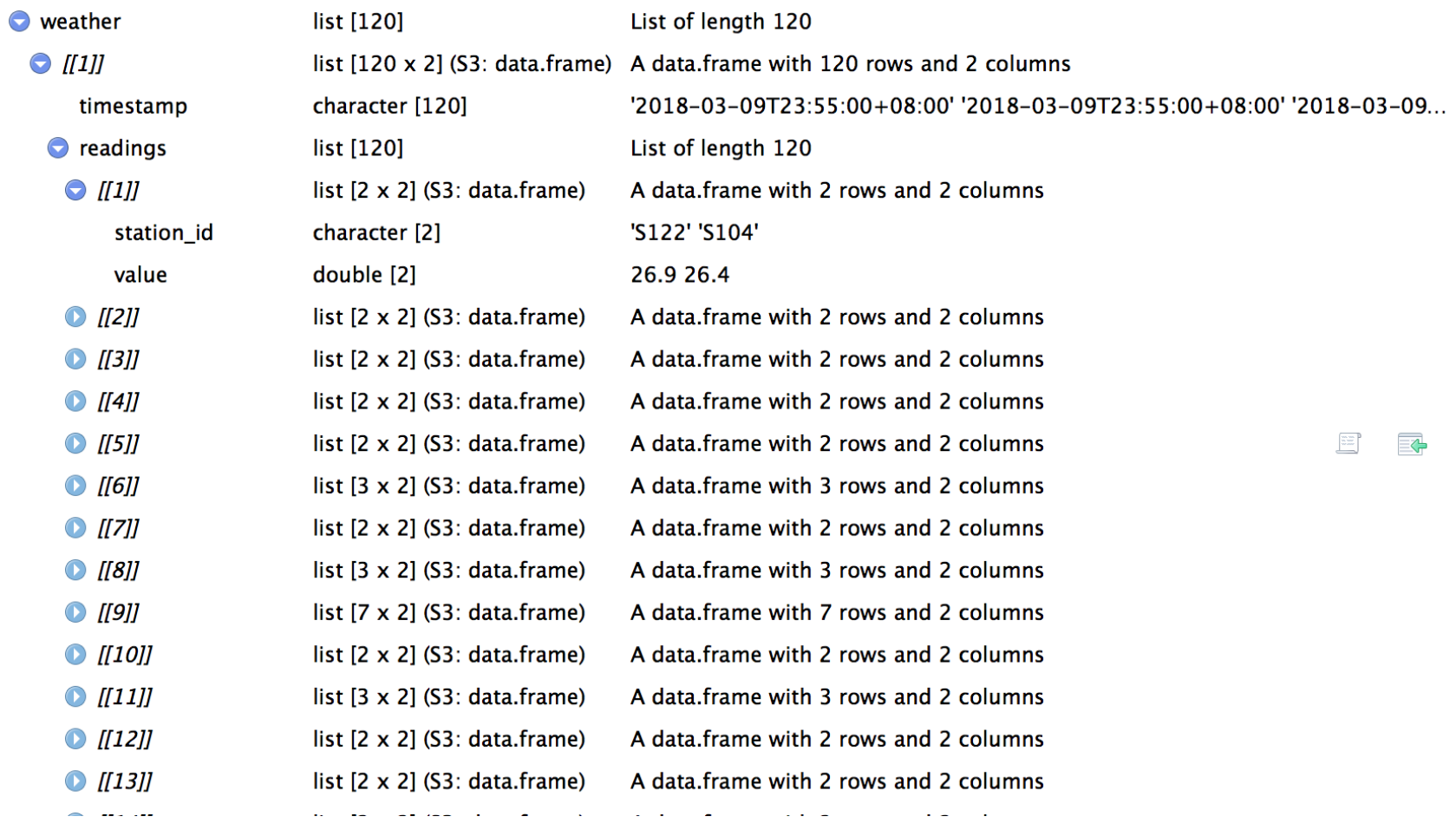
# Read in RDS

Data is saved as an RDS because it is a recursively nested list

```
require(dplyr)
require(lubridate)
require(tidyr)
weather <- readRDS("data/scraped_data.rds")
class(weather)
```

```
[1] "list"
```

# Data



| | | |
|---|---|---|
| weather | list [120] | List of length 120 |
| *[[1]]* | list [120 x 2] (S3: data.frame) | A data.frame with 120 rows and 2 columns |
| timestamp | character [120] | '2018-03-09T23:55:00+08:00' '2018-03-09T23:55:00+08:00' '2018-03-09... |
| readings | list [120] | List of length 120 |
| *[[1]]* | list [2 x 2] (S3: data.frame) | A data.frame with 2 rows and 2 columns |
| station_id | character [2] | 'S122' 'S104' |
| value | double [2] | 26.9 26.4 |
| *[[2]]* | list [2 x 2] (S3: data.frame) | A data.frame with 2 rows and 2 columns |
| *[[3]]* | list [2 x 2] (S3: data.frame) | A data.frame with 2 rows and 2 columns |
| *[[4]]* | list [2 x 2] (S3: data.frame) | A data.frame with 2 rows and 2 columns |
| *[[5]]* | list [2 x 2] (S3: data.frame) | A data.frame with 2 rows and 2 columns |
| *[[6]]* | list [3 x 2] (S3: data.frame) | A data.frame with 3 rows and 2 columns |
| *[[7]]* | list [2 x 2] (S3: data.frame) | A data.frame with 2 rows and 2 columns |
| *[[8]]* | list [3 x 2] (S3: data.frame) | A data.frame with 3 rows and 2 columns |
| *[[9]]* | list [7 x 2] (S3: data.frame) | A data.frame with 7 rows and 2 columns |
| *[[10]]* | list [2 x 2] (S3: data.frame) | A data.frame with 2 rows and 2 columns |
| *[[11]]* | list [3 x 2] (S3: data.frame) | A data.frame with 3 rows and 2 columns |
| *[[12]]* | list [2 x 2] (S3: data.frame) | A data.frame with 2 rows and 2 columns |
| *[[13]]* | list [2 x 2] (S3: data.frame) | A data.frame with 2 rows and 2 columns |

Figure 1:

# Cleaning

```
weather <- unlist(rbind(weather[sapply(weather,
                    length)>0]),
                    recursive=FALSE)
```

```
weather.times <- weather[(length(weather)-1)]$timestamp
weather.readings <- do.call("rbind",
                       weather[length(weather)]$readings)

final_readings <- weather[length(weather)]$readings

for (i in c(1:length(final_readings))) {
  final_readings[[i]][3] <- i
}

weather.readings <- do.call("rbind", final_readings)
```

# Continued

```
weather.readings <- spread(weather.readings,
                           station_id, value)
weather.readings$date <- weather.times
```

# Finished

| S116 | S117 | S121 | S122 | S43 | S44 | S50 | S60 | date |
|---|---|---|---|---|---|---|---|---|
| NA | NA | NA | 24.3 | NA | NA | NA | NA | 2018-03-07T23:55:00+08:00 |
| NA | NA | NA | 24.0 | NA | NA | NA | NA | 2018-03-08T00:55:00+08:00 |
| NA | NA | NA | 24.4 | NA | 24.6 | NA | NA | 2018-03-08T01:55:00+08:00 |
| NA | NA | NA | 24.5 | NA | NA | NA | NA | 2018-03-08T02:55:00+08:00 |
| NA | NA | NA | 24.2 | NA | NA | NA | NA | 2018-03-08T03:55:00+08:00 |
| NA | NA | NA | 24.3 | NA | NA | NA | NA | 2018-03-08T04:55:00+08:00 |
| NA | NA | NA | 23.7 | 25.7 | 24.7 | 24.9 | 25.6 | 2018-03-08T05:55:00+08:00 |
| NA | NA | NA | 23.8 | NA | NA | NA | NA | 2018-03-08T06:55:00+08:00 |
| NA | NA | NA | 24.8 | NA | NA | NA | NA | 2018-03-08T07:55:00+08:00 |
| NA | NA | NA | 24.8 | NA | NA | NA | NA | 2018-03-08T07:55:00+08:00 |
| 28.0 | 28.3 | 27.4 | 28.7 | NA | 27.3 | 28.6 | NA | 2018-03-08T09:55:00+08:00 |
| NA | NA | NA | 30.5 | NA | NA | NA | NA | 2018-03-08T10:55:00+08:00 |
| NA | NA | NA | 30.1 | 28.9 | NA | NA | NA | 2018-03-08T11:55:00+08:00 |
| NA | NA | NA | 28.8 | NA | NA | NA | NA | 2018-03-08T12:55:00+08:00 |
| NA | NA | NA | 27.7 | NA | NA | NA | NA | 2018-03-08T13:55:00+08:00 |
| NA | NA | NA | 27.5 | NA | NA | NA | NA | 2018-03-08T14:55:00+08:00 |
| NA | 28.6 | 27.6 | 27.4 | 26.7 | NA | 27.1 | 27.9 | 2018-03-08T15:55:00+08:00 |
| NA | NA | NA | 28.1 | NA | NA | NA | NA | 2018-03-08T16:55:00+08:00 |
| NA | NA | 28.2 | 28.2 | NA | NA | NA | NA | 2018-03-08T17:55:00+08:00 |

Figure 2:

# Example 2

```
sales <- read.csv("data/sales.csv",
                  na.strings=c("NULL", "NA"))
```

# Function

```
perc.na <- function(data) {
  sing.na <- function(x) {
    sum(is.na(data[[x]])/nrow(data))
  }
  return(unlist(lapply(colnames(data), sing.na)))
}

sales.na <- perc.na(sales)
```

# Remove outliers, select columns

```
sales <- sales[,-which(sales.na >= 0.9)]
```

```
sales <- sales %>%
  select(-c(X, primary_act_id, secondary_act_id,
            primary_act_id, secondary_act_id,
            purch_party_lkup_id,
            web_session_cookie_val))
```

# Reclassify

```
sales$secondary <- 0
sales$secondary[!is.na(sales$secondary_act_name)] <- 1
sales$secondary <- as.factor(sales$secondary)
```

# Calc new columns

```
sales$onsale_dt <- as.Date(sales$onsale_dt)
sales$event_dt <- as.Date(sales$event_dt)
sales$sales_ord_tran_dt <-
  as.Date(sales$sales_ord_tran_dt)

sales$sale_length <- sales$event_dt - sales$onsale_dt
sales$purchased_date <- sales$sales_ord_tran_dt -
  sales$onsale_dt

sales$event_hour <- hour(sales$event_date_time)
```

# Remove unnecessary columns before aggregating

```
sales <- sales[,-c(1,2,3,4,7,8,9,13,
                   15,16,17,18,19,20,
                   23,24,25,26,27)]
```

# Datetime conversions

```
sales$month <- month(sales$event_dt)
sales$year <- year(sales$event_dt)
sales$month_year <- paste(sales$month, sales$year)
```

# dplyr for final data

Go to Matt's data exploration workshop to learn more about this!

```
sales.y <- sales %>%
  select(-c(minor_cat_name, venue_city, event_dt,
            month, month_year, secondary,
            major_cat_name)) %>%
  group_by(year, delivery_type_cd,
           venue_state) %>%
  summarise_all(c("mean", "sum"))
```