More Data Wrangling

Fall 2022

September 26 2022

rename()

```
pollution <- tribble(
       ~city,   ~size, ~amount,
  "New York", "large",      23.4,
  "New York", "small",      14.5,
    "London", "large",      22.2,
    "London", "small",      16.7,
   "Beijing", "large",      121.0,
   "Beijing", "small",      56.9
)
```

```
pollution %>% rename(quantity = amount)
# A tibble: 6 × 3
   city      size  quantity
   <chr>     <chr>    <dbl>
 1 New York  large     23.4
 2 New York  small     14.5
 3 London    large     22.2
 4 London    small     16.7
 5 Beijing   large    121
 6 Beijing   small     56.9
```

Mutating multiple columns at once: `mutate_*`

- variants of mutate() that are useful for mutating multiple columns at once
  - `mutate_at()`, `mutate_if()`, `mutate_all()`, etc.
- which columns get mutated depends on a predicate, can be:
  - a function that returns TRUE/FALSE like `is.numeric()`, or
  - variable names through `vars()`

```
pollution %>%
  mutate_at(vars(city:amount), toupper)
# A tibble: 6 × 3
  city     size  amount
  <chr>    <chr> <chr>
1 NEW YORK LARGE 23.4
2 NEW YORK SMALL 14.5
3 LONDON   LARGE 22.2
4 LONDON   SMALL 16.7
5 BEIJING  LARGE 121
6 BEIJING  SMALL 56.9
```

```
pollution %>%
  mutate_if(is.double, round, digits = 0)
# A tibble: 6 × 3
  city     size  amount
  <chr>    <chr>  <dbl>
1 New York large     23
2 New York small     14
3 London   large     22
4 London   small     17
5 Beijing  large    121
6 Beijing  small     57
```

Selecting & renaming multiple columns

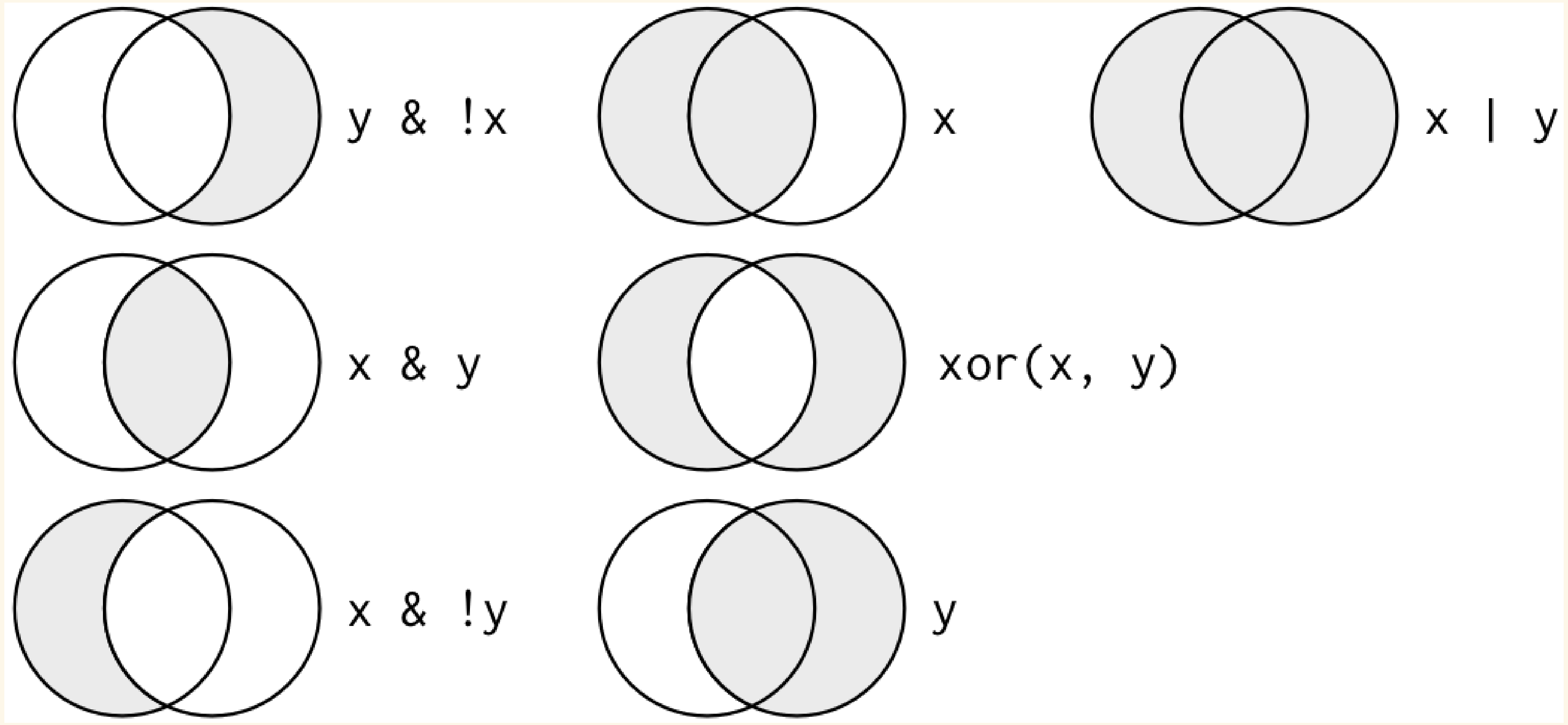
- `select_*()` & `rename_*()` are variants of `select()` and `rename()`
- use like `mutate_*()` options on previous slide

What do these commands do?

```
pollution %>% select_if(is.numeric)
pollution %>% rename_all(toupper)
pollution %>% rename_if(is.character, toupper)
pollution %>% rename_at(vars(contains("it")), toupper)
```

Boolean operators

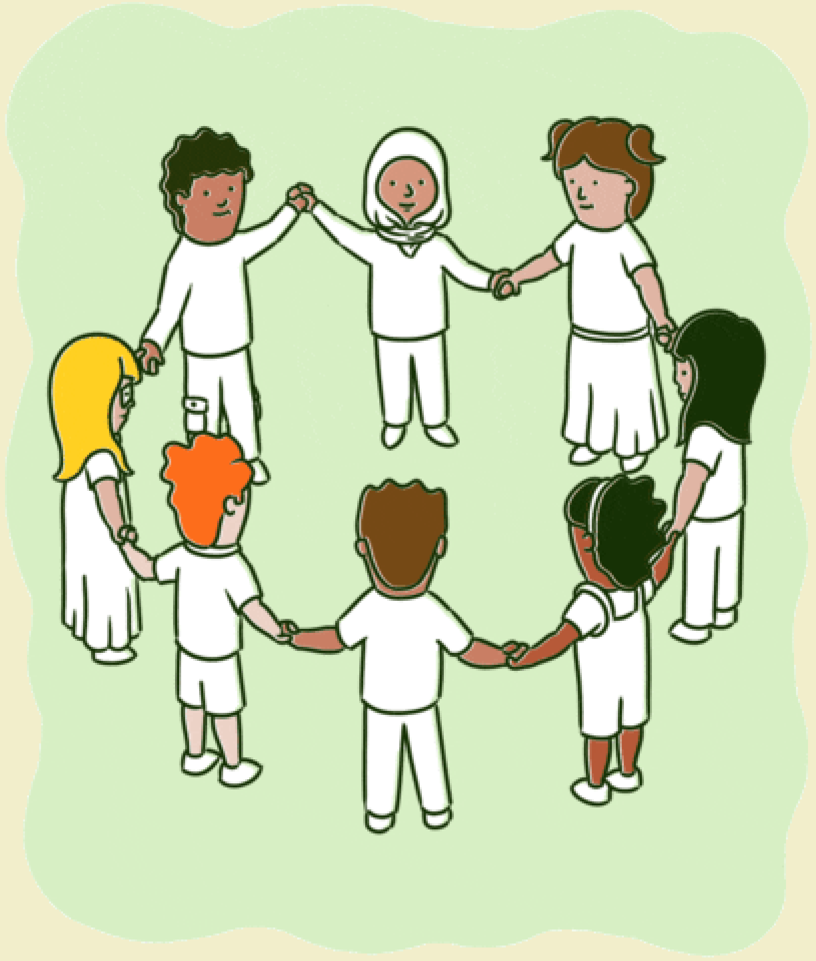
For help, `?base::Logic`



Source: *R for Data Science*, by Grolemund & Wickham

Group Activity 1

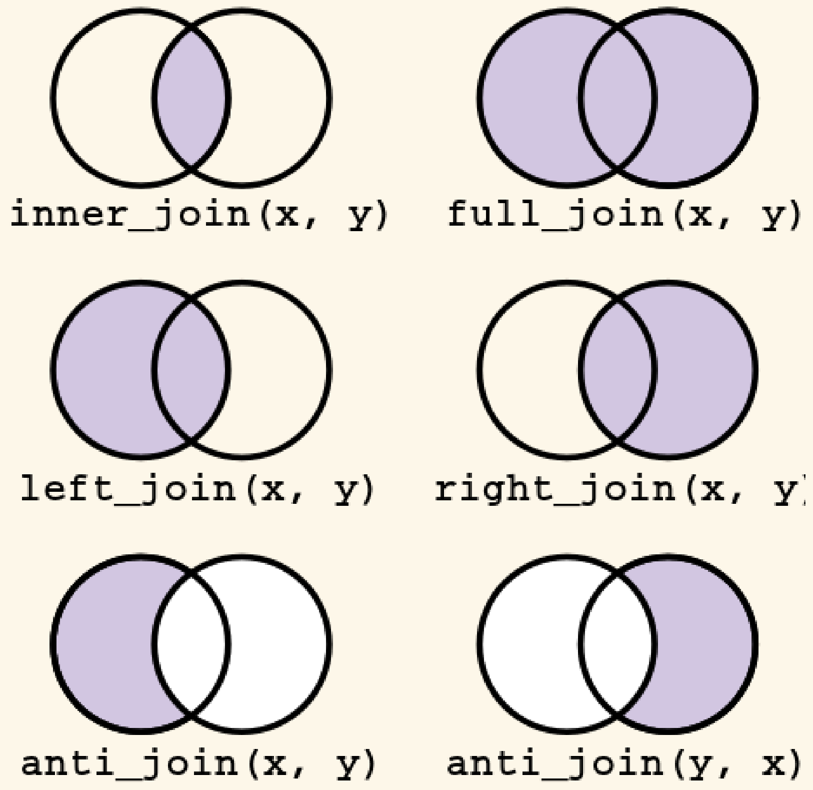
05:00



- Let's go over to maize server/ local Rstudio and our class moodle
- Get the class activity 7.Rmd file
- Work on problems 1-2
- Ask me questions

Two-table verbs

- `inner_join()` - Merge two datasets. Exclude all unmatched rows.
- `full_join()` - Merge two datasets. Keep all observations.
- `left_join()` - Merge two datasets. Keep all observations from the origin table.
- `right_join()` - Merge two datasets. Keep all observations from the destination table.
- `anti_join()` - Drops all observations in origin that have a match in destination table.



Mutating Joins

- `left_join()`
- `right_join()`
- `inner_join()`
- `full_join()`

Differ in their behavior when a match is not found

Flights data

```
library(nycflights13)
flights2 <- flights %>%
  select(year:day, hour, origin, dest, tailnum, carrier)
```

```
head(flights2)
# A tibble: 6 × 8
   year month   day  hour origin dest  tailnum carrier
  <int> <int> <int> <dbl> <chr>  <chr> <chr>   <chr>
1  2013     1     1     5 EWR    IAH   N14228  UA
2  2013     1     1     5 LGA    IAH   N24211  UA
3  2013     1     1     5 JFK    MIA   N619AA  AA
4  2013     1     1     5 JFK    BQN   N804JB  B6
5  2013     1     1     6 LGA    ATL   N668DN  DL
6  2013     1     1     5 EWR    ORD   N39463  UA
```

Airline information

```
head(airlines)
# A tibble: 6 × 2
  carrier name
  <chr>   <chr>
1 9E      Endeavor Air Inc.
2 AA      American Airlines Inc.
3 AS      Alaska Airlines Inc.
4 B6      JetBlue Airways
5 DL      Delta Air Lines Inc.
6 EV      ExpressJet Airlines Inc.
```

left_join()

```
flights2 %>%
  left_join(airlines)
# A tibble: 336,776 × 9
    year month   day  hour origin dest  tailnum carrier name
   <int> <int> <int> <dbl> <chr>  <chr> <chr>   <chr>   <chr>
 1  2013     1     1     5 EWR    IAH   N14228  UA      United Air Lines Inc.
 2  2013     1     1     5 LGA    IAH   N24211  UA      United Air Lines Inc.
 3  2013     1     1     5 JFK    MIA   N619AA  AA      American Airlines Inc.
 4  2013     1     1     5 JFK    BQN   N804JB  B6      JetBlue Airways
 5  2013     1     1     6 LGA    ATL   N668DN  DL      Delta Air Lines Inc.
 6  2013     1     1     5 EWR    ORD   N39463  UA      United Air Lines Inc.
 7  2013     1     1     6 EWR    FLL   N516JB  B6      JetBlue Airways
 8  2013     1     1     6 LGA    IAD   N829AS  EV      ExpressJet Airlines Inc.
 9  2013     1     1     6 JFK    MCO   N593JB  B6      JetBlue Airways
10  2013     1     1     6 LGA    ORD   N3ALAA  AA      American Airlines Inc.
# … with 336,766 more rows
```

Planes information

```
head(planes)
# A tibble: 6 × 9
  tailnum  year type                    manuf…¹ model engines seats speed engine
  <chr>   <int> <chr>                   <chr>   <chr>   <int> <int> <int> <chr> 
1 N10156   2004 Fixed wing multi engine EMBRAER EMB-…       2    55    NA Turbo…
2 N102UW   1998 Fixed wing multi engine AIRBUS… A320…       2   182    NA Turbo…
3 N103US   1999 Fixed wing multi engine AIRBUS… A320…       2   182    NA Turbo…
4 N104UW   1999 Fixed wing multi engine AIRBUS… A320…       2   182    NA Turbo…
5 N10575   2002 Fixed wing multi engine EMBRAER EMB-…       2    55    NA Turbo…
6 N105UW   1999 Fixed wing multi engine AIRBUS… A320…       2   182    NA Turbo…
# … with abbreviated variable name ¹manufacturer
```

Keys: controlling how the tables are matched

```
flights2 %>% left_join(planes, by = "tailnum")
# A tibble: 336,776 × 16
   year.x month   day  hour origin dest  tailnum carrier year.y type     manuf…¹
    <int> <int> <int> <dbl> <chr>  <chr> <chr>   <chr>    <int> <chr>    <chr>
 1   2013     1     1     5 EWR    IAH   N14228  UA        1999 Fixed w… BOEING
 2   2013     1     1     5 LGA    IAH   N24211  UA        1998 Fixed w… BOEING
 3   2013     1     1     5 JFK    MIA   N619AA  AA        1990 Fixed w… BOEING
 4   2013     1     1     5 JFK    BQN   N804JB  B6        2012 Fixed w… AIRBUS
 5   2013     1     1     6 LGA    ATL   N668DN  DL        1991 Fixed w… BOEING
 6   2013     1     1     5 EWR    ORD   N39463  UA        2012 Fixed w… BOEING
 7   2013     1     1     6 EWR    FLL   N516JB  B6        2000 Fixed w… AIRBUS…
 8   2013     1     1     6 LGA    IAD   N829AS  EV        1998 Fixed w… CANADA…
 9   2013     1     1     6 JFK    MCO   N593JB  B6        2004 Fixed w… AIRBUS
10   2013     1     1     6 LGA    ORD   N3ALAA  AA          NA <NA>     <NA>
# … with 336,766 more rows, 5 more variables: model <chr>, engines <int>,
#   seats <int>, speed <int>, engine <chr>, and abbreviated variable name
#   ¹manufacturer
```

Matching keys

```
flights2 %>% left_join(airports, c("origin" = "faa"))
# A tibble: 336,776 × 15
    year month   day  hour origin dest  tailnum carrier name     lat   lon   alt
   <int> <int> <int> <dbl> <chr>  <chr> <chr>   <chr>   <chr>  <dbl> <dbl> <dbl>
 1  2013     1     1     5 EWR    IAH   N14228  UA      Newar…  40.7 -74.2    18
 2  2013     1     1     5 LGA    IAH   N24211  UA      La Gu…  40.8 -73.9    22
 3  2013     1     1     5 JFK    MIA   N619AA  AA      John …  40.6 -73.8    13
 4  2013     1     1     5 JFK    BQN   N804JB  B6      John …  40.6 -73.8    13
 5  2013     1     1     6 LGA    ATL   N668DN  DL      La Gu…  40.8 -73.9    22
 6  2013     1     1     5 EWR    ORD   N39463  UA      Newar…  40.7 -74.2    18
 7  2013     1     1     6 EWR    FLL   N516JB  B6      Newar…  40.7 -74.2    18
 8  2013     1     1     6 LGA    IAD   N829AS  EV      La Gu…  40.8 -73.9    22
 9  2013     1     1     6 JFK    MCO   N593JB  B6      John …  40.6 -73.8    13
10  2013     1     1     6 LGA    ORD   N3ALAA  AA      La Gu…  40.8 -73.9    22
# … with 336,766 more rows, and 3 more variables: tz <dbl>, dst <chr>,
#   tzone <chr>
```

inner_join()

```
df1 <- tibble(x = c(1, 2), y = 2:1)
df2 <- tibble(x = c(3, 1), a = 10, b = "a")
```

Table: df1

x	y
1	2
2	1

Table: df2

x	a	b
3	10	a
1	10	a

```
df1 %>% inner_join(df2)
```

x	y	a	b
1	2	10	a

left_join()

Table: df1

x	y
1	2
2	1

Table: df2

x	a	b
3	10	a
1	10	a

```
df1 %>% left_join(df2)
```

x	y	a	b
1	2	10	a
2	1	NA	NA

```
df2 %>% left_join(df1)
```

x	a	b	y
3	10	a	NA
1	10	a	2

right_join()

Table: df1

x	y
1	2
2	1

```
df1 %>% right_join(df2)
```

x	y	a	b
1	2	10	a
3	NA	10	a

Table: df2

x	a	b
3	10	a
1	10	a

```
df2 %>% right_join(df1)
```

x	a	b	y
1	10	a	2
2	NA	NA	1

Filtering joins

Filtering joins return a copy of the dataset that has been filtered, not augmented (as with mutating joins)

- `semi_join(x,y)` : keeps all observations in x that have a match in y.
- `anti_join(x,y)` : drops all observations in x that have a match in y.

most useful for diagnosing join mismatches

Another example

```r
df1 <- tibble(x = c(1, 1, 3, 4), y = 1:4)
df2 <- tibble(x = c(1, 1, 2), z = c("a", "b", "a"))
```

Table: df1

x	y
1	1
1	2
3	3
4	4

Table: df2

x	z
1	a
1	b
2	a

semi_join()

Table: df1

x	y
1	1
1	2
3	3
4	4

```
df1 %>% semi_join(df2, by = "x")
```

x	y
1	1
1	2

Table: df2

x	z
1	a
1	b
2	a

```
df2 %>% semi_join(df1, by = "x")
```

x	z
1	a
1	b

anti_join()

Table: df1

x	y
1	1
1	2
3	3
4	4

```r
df1 %>% anti_join(df2, by = "x")
```

x	y
3	3
4	4

Table: df2

x	z
1	a
1	b
2	a

```r
df2 %>% anti_join(df1, by = "x")
```

x	z
2	a

Set Operations

These expect the x and y inputs to have the same variables, and treat the observations like sets:

- `intersect(x,y)`
  - will return only the rows that appear in both datasets
- `union(x,y)`
  - return every row that appears in one or more of the datasets
  - If a row appears multiple times union will only return it once
- `setdiff(x,y)`
  - will return the rows that appear in the first dataset but not the second

One more example

```
df1 <- tibble(x = 1:2, y = c(1L, 1L))
df2 <- tibble(x = 1:2, y = 1:2)
```

Table: df1

x	y
1	1
2	1

Table: df2

x	y
1	1
2	2

Set operations

```
intersect(df1, df2))
```

x	y
1	1

```
union(df1, df2))
```

x	y
1	1
2	1
2	2

```
setdiff(df1, df2))
```

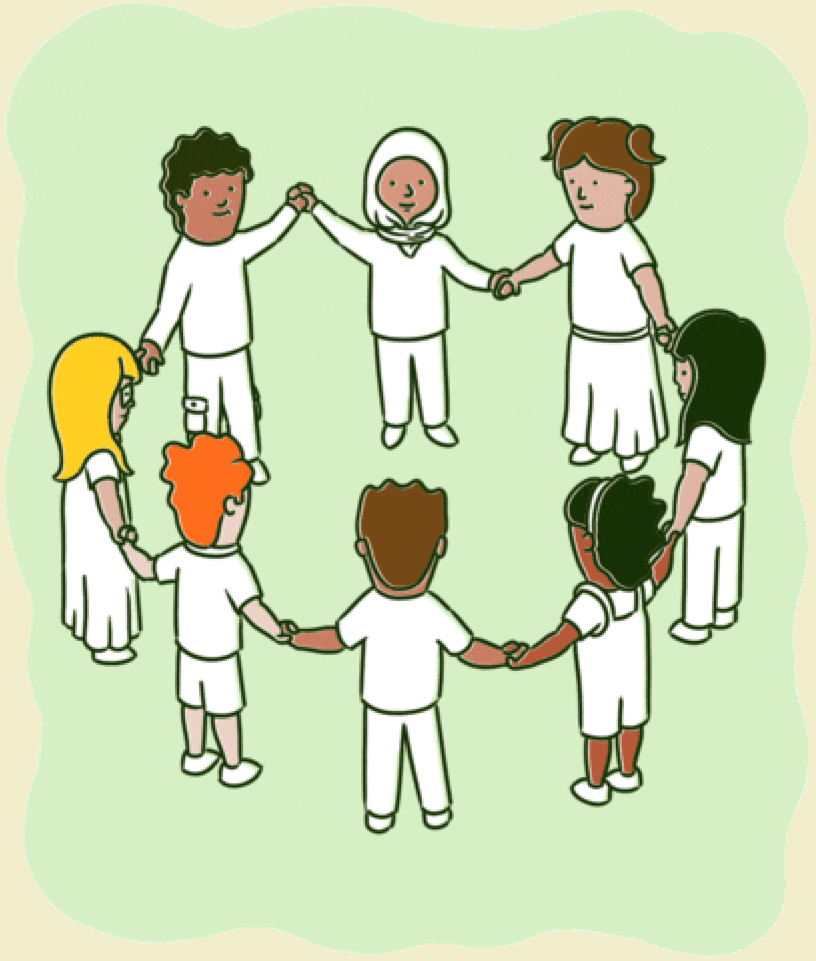
x	y
2	1

```
setdiff(df2, df1))
```

x	y
2	2

Group Activity 2

10:00



- Work on problems 3-5
- Ask me questions
- Any hw-related questions?