Creating unique combinations of vectors

RESHAPING DATA WITH TIDYR

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The early atomic era: 1945 - 1954

```
nuke_df
```

```
# A tibble: 13 x 3
   country             year n_bombs
   <chr>              <int>   <int>
 1 United States       1945       3
 2 United States       1946       2
 3 United States       1948       3
 4 Russian Federation  1949       1
 5 Russian Federation  1951       2
 6 United States       1951      16
# ... with 7 more rows
```

The expand_grid() function

```r
full_df <- expand_grid(
  year = 1945:1954,
  country = c(
    "Russian Federation",
    "United Kingdom",
    "United States")
  )

full_df
```

```
# A tibble: 30 x 2
    year country
   <int> <chr>
 1  1945 Russian Federation
 2  1945 United Kingdom
 3  1945 United States
 4  1946 Russian Federation
 5  1946 United Kingdom
 6  1946 United States
 7  1947 Russian Federation
 8  1947 United Kingdom
# ... with 22 more rows
```

right_join() with a tibble of unique combinations

```
nuke_df %>%
  right_join(
    full_df,
    by = c("country", "year")
  ) %>%
  arrange(year)
```

```
# A tibble: 30 x 3
   country             year n_bombs
   <chr>              <int>   <int>
 1 United States       1945       3
 2 Russian Federation  1945      NA
 3 United Kingdom      1945      NA
 4 United States       1946       2
 5 Russian Federation  1946      NA
 6 United Kingdom      1946      NA
 7 Russian Federation  1947      NA
 8 United Kingdom      1947      NA
# ... with 22 more rows
```

right_join() with a tibble of unique combinations

```r
nuke_df %>%
  right_join(
    full_df,
    by = c("country", "year")
  ) %>%
  arrange(year) %>%
  replace_na(list(n_bombs = 0L))
```

```
# A tibble: 30 x 3
   country             year n_bombs
   <chr>              <int>   <int>
 1 United States       1945       3
 2 Russian Federation  1945       0
 3 United Kingdom      1945       0
 4 United States       1946       2
 5 Russian Federation  1946       0
 6 United Kingdom      1946       0
 7 Russian Federation  1947       0
 8 United Kingdom      1947       0
# ... with 22 more rows
```

anti_join() to select missing observations

```r
full_df %>%
  anti_join(
    nuke_df,
    by = c("country", "year")
  )
```

```
# A tibble: 17 x 2
    year country
   <int> <chr>
 1  1945 Russian Federation
 2  1945 United Kingdom
 3  1946 Russian Federation
 4  1946 United Kingdom
 5  1947 Russian Federation
 6  1947 United Kingdom
 7  1947 United States
 8  1948 Russian Federation
# ... with 9 more rows
```

Let's practice!

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Completing data with all value combinations

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Rolling Stones and Beatles

```
album_df
```

```
# A tibble: 3 x 3
   year artist         n_albums
  <int> <chr>             <int>
1  1977 Beatles               2
2  1977 Rolling Stones        1
3  1979 Beatles               1
```

Initial and target situation

year	artist	n_albums
1977	Beatles	2
1977	Rolling Stones	1
1979	Beatles	1

year	artist	n_albums
1977	Beatles	2
1977	Rolling Stones	1
1979	Beatles	1
1979	Rolling Stones	0

Initial and target situation

year	artist	n_albums
1977	Beatles	2
1977	Rolling Stones	1
1979	Beatles	1

year	artist	n_albums
1977	Beatles	2
1977	Rolling Stones	1
1978	Beatles	0
1978	Rolling Stones	0
1979	Beatles	1
1979	Rolling Stones	0

The complete() function

```
album_df %>%
  complete(year, artist)
```

```
# A tibble: 4 x 3
   year artist         n_albums
  <int> <chr>             <int>
1  1977 Beatles               2
2  1977 Rolling Stones        1
3  1979 Beatles               1
4  1979 Rolling Stones       NA
```

The complete() function: overwriting NA values

```r
album_df %>%
  complete(year, artist, fill = list(n_albums = 0L))
```

```
# A tibble: 4 x 3
   year artist          n_albums
  <int> <chr>              <int>
1  1977 Beatles                2
2  1977 Rolling Stones         1
3  1979 Beatles                1
4  1979 Rolling Stones         0
```

The complete() function: adding unseen values

```r
album_df %>%
  complete(
    year,
    artist = c(
      "Beatles",
      "Rolling Stones",
      "ABBA"),
    fill = list(n_albums = 0L)
  )
```

```
# A tibble: 6 x 3
   year artist         n_albums
  <int> <chr>             <int>
1  1977 ABBA                  0
2  1977 Beatles               2
3  1977 Rolling Stones        1
4  1979 ABBA                  0
5  1979 Beatles               1
6  1979 Rolling Stones        0
```

The complete() function: adding unseen values

```r
album_df %>%
  complete(
    year = 1977:1979,
    artist,
    fill = list(n_albums = 0L)
  )
```

```
# A tibble: 6 x 3
   year artist         n_albums
  <int> <chr>             <int>
1  1977 Beatles               2
2  1977 Rolling Stones        1
3  1978 Beatles               0
4  1978 Rolling Stones        0
5  1979 Beatles               1
6  1979 Rolling Stones        0
```

Generating a sequence with full_seq()

```
full_seq(c(1977, 1979), period = 1)
```

```
1977 1978 1979
```

```
full_seq(c(1977, 1979, 1980, 1980, 1980), period = 1)
```

```
1977 1978 1979 1980
```

```
full_seq(album_df$year, period = 1)
```

```
1977 1978 1979
```

Using full_seq() inside complete()

```r
album_df %>%
  complete(
    year = full_seq(year, period = 1),
    artist,
    fill = list(n_albums = 0L)
  )
```

```
# A tibble: 6 x 3
   year artist         n_albums
  <dbl> <chr>             <int>
1  1977 Beatles               2
2  1977 Rolling Stones        1
3  1978 Beatles               0
4  1978 Rolling Stones        0
5  1979 Beatles               1
6  1979 Rolling Stones        0
```

Generating a date sequence with full_seq()

```r
full_seq(c(as.Date("2000-01-01"), as.Date("2000-01-10")), period = 1)
```

```
 [1] "2000-01-01" "2000-01-02" "2000-01-03" "2000-01-04" "2000-01-05"
 [6] "2000-01-06" "2000-01-07" "2000-01-08" "2000-01-09" "2000-01-10"
```

Let's practice!

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Advanced completions

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Nesting connected variables

```
nuke_df
```

```
# A tibble: 5 x 4
  continent     country n_bombs decade
  <chr>         <chr>     <int>  <int>
1 North America USA           8   1940
2 Europe        USSR          1   1940
3 North America USA         188   1950
4 Europe        USSR         82   1950
5 Europe        UK           21   1950
```

Nesting connected variables

```
nuke_df %>%
  complete(
    continent,
    country,
    decade,
    fill = list(n_bombs = 0L)
  )
```

```
# A tibble: 12 x 4
   continent     country decade n_bombs
   <chr>         <chr>    <int>   <int>
 1 Europe        UK        1940       0
 2 Europe        UK        1950      21
 3 Europe        USA       1940       0
 4 Europe        USA       1950       0
 5 Europe        USSR      1940       1
 6 Europe        USSR      1950      82
 7 North America UK        1940       0
 8 North America UK        1950       0
# ... with 4 more rows
```

The nesting() function

```r
nuke_df %>%
  complete(
    nesting(continent, country),
    decade,
    fill = list(n_bombs = 0L)
  )
```

```
# A tibble: 6 x 4
  continent     country decade n_bombs
  <chr>         <chr>    <int>   <int>
1 Europe        UK        1940       0
2 Europe        UK        1950      21
3 Europe        USSR      1940       1
4 Europe        USSR      1950      82
5 North America USA       1940       8
6 North America USA       1950     188
```

Counting tropical storms

```r
storm_df
```

```
# A tibble: 35 x 3
   name       start      end
   <chr>      <date>     <date>
 1 ANDREA     2013-06-05 2013-06-08
 2 ARTHUR     2014-06-28 2014-07-09
 3 ANA        2015-05-06 2015-05-12
 4 BARRY      2013-06-16 2013-06-21
 5 TWO        2014-07-19 2014-07-23
 6 BILL       2015-06-16 2015-06-21
# ... with 29 more rows
```

Counting tropical storms: pivot to long format

```r
storm_df %>%
  pivot_longer(
    -name,
    names_to = "status",
    values_to = "date"
  )
```

```
# A tibble: 70 x 3
   name    status date
   <chr>   <chr>  <date>
 1 ANDREA start   2013-06-05
 2 ANDREA end     2013-06-08
 3 ARTHUR start   2014-06-28
 4 ARTHUR end     2014-07-09
 5 ANA    start   2015-05-06
 6 ANA    end     2015-05-12
 7 BARRY  start   2013-06-16
 8 BARRY  end     2013-06-21
 9 TWO    start   2014-07-19
10 TWO    end     2014-07-23
# ... with 60 more rows
```

Counting tropical storms: grouped completion

```r
storm_df %>%
  pivot_longer(
    -name,
    names_to = "status",
    values_to = "date"
  )  %>%
  group_by(name) %>%
  complete(date = full_seq(date, 1)) %>%
  ungroup()
```

```
# A tibble: 263 x 3
   name   date       status
   <chr>  <date>     <chr>
 1 ANA    2015-05-06 start
 2 ANA    2015-05-07 NA
 3 ANA    2015-05-08 NA
 4 ANA    2015-05-09 NA
 5 ANA    2015-05-10 NA
 6 ANA    2015-05-11 NA
 7 ANA    2015-05-12 end
 8 ANDREA 2013-06-05 start
 9 ANDREA 2013-06-06 NA
10 ANDREA 2013-06-07 NA
# ... with 253 more rows
```

Counting tropical storms: the actual count

```r
storm_df %>%
  pivot_longer(
    -name,
    names_to = "status",
    values_to = "date"
  )  %>%
  group_by(name) %>%
  complete(date = full_seq(date, 1)) %>%
  ungroup() %>%
  count(date, name = "n_storms")
```

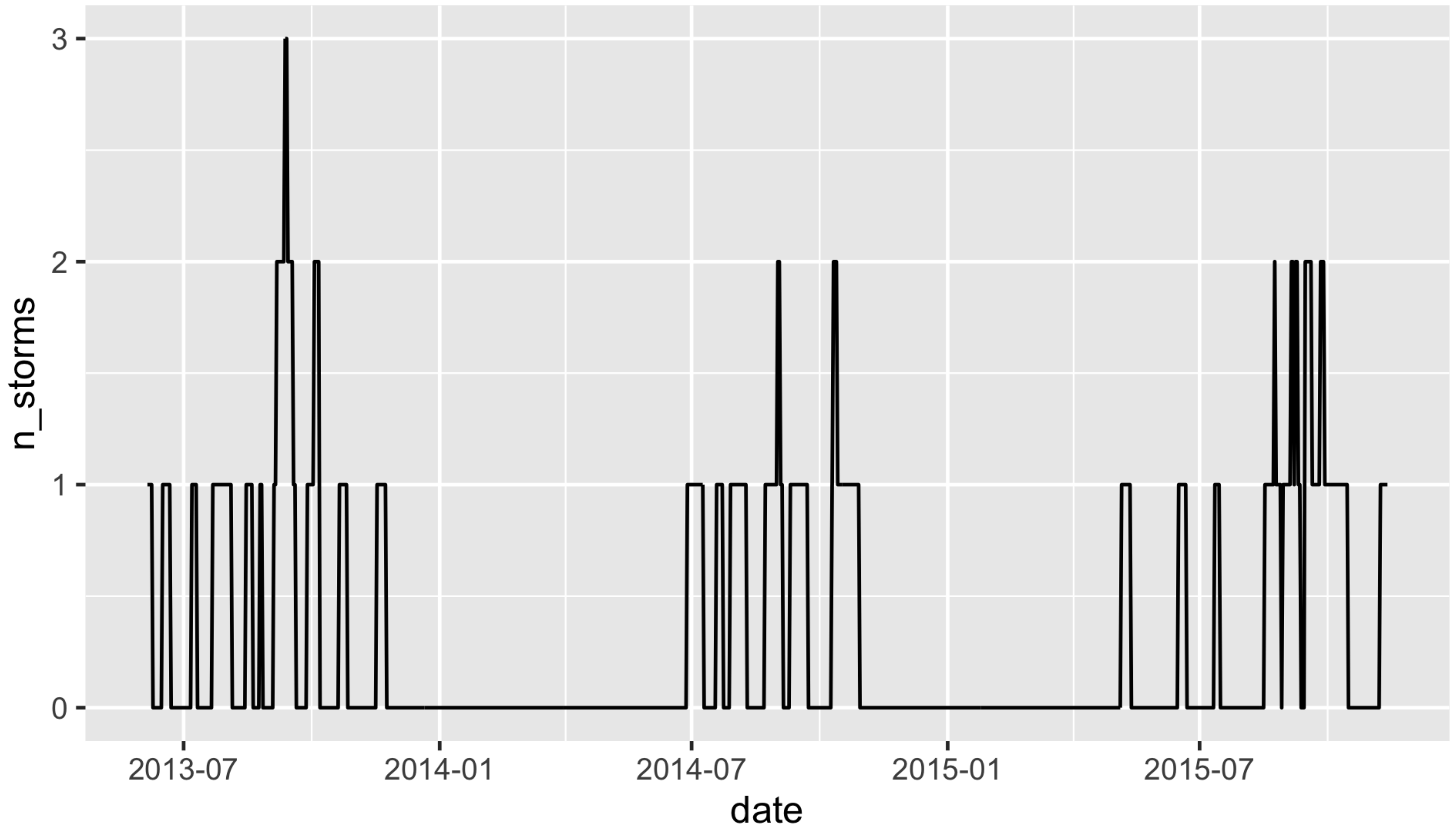
```
# A tibble: 227 x 2
   date       n_storms
   <date>        <int>
 1 2013-06-05        1
 2 2013-06-06        1
 3 2013-06-07        1
 4 2013-06-08        1
 5 2013-06-16        1
 6 2013-06-17        1
 7 2013-06-18        1
 8 2013-06-19        1
 9 2013-06-20        1
10 2013-06-21        1
# ... with 217 more rows
```

Counting tropical storms: adding zero counts

```r
storm_df %>%
  pivot_longer(
    -name,
    names_to = "status",
    values_to = "date"
  )  %>%
  group_by(name) %>%
  complete(date = full_seq(date, 1)) %>%
  ungroup() %>%
  count(date, name = "n_storms") %>%
  complete(
    date = full_seq(date, 1),
    fill = list(n_storms = 0L)
  )
```

```
# A tibble: 892 x 2
   date       n_storms
   <date>        <int>
 1 2013-06-05        1
 2 2013-06-06        1
 3 2013-06-07        1
 4 2013-06-08        1
 5 2013-06-09        0
 6 2013-06-10        0
 7 2013-06-11        0
 8 2013-06-12        0
 9 2013-06-13        0
10 2013-06-14        0
# ... with 882 more rows
```

Counting tropical storms: visualizing the result



Timestamp completions

```r
sensor_df
```

```
# A tibble: 3 x 2
  time                temperature
  <dttm>                    <int>
1 2020-01-01 11:00:00          25
2 2020-01-01 11:40:00          26
3 2020-01-01 12:20:00          25
```

Timestamp completions

```r
sensor_df %>%
  complete(time = seq(from = min(time), to = max(time), by = "20 min"))
```

```
# A tibble: 5 x 2
  time                temperature
  <dttm>                    <int>
1 2020-01-01 11:00:00          25
2 2020-01-01 11:20:00          NA
3 2020-01-01 11:40:00          26
4 2020-01-01 12:00:00          NA
5 2020-01-01 12:20:00          25
```

Timestamp completions

```
sensor_df %>%
  complete(time = seq(from = min(time), to = max(time), by = "20 min")) %>%
  fill(temperature)
```

```
# A tibble: 5 x 2
  time                   temperature
  <dttm>                       <int>
1 2020-01-01 11:00:00             25
2 2020-01-01 11:20:00             25
3 2020-01-01 11:40:00             26
4 2020-01-01 12:00:00             26
5 2020-01-01 12:20:00             25
```

Let's practice!

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