# IRC_Data_Analysis_Training_2

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### Load packages

```
# Load packages
library(tidyverse)
```

```
## Warning: package 'tidyverse' was built under R version 4.0.2
```

```
## -- Attaching packages --------------------------------- tidyverse 1.3.0 --
```

```
## v ggplot2 3.3.2     v purrr   0.3.4
## v tibble  3.0.3     v dplyr   1.0.1
## v tidyr   1.1.1     v stringr 1.4.0
## v readr   1.3.1     v forcats 0.5.0
```

```
## Warning: package 'ggplot2' was built under R version 4.0.2
```

```
## Warning: package 'tibble' was built under R version 4.0.2
```

```
## Warning: package 'tidyr' was built under R version 4.0.2
```

```
## Warning: package 'dplyr' was built under R version 4.0.2
```

```
## -- Conflicts ------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
library(here)
```

```
## here() starts at /Users/rachelkenny/Documents/IRC/R Code/IRC_Data_Analysis_Training
```

```
library(janitor)
```

```
##
## Attaching package: 'janitor'
```

```
## The following objects are masked from 'package:stats':
##
##     chisq.test, fisher.test
```

```
library(readxl)
```

### Load data

```
# Load oak data
oak_data_raw <- read_csv(here("data", "Weir_Oak_Restoration_Data_winter19.csv"))
```

```
## Parsed with column specification:
## cols(
##   `Short ID` = col_character(),
##   Survival = col_logical(),
##   Quantity = col_double(),
##   `Height (cm)` = col_double(),
##   `Open Closed` = col_character(),
##   `Location UML` = col_character(),
##   `Water Yes No` = col_character(),
##   `Sampling Group` = col_character()
## )
```

```
oak_data <- clean_names(oak_data_raw)

# Load agua chinon veg data
ac_data_raw <- read_excel(here("data", "OCWR_AC_2019_Data.xlsx"))
ac_data <- clean_names(ac_data_raw)
```

## Subsetting data

```
# To refer to specific column in a dataframe, use the [$] symbol
oak_data$height_cm
```

```
##    [1]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##   [15]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##   [29]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##   [43]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##   [57]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##   [71]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##   [85]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##   [99]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [113]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [127]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [141]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [155]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [169]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [183]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [197]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [211]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [225]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [239]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [253]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [267]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [281]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [295]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [309]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [323]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [337]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [351]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [365]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [379]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [393]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [407]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
```

```
##  [421]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [435]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [449]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [463]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [477]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [491]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [505]  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
##  [519]  0.0  0.0  0.0  1.0  1.5  1.7  3.0  3.1  4.0  4.0  4.5  5.0  5.0  5.0
##  [533]  5.0  5.0  5.0  5.5  6.0  6.0  6.0  6.0  6.0  6.0  6.0  6.0  6.0  6.0
##  [547]  6.0  6.0  6.0  6.0  6.0  6.5  6.5  6.5  6.5  6.5  7.0  7.0  7.0  7.0
##  [561]  7.0  7.0  7.0  7.0  7.0  7.5  7.5  7.5  8.0  8.0  8.0  8.0  8.0  8.0
##  [575]  8.0  8.0  8.0  8.0  8.0  8.0  8.0  8.0  8.0  8.0  8.1  8.1  8.5  8.7
##  [589]  9.0  9.0  9.0  9.0  9.0  9.0  9.0  9.0  9.0  9.0  9.0  9.0  9.0  9.0
##  [603]  9.0  9.0  9.0  9.0  9.0  9.0  9.0  9.0  9.0  9.5  9.5  9.5  9.5  9.5
##  [617]  9.8  9.8  9.9  9.9 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0
##  [631] 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0
##  [645] 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0
##  [659] 10.5 10.5 10.5 10.5 10.5 10.5 10.5 10.6 10.7 10.9 11.0 11.0 11.0 11.0
##  [673] 11.0 11.0 11.0 11.0 11.0 11.0 11.0 11.0 11.0 11.0 11.0 11.0 11.0 11.0
##  [687] 11.0 11.0 11.0 11.0 11.0 11.0 11.0 11.0 11.0 11.0 11.0 11.0 11.0 11.0
##  [701] 11.0 11.0 11.0 11.0 11.0 11.0 11.2 11.4 11.5 11.5 11.5 11.5 11.5 11.5
##  [715] 11.6 11.7 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0
##  [729] 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0
##  [743] 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.0 12.3 12.3 12.3
##  [757] 12.5 12.5 12.5 12.5 12.7 13.0 13.0 13.0 13.0 13.0 13.0 13.0 13.0 13.0
##  [771] 13.0 13.0 13.0 13.0 13.0 13.0 13.0 13.0 13.0 13.0 13.0 13.0 13.0 13.0
##  [785] 13.0 13.0 13.0 13.0 13.0 13.0 13.0 13.0 13.0 13.0 13.0 13.0 13.0 13.0
##  [799] 13.0 13.2 13.2 13.3 13.5 13.5 13.5 13.9 14.0 14.0 14.0 14.0 14.0 14.0
##  [813] 14.0 14.0 14.0 14.0 14.0 14.0 14.0 14.0 14.0 14.0 14.0 14.0 14.0 14.0
##  [827] 14.0 14.0 14.0 14.0 14.0 14.0 14.0 14.0 14.0 14.0 14.0 14.0 14.0 14.0
##  [841] 14.0 14.0 14.0 14.0 14.1 14.1 14.2 14.3 14.5 14.5 14.5 14.5 14.5 14.5
##  [855] 14.5 14.5 14.5 14.9 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0
##  [869] 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0
##  [883] 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0
##  [897] 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.3
##  [911] 15.5 15.5 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.0
##  [925] 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.0
##  [939] 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.1 16.2 16.3 16.3 16.3
##  [953] 16.5 16.5 16.5 16.5 16.5 16.5 16.7 16.8 17.0 17.0 17.0 17.0 17.0 17.0
##  [967] 17.0 17.0 17.0 17.0 17.0 17.0 17.0 17.0 17.0 17.0 17.0 17.0 17.0 17.0
##  [981] 17.0 17.0 17.0 17.0 17.0 17.0 17.0 17.0 17.0 17.0 17.0 17.0 17.1 17.2
##  [995] 17.5 17.5 17.5 17.5 17.5 17.5 17.5 17.5 17.7 17.8 18.0 18.0 18.0 18.0
## [1009] 18.0 18.0 18.0 18.0 18.0 18.0 18.0 18.0 18.0 18.0 18.0 18.0 18.0 18.0
## [1023] 18.0 18.0 18.0 18.0 18.0 18.0 18.0 18.0 18.0 18.0 18.0 18.4 18.5 18.5
## [1037] 18.5 18.5 18.5 18.5 18.6 18.9 19.0 19.0 19.0 19.0 19.0 19.0 19.0 19.0
## [1051] 19.0 19.0 19.0 19.0 19.0 19.0 19.0 19.0 19.0 19.0 19.0 19.3 19.4 19.5
## [1065] 19.5 19.5 19.5 19.6 20.0 20.0 20.0 20.0 20.0 20.0 20.0 20.0 20.0 20.0
## [1079] 20.0 20.0 20.1 20.3 20.5 20.5 20.5 20.5 20.9 21.0 21.0 21.0 21.0 21.0
## [1093] 21.0 21.0 21.0 21.0 21.0 21.0 21.0 21.0 21.0 21.0 21.0 21.0 21.0 21.5
## [1107] 21.5 21.5 21.5 21.5 21.6 22.0 22.0 22.0 22.0 22.0 22.0 22.0 22.0 22.0
## [1121] 22.0 22.0 22.0 22.0 22.0 22.0 22.0 22.0 22.0 22.0 22.0 22.1 22.3 22.3 22.4
## [1135] 22.5 22.5 22.5 23.0 23.0 23.0 23.0 23.0 23.0 23.0 23.0 23.0 23.0 23.2 23.5
## [1149] 23.8 24.0 24.0 24.0 24.0 24.0 24.0 24.0 24.0 24.0 24.0 24.0 24.0 24.2 24.5
## [1163] 24.5 24.5 24.5 24.5 24.9 25.0 25.0 25.0 25.0 25.0 25.5 25.5 25.5 25.6
```

```
## [1177] 26.0 26.0 26.0 26.0 26.0 26.5 27.0 27.0 27.0 27.0 27.0 27.0 28.0 28.0
## [1191] 29.0 29.0 30.5 31.6 31.7 35.0 37.0 40.0 40.0 46.0 46.5 63.0
```

```
View(oak_data$height_cm)


View(oak_data)

# You can also refer to the number of the column using square brackets []. Using a colon indicates subs
oak_data[4] # column 4
```

```
## # A tibble: 1,202 x 1
##    height_cm
##        <dbl>
##  1         0
##  2         0
##  3         0
##  4         0
##  5         0
##  6         0
##  7         0
##  8         0
##  9         0
## 10         0
## # ... with 1,192 more rows
```

```
oak_data[4:6] # column 4-6
```

```
## # A tibble: 1,202 x 3
##    height_cm open_closed location_uml
##        <dbl> <chr>       <chr>
##  1         0 Closed      Lower
##  2         0 Closed      Lower
##  3         0 Closed      Lower
##  4         0 Closed      Lower
##  5         0 Closed      Lower
##  6         0 Closed      Lower
##  7         0 Closed      Lower
##  8         0 Closed      Lower
##  9         0 Closed      Lower
## 10         0 Closed      Lower
## # ... with 1,192 more rows
```

```
oak_data[-4] # everything except for column 4
```

```
## # A tibble: 1,202 x 7
##    short_id survival quantity open_closed location_uml water_yes_no
##    <chr>    <lgl>       <dbl> <chr>       <chr>        <chr>
##  1 L_C_01_4 FALSE           0 Closed      Lower        No
##  2 L_C_02_1 FALSE           0 Closed      Lower        Yes
##  3 L_C_02_2 FALSE           0 Closed      Lower        Yes
##  4 L_C_02_3 FALSE           0 Closed      Lower        Yes
##  5 L_C_02_4 FALSE           0 Closed      Lower        No
##  6 L_C_03_3 FALSE           0 Closed      Lower        No
##  7 L_C_03_4 FALSE           0 Closed      Lower        No
##  8 L_C_04_1 FALSE           0 Closed      Lower        Yes
```

```
##  9 L_C_04_3 FALSE           0 Closed      Lower        No
## 10 L_C_05_1 FALSE           0 Closed      Lower        No
## # ... with 1,192 more rows, and 1 more variable: sampling_group <chr>
```

```
# A comma before the number indicates a column (though it is not necessary), while a comma after the nu

# FOR EXAMPLE:

# To return column 3
ac_data[3]
```

```
## # A tibble: 1,732 x 1
##    transect
##       <dbl>
##  1        1
##  2        1
##  3        1
##  4        1
##  5        1
##  6        1
##  7        1
##  8        1
##  9        1
## 10        1
## # ... with 1,722 more rows
```

```
# OR
ac_data[,3]
```

```
## # A tibble: 1,732 x 1
##    transect
##       <dbl>
##  1        1
##  2        1
##  3        1
##  4        1
##  5        1
##  6        1
##  7        1
##  8        1
##  9        1
## 10        1
## # ... with 1,722 more rows
```

```
# To return row 3
ac_data[3,]
```

```
## # A tibble: 1 x 10
##   desired_habitat polygon_id transect pin_number data_type species_code
##   <chr>           <chr>         <dbl>      <dbl> <chr>     <chr>
## 1 Weedy Control   Weedy Con~        1         NA A.Belt    AMBPSI
## # ... with 4 more variables: scientific_name <chr>, native_non_native <chr>,
## #   functional_group <chr>, layer <chr>
```

```
# To return columns 1-3
ac_data[1:3]
```

```
## # A tibble: 1,732 x 3
##    desired_habitat          polygon_id    transect
##    <chr>                    <chr>            <dbl>
##  1 Weedy Control            Weedy Control        1
##  2 Weedy Control            Weedy Control        1
##  3 Weedy Control            Weedy Control        1
##  4 Weedy Control            Weedy Control        1
##  5 Weedy Control            Weedy Control        1
##  6 Weedy Control            Weedy Control        1
##  7 Mulefat Scrub/sage Scrub OW-M7                1
##  8 Mulefat Scrub/sage Scrub OW-M7                1
##  9 Mulefat Scrub/sage Scrub OW-M7                1
## 10 Mulefat Scrub/sage Scrub OW-M7                1
## # ... with 1,722 more rows
```

```
# OR
ac_data[,1:3]
```

```
## # A tibble: 1,732 x 3
##    desired_habitat          polygon_id    transect
##    <chr>                    <chr>            <dbl>
##  1 Weedy Control            Weedy Control        1
##  2 Weedy Control            Weedy Control        1
##  3 Weedy Control            Weedy Control        1
##  4 Weedy Control            Weedy Control        1
##  5 Weedy Control            Weedy Control        1
##  6 Weedy Control            Weedy Control        1
##  7 Mulefat Scrub/sage Scrub OW-M7                1
##  8 Mulefat Scrub/sage Scrub OW-M7                1
##  9 Mulefat Scrub/sage Scrub OW-M7                1
## 10 Mulefat Scrub/sage Scrub OW-M7                1
## # ... with 1,722 more rows
```

```
# To return rows 1-3
ac_data[1:3,]
```

```
## # A tibble: 3 x 10
##   desired_habitat polygon_id transect pin_number data_type species_code
##   <chr>           <chr>         <dbl>      <dbl> <chr>     <chr>
## 1 Weedy Control   Weedy Con~        1         NA A.Belt    SOLSPP
## 2 Weedy Control   Weedy Con~        1         NA A.Belt    AMBACA
## 3 Weedy Control   Weedy Con~        1         NA A.Belt    AMBPSI
## # ... with 4 more variables: scientific_name <chr>, native_non_native <chr>,
## #   functional_group <chr>, layer <chr>
```

```
# Single brackets extract a list
ac_data[5]
```

```
## # A tibble: 1,732 x 1
##    data_type
##    <chr>
##  1 A.Belt
##  2 A.Belt
##  3 A.Belt
##  4 A.Belt
##  5 A.Belt
```

```
##  6 A.Belt
##  7 T.PI
##  8 T.PI
##  9 T.PI
## 10 T.PI
## # ... with 1,722 more rows
```

```
# Double brackets extract the items in a list
ac_data[[5]]
```

```
##    [1] "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "T.PI"   "T.PI"
##    [9] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##   [17] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##   [25] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##   [33] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##   [41] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##   [49] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##   [57] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##   [65] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##   [73] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##   [81] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##   [89] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##   [97] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [105] "T.PI"   "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt"
##  [113] "A.Belt" "A.Belt" "A.Belt" "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [121] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [129] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [137] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [145] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [153] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [161] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [169] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [177] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [185] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "A.Belt"
##  [193] "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt"
##  [201] "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt"
##  [209] "A.Belt" "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [217] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [225] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [233] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [241] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [249] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [257] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [265] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [273] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [281] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [289] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [297] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [305] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "A.Belt" "A.Belt" "A.Belt" "A.Belt"
##  [313] "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "T.PI"   "T.PI"
##  [321] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [329] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [337] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [345] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [353] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
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##  [361] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [369] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [377] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [385] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [393] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [401] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [409] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [417] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [425] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [433] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [441] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [449] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [457] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [465] "T.PI"   "T.PI"   "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt"
##  [473] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [481] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [489] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [497] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [505] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [513] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [521] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [529] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [537] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [545] "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt"
##  [553] "A.Belt" "A.Belt" "A.Belt" "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [561] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [569] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [577] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [585] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [593] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [601] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [609] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [617] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [625] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [633] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [641] "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt"
##  [649] "A.Belt" "A.Belt" "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [657] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [665] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [673] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [681] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [689] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [697] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [705] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [713] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [721] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [729] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "A.Belt" "A.Belt" "A.Belt" "A.Belt"
##  [737] "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt"
##  [745] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [753] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [761] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [769] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [777] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [785] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
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##  [793] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [801] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [809] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [817] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [825] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [833] "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "T.PI"   "T.PI"   "T.PI"
##  [841] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [849] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [857] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [865] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [873] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [881] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [889] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [897] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [905] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [913] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [921] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [929] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [937] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "A.Belt" "A.Belt" "A.Belt"
##  [945] "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt"
##  [953] "A.Belt" "A.Belt" "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [961] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [969] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [977] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [985] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
##  [993] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1001] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1009] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1017] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1025] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1033] "T.PI"   "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt"
## [1041] "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "T.PI"   "T.PI"   "T.PI"
## [1049] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1057] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1065] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1073] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1081] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1089] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1097] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1105] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1113] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1121] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "A.Belt" "A.Belt" "A.Belt"
## [1129] "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt"
## [1137] "A.Belt" "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1145] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1153] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1161] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1169] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1177] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1185] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1193] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1201] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1209] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "A.Belt" "A.Belt" "A.Belt"
## [1217] "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "T.PI"   "T.PI"   "T.PI"
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## [1225] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1233] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1241] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1249] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1257] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1265] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1273] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1281] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1289] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1297] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1305] "T.PI"   "T.PI"   "T.PI"   "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt"
## [1313] "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt"
## [1321] "A.Belt" "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1329] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1337] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1345] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1353] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1361] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1369] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1377] "T.PI"   "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt"
## [1385] "A.Belt" "A.Belt" "A.Belt" "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1393] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1401] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1409] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1417] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1425] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1433] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1441] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1449] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1457] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1465] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1473] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1481] "T.PI"   "T.PI"   "T.PI"   "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt"
## [1489] "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt"
## [1497] "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt"
## [1505] "A.Belt" "A.Belt" "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1513] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1521] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1529] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1537] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1545] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1553] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1561] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1569] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1577] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1585] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1593] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1601] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1609] "T.PI"   "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt"
## [1617] "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "A.Belt" "T.PI"   "T.PI"
## [1625] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1633] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1641] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1649] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
```

```
## [1657] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1665] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1673] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1681] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1689] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1697] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1705] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1713] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"
## [1721] "T.PI"   "T.PI"   "T.PI"   "T.PI"   "T.PI"   "A.Belt" "A.Belt" "A.Belt"
## [1729] "A.Belt" "A.Belt" "A.Belt" "A.Belt"
```

```
ac_data[5,3]
```

```
## # A tibble: 1 x 1
##   transect
##      <dbl>
## 1        1
```

### Data wrangling (part 1)

```
# Use the which() function to refer to specific observations in the code. In this example, we are repla
ac_data$polygon_id[which(ac_data$polygon_id=="5M Buffer")] <- "5M BUFFER"

# There are a few ways to rename a column
# Method 1: use function [colnames]
df <- ac_data
colnames(df)[4:6] <- c("pin", "type_data", "code_species") # rename columns 4 through 6

# Method 2: use function [names]
df <- ac_data
names(df)[1] <- paste("habitat") # name column 1 "habitat"

View(df)
```

### Data wrangling (part 2)

```
# There are a few ways to create a new column
# Method 1: Use the function [mutate]. Within the new column you can make transformations on your data.
oak_data2 <- oak_data %>%
  mutate(new_column=height_cm*2)

# Method 2: Create a new column using the [$] symbol
oak_data3 <- oak_data
oak_data3$height_rounded <- round(oak_data3$height_cm)

View(oak_data2)
View(oak_data3)
```

### Creating tables

```
# To count observations by group, use the [group_by] and [count] functions. Here are two examples below

# agua chinon data example - number of observations per species code in each polygon and transect
richness1 <- ac_data %>%
  group_by(polygon_id, transect) %>%
  count(species_code)

View(richness1)

# richness2 - add column for the number of unique species per transect
richness2 <- richness1 %>%
  mutate(unique_species=n_distinct(species_code)) %>%
  select(transect, polygon_id, unique_species)
richness2 <- distinct(richness2)
View(richness2)

# oak data example - # of plantings watered or not watered by sampling group
oak_water_sampling_grp <- oak_data %>%
  group_by(sampling_group) %>%
  count(survival)

View(oak_water_sampling_grp)
View(oak_data)
```