

# Donut plots

## Overview

This script creates donut plots that show survey participation rates across various groups. If the script is run without arguments, it will create donut charts for all participants. If run with the command-line flag “-c”, it will create donut charts for OS contributors only.

## Import packages and utilities

```
project_root <- here::here() # requires that you be somewhere in the
# project directory (not above it)
# packages
suppressMessages(source(file.path(project_root, "scripts/packages.R")))
# functions and objects used across scripts
suppressMessages(source(file.path(project_root, "scripts/utils.R")))
```

## Define functions

### create\_df\_for\_plotting

- Arguments:
  - **data**: The unmodified data frame with all the (deidentified) survey data.
  - **column**: The name of the column with the data to be plotted.
- Details:
  - This function creates a new data frame suitable for plotting as a donut plot. It essentially creates a single stacked bar with all our data, and then plots that on a polar coordinate system to make it a donut. Method from <https://r-graph-gallery.com/128-ring-or-donut-plot.html>. This function extracts the data of interest from the larger

data frame, and puts them into a new data frame along with relevant breakpoints for and label locations.

- Outputs:

- `long_data`: a new data frame with columns values, Freq, fraction, ymax, ymin, labelPosition, and label.

```
create_df_for_plotting <- function(data, column) {
  if (!column %in% names(data)) {
    stop("Column not found in data frame")
  }
  # Extract specified column and remove rows where this column is an empty string
  # i.e. the participant didn't answer
  values <- data[[column]][nzchar(data[[column]])]
  # Count occurrences of each unique value
  values_table <- table(values)

  # Convert to data frame and compute fractions
  long_data <- as.data.frame(values_table) %>%
    mutate(fraction = Freq / sum(Freq)) %>%
    arrange(desc(fraction))

  # Compute the cumulative percentages (top of each rectangle)
  long_data$ymax <- cumsum(long_data$fraction)
  long_data$ymin <- c(0, head(long_data$ymax, n = -1))

  # Compute label position
  long_data$labelPosition <- (long_data$ymax + long_data$ymin) / 2

  # Create label column
  long_data$label <- paste0(long_data$Freq)

  # Make the text wrap so the legend is more compact
  long_data <- long_data %>%
    mutate(values = str_wrap(values, width = 20))

  # from scripts/utils.R
  long_data <- reorder_factor_by_column(
    long_data,
    values,
    Freq
  )
}
```

```
    return(long_data)
  }
```

## donut\_chart

- Arguments:
  - `df`: The data frame ready for plotting, such as the one produced by `create_df_for_plotting`.
- Details:
  - This function creates a donut plot.
- Outputs:
  - A ggplot object.

```
donut_chart <- function(
  df,
  cpalette = colors, # default: colors from utils.R
  legendpos = "right",
  title_bottom_margin = 15,
  legend_top_margin = 0,
  white_labels = FALSE
) {

  if (white_labels) {
    label_x      <- 3.5
    label_size   <- 8
    label_color  <- "white"
    # We only need xlim up to 4 (labels sit inside the ring)
    #x_limits    <- c(2, 4)
  } else {
    label_x      <- 4.3
    label_size   <- 9
    label_color  <- "black"
    # Extend x-axis so outside labels aren't cut off
    #x_limits    <- c(2, 4.6)
  }

  ggplot(
    df,
```

```

aes(
  ymax = ymax,
  ymin = ymin,
  xmax = 4,
  xmin = 3,
  fill = values
)
) +
geom_rect() +
# Add labels
geom_text(
  x = label_x,
  aes(y = labelPosition, label = label),
  size = label_size,
  color = label_color
) +
scale_fill_manual(values = cpalette) +
theme_void() +
coord_polar(theta = "y") +
xlim(c(2, 4)) +
theme(
  legend.text = element_text(size = 18),
  legend.title = element_blank(),
  legend.position = legendpos,
  legend.key.spacing.y = unit(0.5, "lines"),
  legend.margin = margin(t = unit(legend_top_margin, "lines")),
  plot.title = element_text(
    hjust = 0.5,
    size = 28,
    margin = margin(b = title_bottom_margin)
  ),
  plot.margin = margin(t = 20, r = 5, b = 5, l = 5),
  plot.background = element_rect(fill = "white", color = "white")
)
}

```

## Load data

```
data <- load_qualtrics_data("deidentified_no_qual.tsv")
```

## Process command-line arguments

Here, I use a boolean variable called `contributor_mode` to record whether the user wants to create donut plots for all respondents or contributors only. It's `FALSE` by default. If you want to run this script interactively in a notebook, you can safely run this cell without any adjustments, and it will create plots for all respondents, or manually change contributor mode to `TRUE` to create plots for just OS contributors.

```
args <- commandArgs(trailingOnly = TRUE)

contributor_mode <- FALSE # default
if (length(args) > 0) {
  # treat the *first* argument as the flag
  flag <- tolower(args[1])
  if (flag %in% c("--contributors", "-c", "contributors")) {
    contributor_mode <- TRUE
  } else {
    stop(
      "Unknown argument: ", flag,
      "\nUsage: Rscript myscript.R [--contributors | -c | contributors]"
    )
  }
}

if (contributor_mode) {
  # Filter the data to include only OS contributors
  data <- data %>%
    filter(
      contributor_status_1 == "True"
    )
}

population <- ""
# For plot axis labels
if (contributor_mode) {
  population <- "Contributors"
} else {
  population <- "Respondents"
}
```

## Donut charts of participation by groups

This script creates 4 plots, called p1-p4.

Plot #1 is of job category (Undergrad, Post-Doc, Non-research Staff, etc.).

```
job_data <- create_df_for_plotting(data, "job_category")
# Clean up this one long job name:
# "Other research staff (e.g., research scientist, research software engineer)"
job_data$values <- gsub(
  "^Other.*",
  "Other research staff",
  job_data$values
)
job_data
```

|   |                      | values | Freq       | fraction  | ymax      | ymin      | labelPosition | label |
|---|----------------------|--------|------------|-----------|-----------|-----------|---------------|-------|
| 1 | Non-research Staff   | 106    | 0.36054422 | 0.3605442 | 0.0000000 | 0.1802721 | 106           |       |
| 2 | Faculty              | 66     | 0.22448980 | 0.5850340 | 0.3605442 | 0.4727891 | 66            |       |
| 3 | Other research staff | 49     | 0.16666667 | 0.7517007 | 0.5850340 | 0.6683673 | 49            |       |
| 4 | Grad Student         | 43     | 0.14625850 | 0.8979592 | 0.7517007 | 0.8248299 | 43            |       |
| 5 | Post-Doc             | 17     | 0.05782313 | 0.9557823 | 0.8979592 | 0.9268707 | 17            |       |
| 6 | Undergraduate        | 13     | 0.04421769 | 1.0000000 | 0.9557823 | 0.9778912 | 13            |       |

```
p1 <- donut_chart(job_data) +
  labs(title = sprintf("Job Category of %s", population))
```

Plot #2 is of campus.

```
campus_data <- create_df_for_plotting(data, "campus")
campus_data <- campus_data %>%
  filter(
    !startsWith(as.character(values), "I'm not affiliat")
  )

p2 <- donut_chart(campus_data) +
  labs(title = sprintf("Campus of %s", population))
```

Plot #3 is of their field of study. Qualitative answers are not included in this plot.

```
field_data <- create_df_for_plotting(data, "field_of_study")
p3 <- donut_chart(field_data) +
  labs(title = sprintf("Academic %s' fields of study", tolower(population)))
```

Plot #4 is of staff categories (IT, Research Support, etc.). This one is more complicated. I'm not using my `create_df_for_plotting` function for this group because I want to combine the jobs that have only 1 or 2 responses into the existing "Other" category. So the code is similar but not the same.

```
staff_data <- data[["staff_categories"]][nzchar(data[["staff_categories"]])]
# Count occurrences of each unique value
staff_data <- as.data.frame(table(staff_data))
names(staff_data) <- c("job", "count")
staff_data$job <- as.character(staff_data$job)
codenames <- c(
  "Academic and Research Support" = "Academic and Research Support",
  "Other" = "Other",
  "Finance" = "Finance"
)
# a two-column dataframe: "job" and "count"
staff_data <- shorten_long_responses(staff_data, codenames)

staff_data_clean <- as.data.frame(staff_data) %>%
  mutate(job = if_else(count < 3, "Other", job)) %>% # relabel rare jobs as "Other"
  group_by(job) %>% # gather all "Other" rows together
  summarise(Freq = sum(count), .groups = "drop")

staff_long_data <- as.data.frame(staff_data_clean) %>%
  mutate(fraction = Freq / sum(Freq)) %>%
  arrange(desc(fraction))

# Compute the cumulative percentages (top of each rectangle)
staff_long_data$ymax <- cumsum(staff_long_data$fraction)
staff_long_data$ymin <- c(0, head(staff_long_data$ymax, n = -1))

# Compute label position
staff_long_data$labelPosition <- (staff_long_data$ymax + staff_long_data$ymin) /
  2

# Create label column
staff_long_data$label <- paste0(staff_long_data$Freq)
```

```

# Rename this one column to match the donut_chart function
names(staff_long_data)[names(staff_long_data) == "job"] <- "values"

# Wrap text
staff_long_data <- staff_long_data %>%
  mutate(values = str_wrap(values, width = 20))

# from scripts/utils.R
staff_long_data <- reorder_factor_by_column(
  staff_long_data,
  values,
  Freq
)

p4 <- donut_chart(staff_long_data) +
  labs(title = sprintf("Staff %s' work areas", tolower(population)))

```

## View and save combined plot

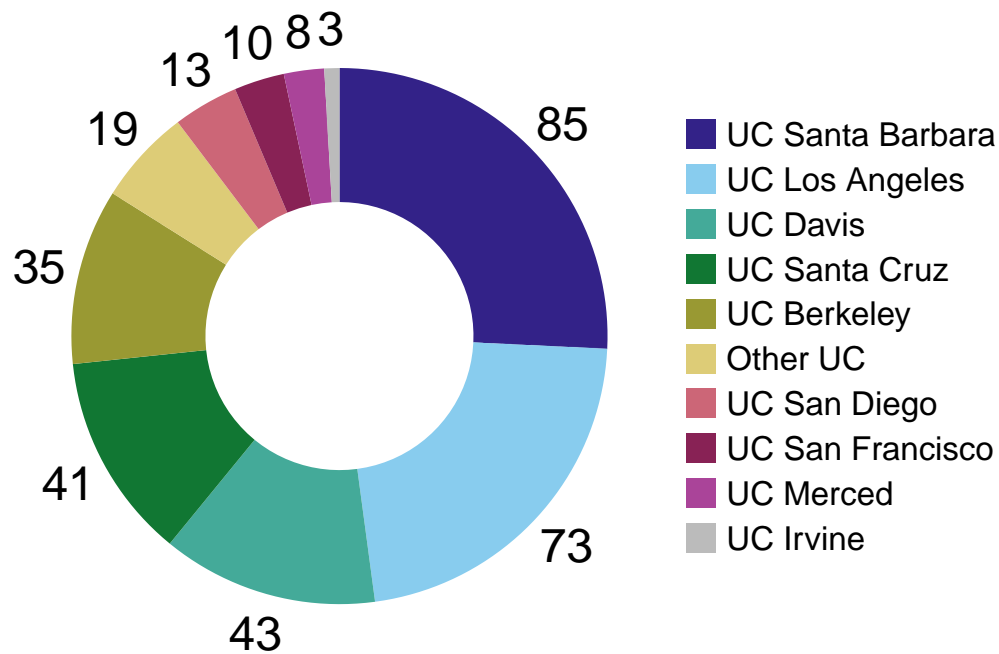
First let's view and save one plot.

### Individual plot: campus

```
p2
```



## Campus of Respondents



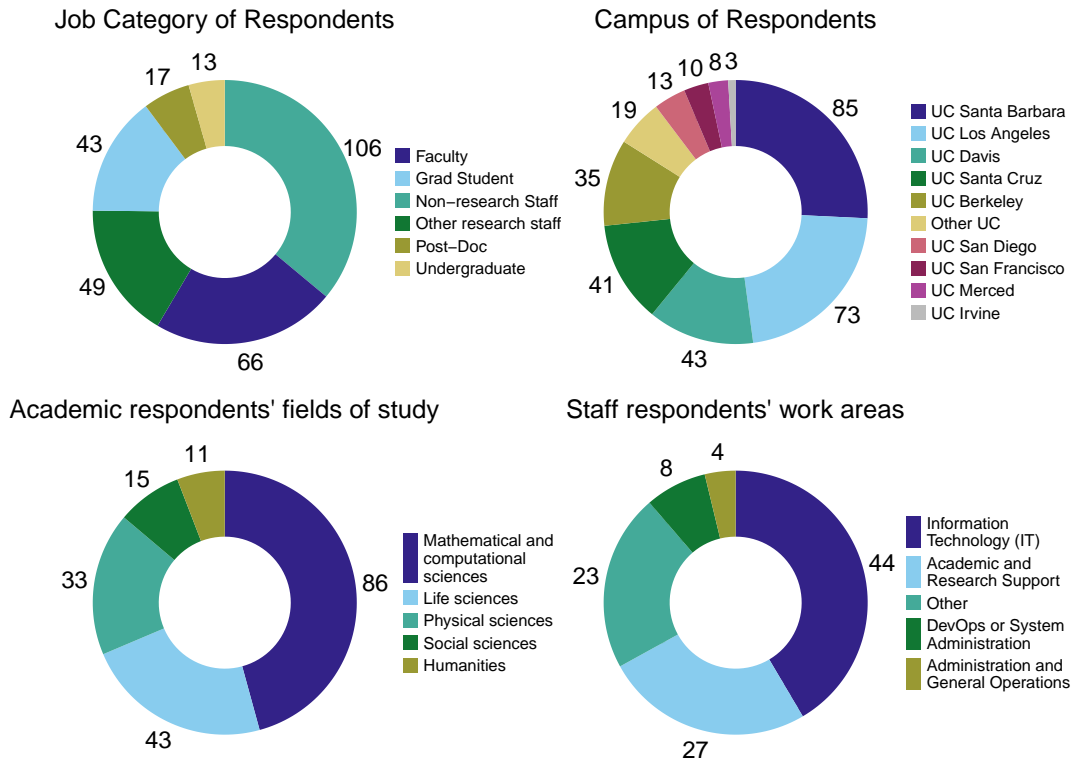
```
# Function from utils.R
save_plot(
  sprintf("campus_donut_%s.tiff", tolower(population)),
  9,
  6,
  p = p2
)
```

### All four plots combined

It's also nice to see them all in one figure.

```
combined_donuts <- patchwork::wrap_plots(p1, p2, p3, p4, ncol = 2)
```

```
combined_donuts
```



```
# Function from utils.R, uses a path in .Renviron
save_plot(
  sprintf("combined_donuts_%s.tiff", tolower(population)),
  18,
  12,
  p = combined_donuts
)
```

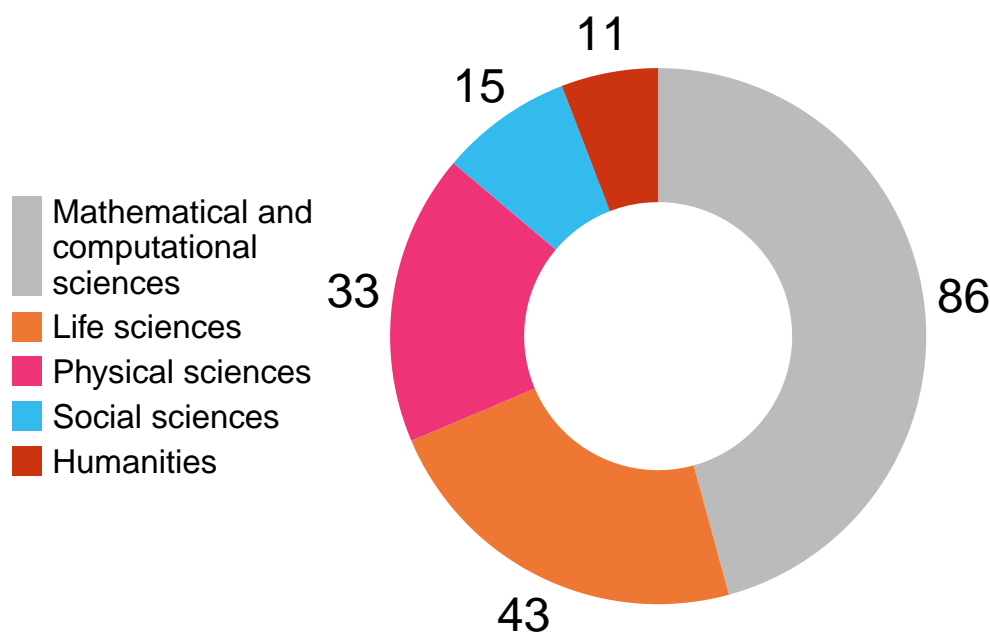
## Refine plot aesthetics

I'm envisioning a figure where I'd like to have some variety in the color palettes and the legend position. I'll put three donuts onto one canvas in Powerpoint, and then make some additional tweaks: I'll add some lines to illustrate which slices of the donut I'm focusing on, and also I will need to fix this bug where the legend keys stretch to multiple lines. (<https://github.com/tidyverse/ggplot2/issues/3669>) (A fix has been merged, but it's not yet available in the latest release of ggplot2.)

### Left plot: fields of study

```
p3 <- donut_chart(
  field_data,
  cpalette = c(
    '#BBBBBB',
    '#EE7733',
    '#EE3377',
    '#33BBEE',
    '#CC3311'
  ),
  legendpos="left"
) +
  labs(title = sprintf("Academic %s' fields of study", tolower(population)))
p3
```

## Academic respondents' fields of study



To save a smaller version (Canva has a file size limit of 50Mb), I'm reducing the resolution from 700 dpi to 450 dpi.

```
# Function from utils.R
save_plot(sprintf("field_donut_%s.tiff", tolower(population)), 10, 6, p = p3)
```

```

save_plot(
  sprintf("field_donut_%s_small.tiff", tolower(population)),
  10,
  6,
  res = 450,
  p = p3
)

```

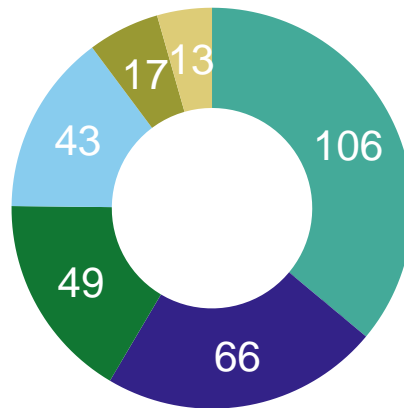
### Central plot: job categories

```

p1 <- donut_chart(
  job_data,
  legendpos = "bottom",
  title_bottom_margin = 40,
  legend_top_margin = 20,
  white_labels = TRUE
) +
  labs(title = sprintf("Job Category of %s", tolower(population)))
)
p1

```

## Job Category of respondents



■ Faculty      ■ Non-research Staff      ■ Post-Doc  
■ Grad Student      ■ Other research staff      ■ Undergraduate

Save plot

```
# Function from utils.R
save_plot(
  sprintf("job_category_donut_%s.tiff", tolower(population)),
  10,
  6,
  p = p1
)
save_plot(
  sprintf("job_category_donut_%s_small.tiff", tolower(population)),
  10,
  6,
  res = 450,
  p = p1
)
```

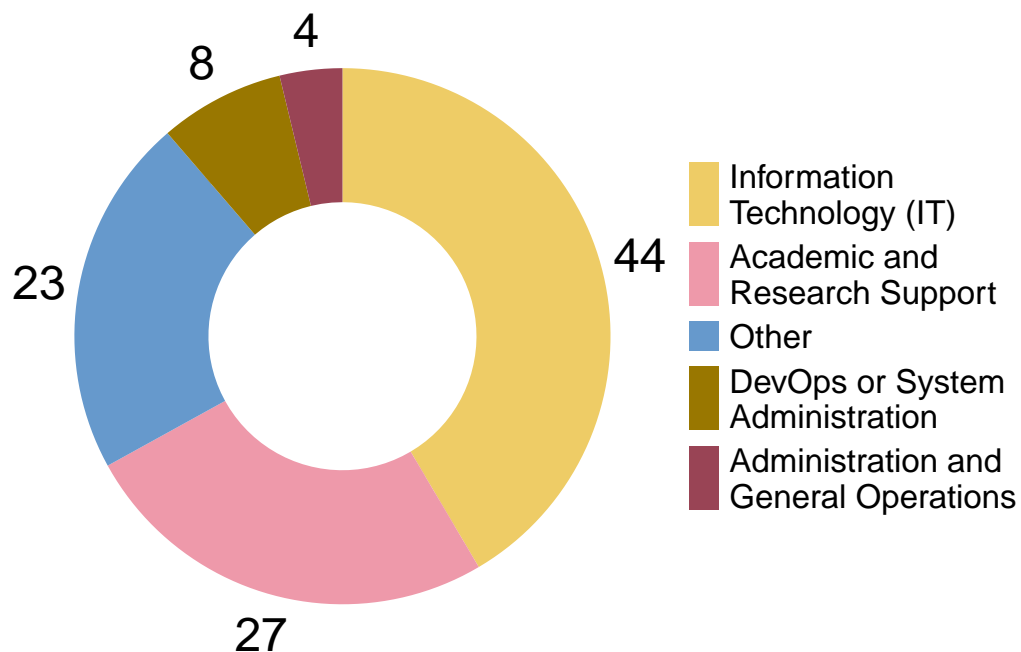
**Right plot: non-research staff categories**

```

p4 <- donut_chart(
  staff_long_data,
  cpalette = c(
    '#EECC66',
    '#EE99AA',
    '#6699CC',
    '#997700',
    '#994455'
  )
) +
  labs(title = sprintf("Staff %s' work areas", tolower(population)))
p4

```

## Staff respondents' work areas



```

# Function from utils.R
save_plot(
  sprintf("nrstaff_category_donut_%s.tiff", tolower(population)),
  10,
  6,
  p = p4
)

```

```
)
save_plot(
  sprintf("nrstaff_category_donut_%s_small.tiff", tolower(population)),
  10,
  6,
  res = 450,
  p = p4
)
```

## Session Info

```
sessionInfo()
```

```
R version 4.4.2 (2024-10-31)
Platform: aarch64-apple-darwin20
Running under: macOS Sequoia 15.4.1
```

```
Matrix products: default
```

```
BLAS: /Library/Frameworks/R.framework/Versions/4.4-arm64/Resources/lib/libRblas.0.dylib
```

```
LAPACK: /Library/Frameworks/R.framework/Versions/4.4-arm64/Resources/lib/libRlapack.dylib;
```

```
locale:
```

```
[1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8
```

```
time zone: America/Los_Angeles
```

```
tzcode source: internal
```

```
attached base packages:
```

```
[1] tools      stats      graphics  grDevices datasets  utils      methods
[8] base
```

```
other attached packages:
```

|                     |                  |                       |
|---------------------|------------------|-----------------------|
| [1] treemap_2.4-4   | tidyr_1.3.1      | stringr_1.5.1         |
| [4] scales_1.4.0    | readr_2.1.5      | pwr_1.3-0             |
| [7] patchwork_1.3.0 | mvabund_4.2.1    | languageserver_0.3.16 |
| [10] here_1.0.1     | gtools_3.9.5     | fpc_2.2-13            |
| [13] forcats_1.0.0  | factoextra_1.0.7 | ggplot2_3.5.2         |
| [16] dplyr_1.1.4    | corrplot_0.95    | cluster_2.1.8.1       |

loaded via a namespace (and not attached):

|                          |                   |                    |
|--------------------------|-------------------|--------------------|
| [1] gtable_0.3.6         | xfun_0.52         | ggrepel_0.9.6      |
| [4] processx_3.8.6       | lattice_0.22-6    | callr_3.7.6        |
| [7] tzdb_0.5.0           | vctrs_0.6.5       | ps_1.9.1           |
| [10] generics_0.1.4      | stats4_4.4.2      | parallel_4.4.2     |
| [13] flexmix_2.3-20      | tibble_3.2.1      | DEoptimR_1.1-3-1   |
| [16] pkgconfig_2.0.3     | data.table_1.17.6 | RColorBrewer_1.1-3 |
| [19] lifecycle_1.0.4     | compiler_4.4.2    | farver_2.1.2       |
| [22] statmod_1.5.0       | httpuv_1.6.16     | htmltools_0.5.8.1  |
| [25] class_7.3-22        | yaml_2.3.10       | later_1.4.2        |
| [28] pillar_1.10.2       | prabclus_2.3-4    | MASS_7.3-61        |
| [31] diptest_0.77-1      | mclust_6.1.1      | mime_0.13          |
| [34] robustbase_0.99-4-1 | tidyselect_1.2.1  | digest_0.6.37      |
| [37] stringi_1.8.7       | purrr_1.0.4       | kernlab_0.9-33     |
| [40] labeling_0.4.3      | rprojroot_2.0.4   | fastmap_1.2.0      |
| [43] grid_4.4.2          | colorspace_2.1-1  | cli_3.6.5          |
| [46] magrittr_2.0.3      | withr_3.0.2       | promises_1.3.3     |
| [49] tweedie_2.3.5       | rmarkdown_2.29    | igraph_2.1.4       |
| [52] nnet_7.3-19         | modeltools_0.2-24 | hms_1.1.3          |
| [55] shiny_1.11.0        | evaluate_1.0.3    | knitr_1.50         |
| [58] rlang_1.1.6         | Rcpp_1.0.14       | xtable_1.8-4       |
| [61] gridBase_0.4-7      | glue_1.8.0        | xml2_1.3.8         |
| [64] renv_1.1.4          | jsonlite_2.0.0    | R6_2.6.1           |