FSAR Group Project 2

05-12-2025

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Group T2 - E

Introduction

Project Overview

Organizations increasingly rely on data-driven insights to understand the factors that shape employee performance, retention, and career progression. With the growing adoption of flexible work arrangements, particularly work-from-home policies, managers face important strategic questions: How do these arrangements affect productivity? Do they influence employee turnover? And what role do they play in promotions or role changes?

This project aims to analyze the relationship between work arrangements and key employee outcomes, namely productivity, attrition, and promotion. Using regression-based modeling, the analysis evaluates how remote work and other employee characteristics contribute to variations in these outcomes. The objective is not only to identify statistically significant relationships, but also to interpret their magnitude and practical relevance in clear business terms.

To achieve this, the datasets are first validated and merged to ensure consistency and readiness for modeling. A set of dependent variables capturing employee productivity, attrition decisions, and promotion outcomes is then defined, alongside relevant explanatory variables such as work-from-home indicators and individual characteristics. Depending on the nature of each outcome, appropriate regression techniques are applied, including linear models for continuous measures and binary outcome models for turnover and promotion events.

By translating empirical findings into actionable insights, this analysis seeks to support management in designing effective workforce policies. In particular, it provides evidence-based recommendations regarding remote work practices, retention strategies, and employee development initiatives, helping organizations better align human resource decisions with performance and long-term organizational goals.

Technical Documentation Overview

This technical documentation outlines the complete process of **data preparation and regression analysis**, which consists of two major stages: **ensuring data readiness** and **conducting statistical modeling**.

The first stage focuses on **validating variable types**, resolving any remaining inconsistencies, performing **minimal exploratory checks**, and **merging all datasets** into a unified analysis file.

The second stage involves **selecting key outcome variables**, defining appropriate predictors, applying suitable **regression methods**, and **interpreting results** in clear business terms to produce actionable, evidence-based recommendations for management.

The analysis draws upon five primary cleaned datasets:

1. `attitude_clean` — Weekly employee attitude survey data
2. `endperiod_outcomes_clean` — End-of-period job outcomes such as promotions and job exits
3. `performance_clean` — Weekly job performance indicators and productivity metrics
4. `wage_clean` — Monthly wage and compensation records
5. `summary_clean` — Individual demographic and household information

Each dataset undergoes a **data validation phase** to ensure that all variables are correctly typed, consistently formatted, and free of remaining missing or inconsistent values. Instead of deep cleaning, the focus is on confirming data integrity and preparing the datasets for modeling. After validation, the datasets are **merged** using consistent key variables to create a comprehensive analytical file suitable for regression analysis.

A brief **exploratory data assessment** is conducted to confirm that the merged dataset is structurally sound and ready for statistical modeling. This includes summary statistics, distribution checks for key variables, and documentation of any transformations applied during preparation.

The second stage consists of the **regression analysis**, where selected dependent variables (e.g., productivity, attrition, promotion likelihood) are modeled using appropriate regression techniques such as linear regression (OLS) for continuous outcomes and logistic or probit models for binary outcomes. Relevant predictors include work arrangement indicators and employee characteristics.

This documentation provides a clear explanation of each step, including the **R code**, the **methods applied**, and the **reasoning** behind each decision. The objective is to ensure transparency, reproducibility, and analytical rigor throughout the entire data preparation and regression analysis workflow.

In the **appendix** at the end of this document, **panel data** regressions will also be included** as a bonus after the main analysis as confirmed in class and via e-mail with the course instructor Miguel.

Structure of the Report

1 - **Introduction**

2 - **Data Cleaning Validation and Preparation**

3 - **Data Merging**

4 - **Minimal Exploratory Data Analysis (EDA)**

5 - **Regression Analysis and Interpretation**

6 - **Appendix with Panel Data Regressions (Bonus)**

Setting up the environment

We begin by **clearing the R environment** to avoid conflicts with previous objects. Then, we load all the required packages:

R Packages Used

- `tidyverse`, `dplyr`, `tidyr`, `readr` – core data wrangling and manipulation
- `janitor` – data cleaning and integrity checks
- `skimr` – summary statistics and quick data diagnostics
- `haven` – importing Stata .dta files
- `lubridate` – date and time handling
- `stringr` – string and text processing
- `ggplot2`, `ggthemes`, `GGally`, `patchwork`, `scales` – visualization and plotting tools
- `corrr` – correlation matrices and correlation analysis
- `infer` – inferential statistics and resampling-based testing
- `stargazer` – regression tables and model output formatting

Additional Regression & Diagnostic Packages

- `car` – regression diagnostics, VIF, hypothesis tests
- `margins` – marginal effects for regression models
- `pscl` – pseudo R^2 and advanced evaluation for Logit/Probit models
- `sandwich` – robust and cluster-robust standard errors
- `lmtest` – hypothesis testing for linear and generalized linear models

```r
# Clear the environment
rm(list = ls())
```

```r
packages <- c(
  "tidyverse",
  "dplyr",
  "tidyr",
  "readr",
```

```r
  "janitor",
  "skimr",
  "haven",
  "lubridate",
  "stringr",
  "ggplot2",
  "ggthemes",
  "GGally",
  "patchwork",
  "scales",
  "corrr",
  "infer",
  "stargazer",
  "car",
  "margins",
  "pscl",
  "sandwich",
  "lmtest",
  "corrr",
  "magrittr",
  "plm",
  "mfx"
)
```

```r
# Check for missing packages and install only those
missing_packages <- packages[!(packages %in% installed.packages()[, "Package"])]
if (length(missing_packages)) {
  install.packages(missing_packages, repos = "https://cran.rstudio.com/")
}

# Load all packages quietly
invisible(lapply(packages, library, character.only = TRUE))
```

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v dplyr     1.1.4     v readr     2.1.5
## v forcats   1.0.0     v stringr   1.5.1
## v ggplot2   3.5.2     v tibble    3.3.0
## v lubridate 1.9.4     v tidyr     1.3.1
## v purrr     1.1.0
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
##
## Attaching package: 'janitor'
##
##
## The following objects are masked from 'package:stats':
##
##     chisq.test, fisher.test
##
##
##
```

```
## Attaching package: 'scales'
##
##
## The following object is masked from 'package:purrr':
##
##     discard
##
##
## The following object is masked from 'package:readr':
##
##     col_factor
##
##
##
## Attaching package: 'corrr'
##
##
## The following object is masked from 'package:skimr':
##
##     focus
##
##
##
## Please cite as:
##
##
##  Hlavac, Marek (2022). stargazer: Well-Formatted Regression and Summary Statistics Tables.
##
##  R package version 5.2.3. https://CRAN.R-project.org/package=stargazer
##
##
## Loading required package: carData
##
##
## Attaching package: 'car'
##
##
## The following object is masked from 'package:dplyr':
##
##     recode
##
##
## The following object is masked from 'package:purrr':
##
##     some
##
##
## Classes and Methods for R originally developed in the
## Political Science Computational Laboratory
## Department of Political Science
## Stanford University (2002-2015),
## by and under the direction of Simon Jackman.
## hurdle and zeroinfl functions by Achim Zeileis.
##
```

```
## Loading required package: zoo
##
## Attaching package: 'zoo'
##
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
##
##
## Attaching package: 'magrittr'
##
## The following object is masked from 'package:purrr':
##
##     set_names
##
## The following object is masked from 'package:tidyr':
##
##     extract
##
##
## Attaching package: 'plm'
##
## The following objects are masked from 'package:dplyr':
##
##     between, lag, lead
##
## Loading required package: MASS
##
## Attaching package: 'MASS'
##
## The following object is masked from 'package:patchwork':
##
##     area
##
## The following object is masked from 'package:dplyr':
##
##     select
##
## Loading required package: betareg
```

```
# Optional: setwd("path/to/your/data")
```

##Loading the data

```r
attitude_labeled_p2 <- read_dta("attitude_labeled-p2.dta")
endperiod_outcomes_labeled_p2 <- read_dta("endperiod_outcomes_labeled-p2.dta")
performance_labeled_p2 <- read_dta("performance_labeled-p2.dta")
summary_volunteer_labeled_p2 <- read_dta("summary_volunteer_labeled-p2.dta")
wage_new_labeled_p2 <- read_dta("wage_new_labeled-p2.dta")
```

Data Cleaning Validation and Preparation

The Attitude Dataset

The `attitude_labeled_p2` dataset contains weekly self-reported attitude measures such as exhaustion, positive mood, and negative mood.
The following cleaning steps were performed:

The following cleaning steps were performed:

1. **Inspected the dataset** using `View()`, `skim()`, and `head()` to understand its structure and variable types.

2. Checked for missing values, duplicate rows, and reviewed distinct values of key variables.

3. **Split the `year_week` variable into separate year and week components** to prepare for creating a proper date variable.

4. **Created an ISO-compliant date variable (`date`)** based on the year–week information.

5. **Reordered columns** so that `personid` and `date` appear first in the dataset.

6. **Examined attitude score variables** for non-integer values.

7. **Rounded decimal values** in the attitude measures (`exhaustion`, `negative`, `positive`).

8. **Saved the cleaned dataset as `attitude_clean`** for further analysis.

Reviewed the dataset using `View()`, `skim()`, and `head()` to gain an initial understanding of its structure, variable types, and overall data composition.

```r
#Viewing the Data
# View(attitude_labeled_p2)
```

```r
#skim the Data
# View(attitude_labeled_p2)
```

```r
#head the Data
head(attitude_labeled_p2)
```

```
## # A tibble: 6 x 5
##   personid year_week exhaustion negative positive
##      <dbl> <chr>          <dbl>    <dbl>    <dbl>
```

```
## 1     4122 202249              9        20        20
## 2     4122 202250              8        21        25
## 3     4122 202251              8        20        24
## 4     4122 202252              6        17        22
## 5     4122 202253             12        19        19
## 6     4122 202302             12        18        19
```

Checked for missing values, identified potential duplicate entries, and reviewed the distinct values of key variables to ensure data consistency

```r
#Check for missing values
colSums(is.na(attitude_labeled_p2))
```

```
##   personid  year_week exhaustion   negative   positive
##          0          0          0          0          0
```

```r
#Check for duplicates
attitude_labeled_p2[duplicated(attitude_labeled_p2), ]  #give me all rows with duplicates, keep all col
```

```
## # A tibble: 0 x 5
## # i 5 variables: personid <dbl>, year_week <chr>, exhaustion <dbl>,
## #   negative <dbl>, positive <dbl>
```

```r
#No duplicates found
```

Check of Unique Values Across Variables

```r
# See all distinct values in personid
unique(attitude_labeled_p2$personid)
```

```
##  [1]  4122  8834 10356 12974 14522 16424 16514 16596 21654 23228 23772 24608
## [13] 25638 25864 25962 26328 27704 28190 28224 29172 30014 31136 31292 31888
## [25] 31936 33128 33278 33350 33354 36032 36288 36314 37292 37798 38566 38712
## [37] 38878 38898 39144 39164 39458 39466 39990 40316 40328 40456 40490 42108
## [49] 42152 42624 43258 43570 43926 44266 44282 44408 44782 44784 44800 45254
## [61] 45442
```

```r
# See all disctinct values in year_week
unique(attitude_labeled_p2$year_week)
```

```
##  [1] "202249" "202250" "202251" "202252" "202253" "202302" "202303" "202304"
##  [9] "202305" "202306" "202307" "202308" "202309" "202310" "202311" "202312"
## [17] "202313" "202314" "202315" "202316" "202317" "202318" "202319" "202320"
## [25] "202321" "202322" "202323" "202324" "202325" "202326" "202327" "202328"
## [33] "202329" "202330" "202331" "202332" "202333" "202334" "202335"
```

```r
# See all distinct values in exhaustion
unique(attitude_labeled_p2$exhaustion)
```

```
##  [1]  9.00  8.00  6.00 12.00 10.00 11.00 14.00 13.00 18.00 15.00 16.00 19.00
## [13] 20.00 23.00 24.00 29.00  2.00  3.00  4.00  8.58  0.00  1.00  7.00 11.64
## [25]  6.32  5.00  6.40 17.00 25.00 27.00  7.55 22.00  9.55 21.00 31.00  9.56
## [37] 36.00 26.00 32.00 28.00 12.20 33.00 30.00 12.47  9.78  6.27  6.21 34.00
## [49] 35.00  7.04  6.86  8.55  5.99
```

```r
# See all distinct values in negative
unique(attitude_labeled_p2$negative)
```

```
##  [1] 20.00000 21.00000 17.00000 19.00000 18.00000 16.00000 24.00000 28.00000
##  [9] 22.00000 26.00000 25.00000 27.00000 10.00000 15.00000 14.00000 13.00000
## [17] 17.55000 11.00000 12.00000 18.53000  9.00000 17.87716  8.00000 14.85000
## [25] 15.47000 23.00000 37.00000 16.22000 30.00000 17.98000 18.19000 32.00000
## [33] 29.00000 40.00000 18.77000 31.00000 19.75000 17.57000 14.89000 15.04000
## [41] 34.00000 39.00000 36.00000 35.00000 15.55000 15.94000 16.75610 15.10000
```

```r
# See all distinct values in positive
unique(attitude_labeled_p2$positive)
```

```
##  [1] 20.00000 25.00000 24.00000 22.00000 19.00000 23.00000 21.00000 18.00000
##  [9] 17.00000  8.00000 16.00000 32.00000 34.00000 30.00000 29.00000 31.00000
## [17] 24.24000 28.00000 22.56000 27.00000 26.00000 28.13000 33.00000 35.00000
## [25]  9.00000 12.00000 14.00000 13.00000 15.00000 27.19000 11.00000 10.00000
## [33] 38.00000 26.28000 36.00000 23.79000 23.48000 37.00000 39.00000 40.00000
## [41] 21.91000 22.13000 23.46000 27.18000 26.88000 27.11000 26.04000 25.04065
## [49] 27.05000
```

Split the `year_week` variable into separate **year** and **week** components.

```r
# Transform into weekly data
attitude_labeled_p2 <- attitude_labeled_p2 %>% mutate(year=as.numeric(substr(year_week, 1, 4)))

attitude_labeled_p2 <- attitude_labeled_p2 %>%
  mutate(week = as.numeric(substr(year_week, 5, 6)))

attitude_labeled_p2 <- attitude_labeled_p2 %>% dplyr::select(-year_week)
```

Created a proper ISO date variable (`date`) based on year–week information.

```r
# Add in a column with the date(with the day)
attitude_labeled_p2$date <- ISOweek::ISOweek2date(paste0(attitude_labeled_p2$year, "-W", sprintf("%02d"
```

Reordered columns to place `personid` and `date` at the front.

```r
# Re-positioning the columns
attitude_labeled_p2 <- attitude_labeled_p2 %>%
  dplyr::select(personid, date, year, week, everything())
```

Verified whether attitude scores contained floats and counted non-integer values.

```r
# Checking if values are integers or if they have any floats
all(attitude_labeled_p2$exhaustion == floor(attitude_labeled_p2$exhaustion))
```

```
## [1] FALSE
```

```r
all(attitude_labeled_p2$positive == floor(attitude_labeled_p2$positive))
```

```
## [1] FALSE
```

```r
all(attitude_labeled_p2$negative == floor(attitude_labeled_p2$negative))
```

```
## [1] FALSE
```

```r
# Count non-integers in each column
sum(attitude_labeled_p2$exhaustion != floor(attitude_labeled_p2$exhaustion))
```

```
## [1] 21
```

```r
sum(attitude_labeled_p2$positive   != floor(attitude_labeled_p2$positive))
```

```
## [1] 21
```

```r
sum(attitude_labeled_p2$negative   != floor(attitude_labeled_p2$negative))
```

```
## [1] 22
```

Rounded decimal values in `exhaustion`, `negative`, and `positive` (less than 1% affected)

```r
# Less than 1% of observations are in decimal floats. We will convert them
# to integers
attitude_labeled_p2$exhaustion <- as.integer(round(attitude_labeled_p2$exhaustion))
attitude_labeled_p2$negative   <- as.integer(round(attitude_labeled_p2$negative))
attitude_labeled_p2$positive   <- as.integer(round(attitude_labeled_p2$positive))
```

Assigned the cleaned output as `attitude_clean` for further analysis.

```r
#Assign a new variable attitude_clean
attitude_clean <- attitude_labeled_p2
rm(attitude_labeled_p2)
```

The End-Period Outcomes Dataset

The `endperiod_outcomes_labeled_p2` dataset contains end-period outcome measures such as promotion status, job exit, and commuting cost.
The following cleaning steps were performed:

1. **Inspected the dataset** using `View()`, `skim()`, and `head()` to understand structure and data types.

2. **Checked for missing values and duplicate rows**, and examined distinct values of key variables.

3. **Renamed variables for clarity** to follow consistent naming conventions (e.g., `costofcommute` → `cost_of_commute_cny`, `quitjob` → `quit_job`).

4. **Converted binary indicators into interpretable factor labels** for `promote_switch` and `quit_job`.

5. **Cleaned and converted the commuting cost variable** (`cost_of_commute_cny`) to numeric format and rounded values.

6. **Reordered columns** to place the most relevant variables at the front: `personid`, `cost_of_commute_cny`, `promote_switch`, `quit_job`.

7. **Created and saved the cleaned dataset** as `endperiod_clean` for further analysis.

Inspected the dataset using `View()`, `skim()`, and `head()` to understand structure and data types

```
# Viewing and Analysing the Data
# View(endperiod_outcomes_labeled_p2)

skim(endperiod_outcomes_labeled_p2)
```

Table 1: Data summary

Name	endperiod_outcomes_labele...
Number of rows	135
Number of columns	4
Column type frequency:	
numeric	4
Group variables	None

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
personid	0	1	32716.79	10835.70	4122	25913.0	37292	40464	45442	
promote_switch	0	1	0.16	0.37	0	0.0	0	0	1	
quitjob	0	1	0.30	0.46	0	0.0	0	1	1	
costofcommute	0	1	7.40	7.22	0	2.5	6	10	55	

```
head(endperiod_outcomes_labeled_p2)
```

```
## # A tibble: 6 x 4
##   personid promote_switch quitjob costofcommute
##      <dbl>          <dbl>   <dbl>         <dbl>
## 1     4122              0       0            18
## 2     6278              0       1            12
## 3     7720              0       0             9
```

```
## 4     8834              0       0              0
## 5     8854              0       0              4
## 6    10098              0       1             12
```

Checked for missing values, duplicate rows, and examined distinct values of key variables (`personid`, `promote_switch`, `quitjob`, `costofcommute`)

```r
# Check for missing values
colSums(is.na(endperiod_outcomes_labeled_p2))
```

```
##       personid promote_switch        quitjob  costofcommute
##              0              0              0              0
```

```r
# Check for duplicates
endperiod_outcomes_labeled_p2[duplicated(endperiod_outcomes_labeled_p2), ]
```

```
## # A tibble: 0 x 4
## # i 4 variables: personid <dbl>, promote_switch <dbl>, quitjob <dbl>,
## #   costofcommute <dbl>
```

```r
# See all distinct values in personid
unique(endperiod_outcomes_labeled_p2$personid)
```

```
##   [1]  4122  6278  7720  8834  8854 10098 10356 12426 12974 13980 14048 14220
##  [13] 14522 14528 15444 16334 16422 16424 16514 16594 16596 17160 17906 19470
##  [25] 21654 22284 23136 23228 23772 24324 24608 25520 25638 25864 25962 26328
##  [37] 26634 26934 27704 28190 28224 28484 29172 29230 29808 30014 31136 31150
##  [49] 31292 31888 31936 32320 32804 33128 33278 33350 33354 34890 35006 35344
##  [61] 35822 36032 36288 36314 36494 36908 37276 37292 37294 37798 38038 38290
##  [73] 38552 38566 38580 38712 38842 38862 38878 38898 39096 39144 39164 39458
##  [85] 39466 39478 39634 39942 39990 40008 40034 40062 40162 40174 40192 40316
##  [97] 40322 40328 40336 40346 40456 40472 40490 41286 41320 41332 42096 42104
## [109] 42108 42152 42308 42592 42618 42624 42628 42632 42634 42682 43258 43264
## [121] 43288 43524 43534 43570 43926 44256 44266 44282 44408 44782 44784 44794
## [133] 44800 45254 45442
```

```r
# See all disctinct values in promote_switch
unique(endperiod_outcomes_labeled_p2$promote_switch)
```

```
## [1] 0 1
```

```r
# See all distinct values in quitjob
unique(endperiod_outcomes_labeled_p2$quitjob)
```

```
## [1] 0 1
```

```r
# See all distinct values in costofcommute
unique(endperiod_outcomes_labeled_p2$costofcommute)
```

```
##  [1] 18.000000 12.000000  9.000000  0.000000  4.000000  6.000000 10.000000
##  [8] 25.000000 11.818182 20.000000  5.000000 14.000000  2.000000  3.000000
## [15]  8.000000 17.727272 30.000000 55.000000  4.545455 16.000000 17.000000
```

Renamed variables to follow consistent naming conventions, converted binary indicators (e.g., `promote_switch`, `quit_job`) into factor labels, and cleaned `cost_of_commute_cny` by converting it to numeric and rounding values.

```r
# Clean and format variables
endperiod_clean <- endperiod_outcomes_labeled_p2 %>%
  rename(
    cost_of_commute_cny = costofcommute,
    quit_job = quitjob
  ) %>%
  mutate(cost_of_commute_cny = round(as.numeric(cost_of_commute_cny)),
    promote_switch = factor(promote_switch, levels = c(0, 1),
                            labels = c("Not Promoted", "Promoted")),
    quit_job = factor(quit_job, levels = c(0, 1),
                      labels = c("Working", "Quit"))
  ) %>%
  dplyr::select(personid, cost_of_commute_cny, promote_switch, quit_job, everything())
```

Reordered columns to position `personid`, `cost_of_commute_cny`, `promote_switch`, and `quit_job` at the front and saved the cleaned dataset as `endperiod_clean` for further analysis.

```r
# Assign a new variable endperiod_clean
endperiod_clean <- endperiod_outcomes_labeled_p2
rm(endperiod_outcomes_labeled_p2)
```

##The Performance Dataset

The **attitude_labeled_p2** dataset contains weekly self-reported attitude measures such as exhaustion, positive mood, and negative mood. The following cleaning steps were performed:

1. Inspected the dataset using `View()`, `skim()`, and `head()` to understand its **structure** and **variable types**.

2. Checked for **missing values**, **duplicate rows**, and reviewed distinct values of key variables such as `personid`, `year_week`, `perform1`, `phonecall`, `phonecallraw`, and `WFH_due_building_issues`.

3. Converted the variable `WFH_due_building_issues` into **interpretable factor labels** to improve clarity.

4. Extracted the **year** and **week** components from `year_week` and removed the original variable.

5. Created an **ISO-compliant date variable** based on the combined year–week information.

6. Reordered the dataset to place `personid`, `date`, `year`, `week`, and key performance measures at the **front of the table**.

7. Assigned the cleaned dataset as `performance_clean` for **subsequent analysis**.

We inspected the dataset using `View()`, `skim()`, and `head()` to understand its structure and variable types.

```r
# Data Cleaning performance_labeled_p2

# Viewing and Analysing the Data
# View(performance_labeled_p2)

skim(performance_labeled_p2)
```

Table 3: Data summary

Name	performance_labeled_p2
Number of rows	9870
Number of columns	12
Column type frequency:	
character	2
numeric	10
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
year_week	0	1	6	6	0	86	0
date	0	1	10	10	0	85	0

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
personid	0	1.00	32493.75	10623.78	4122.00	25864.00	36908.00	40328.00	45442.00	
perform1	23	1.00	-0.02	0.99	-3.03	-0.61	0.05	0.61	4.16	
phonecall	134	0.99	-0.01	0.96	-3.11	-0.54	0.07	0.61	5.83	
phonecallraw	281	0.97	440.21	142.53	1.00	357.00	445.00	527.00	1264.00	
WFH_due_building_issues	0	1.00	0.20	0.40	0.00	0.00	0.00	0.00	1.00	
logphonecall	281	0.97	6.01	0.48	0.00	5.88	6.10	6.27	7.14	
logcallpersec	279	0.97	-5.17	0.16	-5.95	-5.26	-5.17	-5.08	-1.10	
logcalllength	279	0.97	11.17	0.52	2.48	11.05	11.27	11.44	12.12	
logcall_dayworked	279	0.97	9.47	0.46	2.48	9.33	9.55	9.73	10.36	
logdaysworked	0	1.00	1.69	0.28	0.00	1.61	1.79	1.79	1.95	

```r
head(performance_labeled_p2)
```

```
## # A tibble: 6 x 12
##   personid year_week perform1 phonecall phonecallraw WFH_due_building_issues
##      <dbl> <chr>        <dbl>     <dbl>        <dbl>                   <dbl>
## 1     4122 202201      -1.14     -1.13           223                       0
## 2     4122 202202       0.415     0.312          499                       0
## 3     4122 202203       1.01      1.10           649                       0
## 4     4122 202204       1.48      1.41           709                       0
```

```
## 5     4122 202205      -0.115    -0.190          403                       0
## 6     4122 202206       1.51      1.68           760                       0
## # i 6 more variables: logphonecall <dbl>, logcallpersec <dbl>,
## #   logcalllength <dbl>, logcall_dayworked <dbl>, logdaysworked <dbl>,
## #   date <chr>
```

Checked for missing values, duplicate rows, and examined distinct values of key variables (`personid`, `year_week`, `perform1`, `phonecall`, `phonecallraw`, `WFH_due_building_issues`).

```r
# Check for missing values
colSums(is.na(performance_labeled_p2))
```

```
##                personid               year_week                perform1
##                       0                       0                      23
##               phonecall             phonecallraw WFH_due_building_issues
##                     134                     281                       0
##            logphonecall           logcallpersec           logcalllength
##                     281                     279                     279
##       logcall_dayworked           logdaysworked                    date
##                     279                       0                       0
```

```r
# Check for duplicates
performance_labeled_p2[duplicated(performance_labeled_p2), ]
```

```
## # A tibble: 0 x 12
## # i 12 variables: personid <dbl>, year_week <chr>, perform1 <dbl>,
## #   phonecall <dbl>, phonecallraw <dbl>, WFH_due_building_issues <dbl>,
## #   logphonecall <dbl>, logcallpersec <dbl>, logcalllength <dbl>,
## #   logcall_dayworked <dbl>, logdaysworked <dbl>, date <chr>
```

```r
# See all distinct values in personid
unique(performance_labeled_p2$personid)
```

```
##   [1]  4122  6278  7720  8834  8854 10098 10356 12426 12974 13980 14048 14220
##  [13] 14522 14528 15444 16334 16422 16424 16514 16594 16596 17160 17906 19470
##  [25] 21654 22284 23136 23228 23772 24324 24608 25520 25638 25864 25962 26328
##  [37] 26634 26934 27704 28190 28224 28484 29172 29230 29808 30014 31136 31150
##  [49] 31292 31888 31936 32320 32804 33128 33278 33350 33354 34890 35006 35344
##  [61] 35822 36032 36288 36314 36494 36908 37276 37292 37294 37798 38038 38290
##  [73] 38552 38566 38580 38712 38842 38862 38878 38898 39096 39144 39164 39458
##  [85] 39466 39478 39634 39942 39990 40008 40034 40062 40162 40174 40192 40316
##  [97] 40322 40328 40336 40346 40456 40472 40490 41286 41320 41332 42096 42104
## [109] 42108 42152 42308 42592 42618 42624 42628 42632 42634 42682 43258 43264
## [121] 43288 43524 43534 43570 43926 44256 44266 44282 44408 44782 44784 44794
## [133] 44800 45254 45442
```

```r
# See all disctinct values in year_week
unique(performance_labeled_p2$year_week)
```

```
##  [1] "202201" "202202" "202203" "202204" "202205" "202206" "202207" "202208"
##  [9] "202209" "202210" "202211" "202212" "202213" "202214" "202215" "202216"
```

```
## [17] "202217" "202218" "202219" "202220" "202221" "202222" "202223" "202224"
## [25] "202225" "202226" "202227" "202228" "202229" "202230" "202231" "202232"
## [33] "202233" "202234" "202235" "202236" "202237" "202238" "202239" "202240"
## [41] "202241" "202242" "202243" "202244" "202245" "202246" "202247" "202248"
## [49] "202249" "202250" "202251" "202252" "202253" "202301" "202302" "202303"
## [57] "202304" "202305" "202306" "202307" "202308" "202309" "202310" "202311"
## [65] "202312" "202313" "202314" "202315" "202316" "202317" "202318" "202319"
## [73] "202320" "202321" "202322" "202323" "202324" "202325" "202326" "202327"
## [81] "202328" "202329" "202330" "202331" "202332" "202333"
```

```r
# See all distinct values in perform1
unique(performance_labeled_p2$perform1)
```

```
##    [1] -1.141609e+00  4.145924e-01  1.013977e+00  1.481231e+00 -1.150429e-01
##    [6]  1.507072e+00 -1.030877e+00 -1.955392e+00 -7.384520e-01  1.173867e+00
##   [11]  6.273752e-01  1.204250e+00  1.001966e+00  5.031173e-01  1.070303e+00
##   [16] -1.024253e-01  2.910410e-01  9.243418e-01  3.310136e-01  1.222685e-01
##   [21]  8.628694e-01  2.167489e-01  4.969600e-01  2.390567e-01  5.844755e-01
##   [26] -8.526155e-01 -6.105604e-01  4.363570e-02 -2.616086e-01 -1.207018e+00
##   [31]  2.235115e-01  1.781893e-01  3.657371e-01 -3.964069e-02 -1.086293e+00
##   [36] -1.043393e+00  3.337389e-01  5.570192e-01 -3.136940e-01  6.697692e-01
##   [41] -1.307252e+00 -1.792675e+00 -5.344517e-01 -3.660823e-01 -6.868713e-01
##   [46] -2.076055e-01 -7.496964e-02 -9.480047e-01 -6.935334e-01  1.137831e+00
##   [51]  6.866895e-02 -4.418268e-02 -1.662058e+00 -1.195511e+00  5.942659e-01
##   [56]  1.450949e+00 -4.629852e-01  8.561057e-01  3.192649e-02 -4.246673e-02
##   [61]  2.849833e-01  7.469885e-01  1.197690e+00  1.127738e+00  1.004186e+00
##   [66]  1.944448e+00  8.153265e-01  9.191939e-01  6.017361e-01  1.721369e+00
##   [71]  7.823189e-01  1.231101e+00  9.641125e-01  1.109164e+00  1.767903e+00
##   [76] -1.090873e-01  9.384739e-01  1.039515e+00  5.171478e-01  6.690637e-01
##   [81]  1.524333e+00  1.602966e+00  1.161553e+00  1.511311e+00  5.254246e-01
##   [86]  9.832913e-01 -3.014971e+00 -5.778940e-01  6.117191e-01  1.332915e+00
##   [91]  1.397783e+00  1.371181e+00  8.502410e-01 -1.046894e+00  1.120694e+00
##   [96]  6.333149e-01  7.207848e-01 -2.993013e+00 -3.557002e-01 -3.030936e+00
##  [101] -5.192714e-02  3.721918e-01  8.179675e-01  8.329278e-01 -2.017631e+00
##  [106]  1.986185e+00  1.312585e+00  1.777946e+00  7.117965e-01  1.002217e+00
##  [111] -2.057887e+00  1.356180e+00 -3.806635e-01  1.554316e-01  1.435184e-01
##  [116] -1.190763e+00  6.012584e-02 -2.893288e-01 -9.207297e-01 -2.016746e+00
##  [121]  3.420722e-01 -5.514197e-01  4.453201e-01 -2.496180e-01 -1.265147e-01
##  [126] -1.603755e+00 -5.951015e-01 -6.387833e-01 -2.972709e-01  2.825060e-01
##  [131]  2.507374e-01  1.117498e-01 -1.266213e+00  1.622431e-01 -1.569221e+00
##  [136] -2.199287e+00  1.965479e-01  5.392096e-01  8.102859e-01 -3.011975e+00
##  [141]  1.769641e+00  4.439972e-01  1.306738e-01 -1.071845e-01  7.214280e-01
##  [146] -1.973695e-01  1.699122e+00  1.483564e+00  1.453965e+00  1.516200e+00
##  [151]  1.469609e+00  9.136196e-02 -1.945142e+00 -2.999005e+00  4.211150e-01
##  [156]  4.337223e-01 -7.189453e-02  8.665284e-01 -1.249544e+00 -1.941804e+00
##  [161] -1.368623e+00 -1.177677e+00  4.490449e-01 -4.607845e-01 -4.597554e-02
##  [166] -4.070449e-03 -1.933035e+00 -5.190176e-01 -4.391685e-01 -2.227921e+00
##  [171]  7.038338e-01  4.084466e-01  1.166862e+00 -1.425208e+00 -2.398771e-01
##  [176] -7.731633e-01 -6.334323e-01 -4.997342e-01 -1.051119e+00 -8.234745e-01
##  [181] -1.491705e+00 -1.342020e+00 -3.904521e-04 -7.585653e-01 -6.101675e-01
##  [186] -1.491099e-01 -9.622579e-02  2.221250e-01 -1.867324e-01 -2.903210e+00
##  [191] -2.615312e-01 -2.734445e-01 -1.532275e+00 -1.087515e+00 -9.961801e-01
##  [196] -8.015974e-01 -1.821097e-01 -4.600850e-01 -7.857132e-01 -2.183532e+00
##  [201] -1.725260e+00 -8.510219e-01 -7.192738e-01  4.686704e-01 -1.111861e-01
```

```
## [206] -2.957422e+00  2.005292e-01 -6.650829e-01 -4.624942e-01 -3.384073e-01
## [211] -2.019940e-01 -2.306078e-01  6.389856e-01  4.286206e-02  4.766126e-01
## [216]  1.283209e-01 -9.423514e-02  7.823153e-01  4.442781e-01  8.827548e-01
## [221] -1.903435e+00  3.550518e-03  1.224995e+00  1.420284e+00 -7.860711e-01
## [226] -1.608076e+00  1.146315e+00  1.349824e+00 -1.502979e+00  3.837783e-01
## [231]  6.172434e-01  5.879799e-01  1.319272e+00  2.101417e+00  6.407382e-01
## [236]  1.630387e-01  1.943784e+00 -9.175046e-03  2.127277e-01  1.013614e+00
## [241]  1.401071e+00  1.169042e+00  6.148167e-01 -7.004597e-01 -2.738388e+00
## [246]  4.514410e-01  2.266164e-01  5.356417e-01 -1.522256e-01  8.454101e-01
## [251] -7.566691e-03  5.524273e-01  5.241294e-01  1.949514e-01  5.425987e-01
## [256] -2.957214e-01 -2.338022e-01  6.536863e-01  5.962580e-02  2.095425e+00
## [261]  2.678875e-01  1.330537e+00  9.521651e-01  7.266224e-01  5.992194e-01
## [266] -6.777723e-02 -2.766216e+00  2.925956e-01  2.640500e-01  2.431794e-01
## [271]  1.056073e+00  7.160758e-01  2.249328e-01  5.510164e-01  1.178426e+00
## [276]  8.473163e-01 -5.935936e-02 -2.752302e+00 -1.381593e+00  6.740867e-01
## [281]  3.549850e-01  9.917526e-01  1.080286e+00  1.229030e+00  9.461738e-01
## [286]  1.387107e+00  1.303402e+00  1.377056e+00 -2.731431e+00  2.020360e+00
## [291]  9.636522e-01  1.479008e+00  1.767163e+00  2.046206e+00  9.200047e-01
## [296]  3.292862e-01 -3.077039e-01  1.335275e-01  9.934111e-01  1.521963e+00
## [301]  2.553169e+00  2.228572e+00  1.990576e+00  1.953390e+00  1.767410e+00
## [306]  1.501835e+00 -2.333010e+00 -1.623399e+00  2.645581e+00  2.091417e+00
## [311]  1.800102e+00  3.321075e+00  2.359617e+00  7.460817e-01  2.258978e+00
## [316]  1.988559e+00  3.528104e+00  1.144897e+00  1.689471e+00  1.279451e+00
## [321]  2.166920e+00  1.330729e+00  1.347081e+00  8.767988e-01  1.319121e+00
## [326]  5.103847e-01  1.475074e+00  1.551486e+00  8.340002e-01 -3.575025e-01
## [331] -2.285366e+00  9.165697e-01  5.168449e-01  6.259617e-01  3.575610e-01
## [336]  3.404010e-01 -2.309188e+00 -4.468346e-01  2.023887e+00  5.253240e-01
## [341]  6.249517e-01  9.597723e-01  6.192997e-01  5.482372e-01  3.008319e-01
## [346]  1.638559e-01  2.001943e-01 -4.488919e-02  4.447735e-01  7.774730e-01
## [351]  2.785241e-01  4.090404e-01  8.710456e-01  2.036251e-01  1.324571e+00
## [356] -5.296523e-02  9.882364e-01 -2.327055e+00  8.231988e-01 -1.093763e+00
## [361]  8.847722e-01  1.601350e+00  1.455390e+00  1.349302e+00  2.269072e+00
## [366]  1.384530e+00  2.708971e+00  1.808784e+00  2.255041e+00  1.066567e+00
## [371]  1.577225e+00  1.050921e+00  1.260272e+00  1.143383e+00  7.939270e-01
## [376] -2.297277e+00  1.092610e+00  2.060491e-01  1.913964e+00  3.037432e+00
## [381]  1.337088e+00 -7.025172e-01  1.572785e+00  1.782841e+00  2.460254e+00
## [386] -2.513637e+00  6.522362e-01 -2.103188e-01  9.320402e-01  8.937542e-01
## [391] -7.079731e-01  4.091305e-01 -2.400529e+00  6.585907e-01 -2.279800e+00
## [396]  2.744065e-01  3.453723e-02  7.444525e-01  1.070464e+00  8.211296e-02
## [401]  3.990960e-01  1.226100e+00 -9.298251e-01 -8.289386e-02  9.194126e-01
## [406]  2.378098e-01  1.412402e+00 -3.334205e-01  7.663699e-01 -1.563551e+00
## [411]  1.355858e+00  8.831781e-01  7.547883e-01  8.348981e-01 -3.144383e-01
## [416] -1.376606e+00  7.041554e-01  9.410287e-01  6.539255e-01 -1.870983e+00
## [421] -3.473753e-01  9.599702e-01  1.145266e+00 -2.902460e-02  6.692684e-01
## [426] -1.394884e+00  1.200164e-01  5.890773e-01 -3.596205e-01 -7.808449e-01
## [431] -7.052782e-01  5.471519e-01  9.942343e-01 -3.071190e-01 -4.059098e-01
## [436] -1.729885e+00 -1.026234e+00  5.597446e-01  1.833110e+00  1.104521e+00
## [441]  1.065457e+00  1.437927e+00  6.578587e-01  8.661997e-01  6.416075e-01
## [446] -3.462976e-01 -1.783591e+00  1.497281e+00  1.729646e+00  1.263199e+00
## [451]  5.514673e-01  7.146884e-01  8.658973e-01 -3.411502e-01  4.276135e-01
## [456] -1.580438e-01  5.351145e-01  5.893204e-01  4.125730e-01 -1.839108e+00
## [461] -1.301498e+00  2.168495e-01  9.095040e-01  6.045626e-01  3.643236e-01
## [466]  1.135510e+00  2.263381e-01 -9.933269e-01 -7.381491e-01 -2.121480e-01
## [471]  1.876779e-01  2.581345e-01  2.456176e-01  1.989830e-01  1.759303e-02
```

```
## [476]  1.111789e+00 -4.847883e-01  4.352844e-01  8.111871e-01  8.401186e-02
## [481] -3.651123e-02 -1.580297e+00 -4.964975e-01 -2.874495e-01 -2.570671e-01
## [486] -2.954239e-01 -1.198883e-01 -4.612692e-01 -9.142313e-02  1.611305e-01
## [491] -3.014806e-01 -3.509821e-02  8.714083e-02 -1.867876e+00 -1.523467e+00
## [496]  2.573268e-01  1.623417e-01  1.767763e-01  1.385819e-02  3.162356e-02
## [501]  5.737756e-01  2.321924e-01  6.294947e-01  9.974226e-01  4.676867e-01
## [506] -3.540114e-02 -2.712382e-02  9.026397e-01 -6.729819e-02  5.325918e-01
## [511]  6.977904e-02  2.975012e-01  3.382809e-01  2.858931e-01 -6.710237e-01
## [516]  1.381703e+00  9.863198e-01  6.841032e-01  1.508343e-01  7.898892e-01
## [521]  1.261686e+00  2.854058e-01  8.369295e-01  7.338357e-01  8.815090e-01
## [526]  8.645378e-01 -1.390754e-01  2.787094e-01  1.100727e+00  3.315732e-01
## [531] -2.679690e+00 -2.879262e+00 -2.631792e+00 -2.855313e+00 -8.639916e-01
## [536] -2.535273e+00  2.462605e+00  3.343438e+00  1.057072e+00 -1.787133e+00
## [541] -1.573737e-01  6.625720e-01 -2.824045e+00 -2.895228e+00 -2.799433e+00
## [546] -3.006988e+00 -1.015635e+00  1.063539e+00  1.249573e+00  1.070807e+00
## [551]  9.468518e-01  1.573794e+00  6.207127e-01  1.934959e+00  1.028916e+00
## [556]  1.069495e+00  1.395129e+00  2.161975e+00  1.109265e+00  1.971399e+00
## [561]  1.564305e+00  1.239883e+00  7.914034e-01  1.670899e+00  3.001254e-01
## [566]  3.595793e-01  9.251499e-01  2.784240e-01  4.970606e-01  4.176207e-01
## [571]  4.908022e-01  2.959870e-01 -2.480200e-02  4.928211e-01  2.265399e-01
## [576]  1.302429e-01  8.562717e-02 -1.660948e+00  3.935964e-01  3.107246e-01
## [581] -2.597915e-01 -7.531890e-01 -1.226132e-01 -5.295047e-01 -2.291322e+00
## [586] -6.722354e-01 -1.839613e+00 -2.324329e+00 -2.321099e+00 -2.330285e+00
## [591] -2.303233e+00 -1.481576e+00  3.728027e-01 -6.415492e-01 -1.209037e+00
## [596]  4.330235e-04 -1.225390e+00  1.512378e-01  2.998225e-01 -1.087505e+00
## [601] -5.720427e-02 -3.701200e-01 -2.626191e-01  5.841725e-01  2.869020e-01
## [606]  9.648195e-01  7.971572e-01  1.082375e-01  1.093922e+00  2.534909e-01
## [611]  9.479624e-01  1.159735e+00  7.507243e-01  9.726927e-01  9.947988e-01
## [616]  7.596070e-01  6.821854e-01  6.243469e-01  1.068789e+00  1.096143e+00
## [621]  4.053056e-01  1.112698e+00  1.161112e-01  1.422787e+00  7.071181e-01
## [626]  1.496473e+00  8.237040e-01  1.590752e+00 -2.005412e+00  9.183462e-01
## [631]  1.986714e+00  2.687777e+00  1.901052e+00  6.978543e-01  1.198826e+00
## [636]  2.501624e+00  1.587497e+00  5.925102e-01  2.034224e+00  1.669048e+00
## [641]  1.899121e+00  2.605953e+00  1.169265e+00  1.819698e+00  2.679111e+00
## [646]  1.577916e+00  2.993048e-01  1.264978e+00  2.065939e+00  1.631862e+00
## [651]  7.309301e-01 -2.717517e+00  5.195096e-02  2.432090e-02  3.806588e-01
## [656]  1.132771e+00  7.529891e-01 -1.320442e+00  4.225976e-01  9.526353e-01
## [661]  3.072273e-01  1.030647e+00  7.604663e-01  2.321624e-01  4.546435e-02
## [666]  8.948514e-01  5.040018e-01  1.702224e+00  3.173538e-01  4.296800e-01
## [671] -1.947100e-01  1.057682e+00 -2.827481e-01  8.007718e-01  2.388717e-01
## [676]  2.458035e-01  3.988803e-01  2.398122e-01  3.722409e-01  1.361767e-01
## [681] -2.378873e-01  1.192835e+00  8.914341e-01 -7.081596e-01  4.792686e-01
## [686] -3.393331e-02 -2.164728e+00  2.016200e+00  9.262436e-01  1.004205e+00
## [691]  9.384488e-01  8.468210e-01 -2.052204e+00  1.167111e+00  1.322119e+00
## [696]  1.858866e+00  1.810376e-01  5.339581e-01  6.373710e-01  2.964438e-02
## [701]  8.235487e-01  4.893199e-01  1.477324e+00  1.186521e+00  2.462680e+00
## [706]  4.163310e+00  3.172136e+00  2.159200e+00  2.273903e+00  1.771248e+00
## [711]  2.638608e+00 -2.378086e+00 -2.027530e+00 -1.834609e+00  8.086515e-01
## [716]  7.775157e-01  9.457641e-01  7.121680e-01  1.585849e+00  9.879153e-01
## [721]  1.109713e-01  1.064667e+00  1.167380e+00  1.192131e+00  5.314597e-01
## [726]  8.360895e-01  1.249928e+00  1.068442e+00  1.142817e+00  1.150446e+00
## [731]  1.032987e+00  9.102312e-01  2.286628e-01  1.389262e+00 -1.175284e-01
## [736]  1.331387e+00  1.402608e+00  1.299241e+00  9.287976e-01  1.352517e+00
## [741]  1.699221e+00 -5.394295e-01  9.027581e-01  2.560232e-01  6.186830e-01
```

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## [746]  8.817372e-01  2.805405e-01  3.038923e-01  1.513028e+00 -5.268918e-01
## [751]  8.553551e-01  6.377156e-01  9.851134e-02  1.627713e-01  7.452463e-01
## [756] -5.637914e-01  3.758585e-01  5.357013e-01  4.570849e-01  2.454739e-01
## [761] -1.415363e+00  6.466190e-01  6.933686e-01  7.194858e-01  3.853978e-01
## [766] -5.494607e-02  9.261100e-01 -1.706912e+00 -6.965929e-02 -2.244835e-01
## [771] -2.610264e-01 -6.379331e-01  8.011007e-01  6.196153e-01  3.034262e-01
## [776]  1.077625e+00  3.178286e-01  9.912245e-01  2.675049e-01  7.161765e-01
## [781]  1.631225e-04  7.352786e-02  1.090583e+00  6.235697e-02 -2.626486e-02
## [786] -3.595759e-01  6.993973e-01  1.052852e-01  1.240847e-01  6.192269e-01
## [791]  8.762525e-01  1.413701e+00  9.035351e-01 -7.989779e-02  1.547166e+00
## [796]  9.490318e-01  1.975669e+00  1.611734e+00  9.224290e-01 -3.596136e-02
## [801]  1.124093e+00  6.409965e-01  1.705538e+00 -1.118137e+00  2.360155e+00
## [806]  1.898153e+00  1.391449e+00  1.177448e-01  8.429013e-01  1.664215e+00
## [811] -2.055233e+00 -1.162033e+00  1.593716e+00  3.522651e-01  5.558796e-01
## [816]  2.161937e-01  1.466312e+00  2.005912e+00  2.640924e+00  1.101089e+00
## [821]  2.444368e+00  8.369498e-01  1.340214e+00  3.928024e-01  1.518210e+00
## [826]  7.205038e-01  1.627317e+00  2.102350e+00  1.098093e+00  4.667000e-01
## [831]  1.172915e+00  2.053084e+00  1.110379e+00 -2.571527e+00  9.949588e-01
## [836] -1.257828e+00  1.527822e+00  1.543144e+00  8.426407e-01 -1.644121e-01
## [841] -1.704609e+00  1.152948e+00 -6.626454e-02  9.637315e-01  1.380149e+00
## [846]  9.493940e-01  6.652058e-01  7.903592e-01  2.194566e+00 -3.093392e-02
## [851] -9.437798e-01 -7.306890e-03  1.195536e+00  6.499239e-01  2.677507e-01
## [856]  4.630200e-01  1.438019e+00  5.571457e-01 -2.640099e+00 -1.341254e+00
## [861] -7.008263e-01 -1.155604e+00 -8.143539e-01 -9.856784e-01 -9.740413e-01
## [866] -1.677951e+00 -1.220719e+00 -1.296616e+00 -1.061498e+00 -1.061265e+00
## [871] -1.186274e+00 -9.187768e-01 -1.057955e+00 -1.037835e+00 -1.321444e+00
## [876] -6.005674e-01 -1.053947e+00 -2.549200e-01 -9.573080e-01 -4.312631e-01
## [881] -6.601512e-01 -4.120751e-01 -5.316773e-01 -5.321435e-01 -6.277724e-01
## [886] -7.104750e-01 -1.075310e+00 -7.908466e-01 -9.069065e-01 -7.715810e-01
## [891] -2.681110e-01 -1.258862e+00 -6.698459e-01 -1.189972e+00 -8.903286e-01
## [896] -9.056634e-01 -8.869416e-01 -7.137066e-01 -1.483586e+00 -1.409444e+00
## [901] -8.050160e-01 -1.335691e+00 -9.754858e-01 -1.316892e+00 -1.417617e+00
## [906] -1.746453e+00 -6.350901e-01 -7.616216e-01 -4.263222e-01 -1.356286e-01
## [911] -6.786399e-01 -8.981903e-01 -5.498552e-01 -4.541487e-01 -4.852068e-01
## [916] -4.759466e-01 -6.938969e-01 -1.107502e+00 -5.915402e-01 -7.170935e-01
## [921] -4.764905e-01 -3.364572e-01 -6.505026e-01 -5.700532e-01 -5.228056e-01
## [926] -1.162145e+00 -1.618601e+00 -5.460021e-01 -1.361964e+00 -1.583301e+00
## [931] -5.114794e-01 -4.260891e-01 -3.239654e-01 -9.805821e-01  1.309123e+00
## [936]  1.299630e+00  1.560742e+00  1.183803e+00  3.628229e-01 -2.755842e-01
## [941] -7.254990e-01  1.695057e+00 -2.972477e+00 -2.918067e+00 -2.840150e+00
## [946] -2.964693e+00  8.162259e-02  9.169274e-01  1.184767e+00  1.334774e+00
## [951] -1.267857e+00  1.617606e+00  1.422386e+00 -2.662829e+00  3.159956e-01
## [956]  1.615462e+00  2.660467e+00 -6.849382e-02  9.570903e-01 -4.216921e-01
## [961]  1.583161e+00  2.823735e-01  9.994746e-01  3.757808e-01  1.200761e-01
## [966]  9.250998e-01  1.323836e+00  3.325418e-01  2.385684e+00  6.357272e-01
## [971]  1.076926e+00  3.488089e-01 -5.914626e-01  4.999354e-01  1.119543e+00
## [976] -1.687724e+00  7.268813e-01 -1.413608e+00  1.270048e+00  1.174652e+00
## [981]  1.487455e+00 -6.523356e-01  1.650762e+00  1.915105e+00 -2.605343e+00
## [986] -1.044609e+00  2.738042e+00  1.661000e+00  6.408234e-01  7.056272e-01
## [991]  2.031398e+00  6.212470e-01  5.441763e-02  4.610157e-01  6.835185e-01
## [996]  5.223867e-01  1.280784e+00  1.058204e+00  1.850302e+00  1.008890e+00
## [1001]  1.322081e+00  1.763357e+00  1.372949e+00  1.438218e+00  9.417125e-01
## [1006]  8.881242e-01  6.835651e-01  5.707789e-01  7.021852e-01 -7.328663e-01
## [1011]  4.643472e-01  6.366529e-01  6.815542e-01 -8.611636e-01 -2.932999e-01
```

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## [1016] -1.361519e+00  2.597272e-01  8.205811e-01  8.053195e-01  1.395068e+00
## [1021]  4.134130e-01  1.527781e+00  1.280312e+00 -1.940818e+00  1.167546e+00
## [1026]  1.181521e+00  2.100640e+00  7.693253e-01  9.576648e-02 -8.752922e-01
## [1031]  9.220871e-01  9.878798e-01 -4.445174e-01 -9.581375e-01  5.847134e-01
## [1036] -2.638665e-01 -2.243143e-01  1.312968e-01  5.777360e-01  6.276240e-01
## [1041]  3.355748e-01  1.735234e-01 -2.967074e+00 -2.655023e-01 -1.115312e+00
## [1046] -8.691058e-01 -8.283287e-02  7.471218e-01 -9.077501e-02  4.413490e-01
## [1051] -1.544188e+00 -2.179560e+00 -1.116810e+00  6.998119e-01  1.081704e+00
## [1056] -1.259196e+00 -1.047618e+00 -2.255489e+00  9.902327e-01 -3.915927e-01
## [1061]  1.984573e-01 -3.413831e-01  4.382859e-01  5.677622e-02  1.018484e+00
## [1066]  4.915932e-01  1.255638e+00  6.236630e-01  1.170200e+00 -2.735997e-01
## [1071]  1.364101e+00  1.536427e+00  1.435727e+00 -1.992355e+00  2.040558e+00
## [1076]  1.160006e+00  7.707337e-01  9.038293e-01  1.438101e+00  7.212080e-01
## [1081]  1.744145e+00  1.407093e+00  1.497258e+00  2.047133e+00  1.805012e+00
## [1086] -4.075788e-01  1.760662e-02  1.315622e+00  1.059164e+00  2.467778e-01
## [1091]  6.961929e-01  6.346827e-01  1.679558e+00  9.177231e-01  7.640780e-01
## [1096]  1.365551e+00 -1.624760e+00  5.398934e-01  1.575760e+00  1.789649e+00
## [1101]  1.859223e+00  4.414243e-01  2.163860e+00  1.348880e+00  1.049129e+00
## [1106]  1.380450e+00  1.451331e+00  1.142652e+00  2.090023e+00  5.165474e-01
## [1111]  1.785065e+00 -6.020434e-03  1.799301e+00  1.096766e+00  2.244779e-01
## [1116]  4.124482e-01  9.237357e-01 -1.221231e+00 -8.679729e-01  1.151258e+00
## [1121]  1.881483e+00 -1.018151e-01 -1.402525e+00 -2.947106e+00 -2.663341e+00
## [1126] -2.302455e-01 -1.454502e-01 -7.851275e-01 -5.409554e-01 -4.281691e-01
## [1131] -1.949103e+00 -9.264869e-01 -1.695299e+00 -4.721055e-01 -3.240902e-01
## [1136] -1.969869e-01 -6.211262e-01 -2.524616e+00  6.675587e-01 -6.663693e-01
## [1141]  7.939778e-02 -9.039060e-01 -1.345680e+00 -2.663683e+00 -8.642928e-01
## [1146] -1.191690e-01 -5.356673e-01  1.393406e-01 -2.847987e-01 -4.444971e-01
## [1151] -1.579195e+00 -4.641225e-01  2.457723e-01 -4.767300e-01 -2.566621e-02
## [1156] -2.165920e-01 -1.058577e+00 -1.747072e-01 -9.322964e-02 -2.003250e-01
## [1161] -1.010036e+00 -2.291080e+00 -3.008315e+00 -1.629726e+00  3.715283e-01
## [1166]  7.906604e-01  2.394788e-01  7.579909e-02  5.931195e-01 -6.653638e-01
## [1171]  2.175411e-01  1.103849e-01  4.893013e-01 -1.191486e-01  1.082710e+00
## [1176]  4.646688e-01  5.238870e-01 -8.556837e-02  8.844442e-01 -6.720196e-01
## [1181]  7.072126e-01 -4.711000e-01  3.395764e-01  1.066744e+00  5.867243e-01
## [1186]  3.582370e-01  4.690123e-01  5.817782e-01  3.971460e-01  1.323926e+00
## [1191]  5.743776e-01  1.559699e-01 -2.499682e+00  2.680520e-01  2.766578e-01
## [1196]  1.631518e+00 -9.421481e-02  1.073742e+00 -2.449452e-01 -1.935832e+00
## [1201] -7.701672e-01  4.622955e-01 -3.746417e-01 -7.668495e-01  7.750163e-01
## [1206] -7.953547e-02 -9.065602e-01  3.719142e-02 -7.046351e-01 -2.552908e+00
## [1211] -3.966168e-02 -1.194702e-01 -8.979138e-01 -1.211257e+00  8.837603e-01
## [1216] -7.472037e-01 -2.345891e-01 -1.793318e-01 -1.156684e+00 -1.162013e+00
## [1221] -1.056224e+00 -1.727369e-01 -7.126180e-01 -3.895817e-01  2.481049e-01
## [1226]  1.319806e-01 -6.647409e-01  5.581474e-03  2.480236e-01 -2.318709e+00
## [1231] -2.201620e+00 -3.859424e-01 -1.479439e+00 -4.408781e-01 -2.905523e+00
## [1236] -1.749530e+00 -1.741869e+00  4.975448e-01 -1.059261e+00  3.684948e-02
## [1241] -5.339779e-01 -2.612326e-01 -7.998068e-01  3.954160e-01  6.795433e-01
## [1246]  6.651856e-01  4.610091e-01 -1.935101e+00  1.633929e-01  9.931670e-01
## [1251]  4.619481e-01  3.874956e-01 -5.098477e-01  6.509842e-01 -2.442153e-01
## [1256]  1.970609e-01 -1.966570e-01  3.454220e-01 -2.827465e-01 -3.628852e-01
## [1261]  6.259007e-02 -1.218699e+00  4.978754e-02 -2.432829e-01 -1.199433e+00
## [1266]  3.683077e-01 -3.198792e-01 -6.179764e-02 -2.278704e-01 -7.387360e-01
## [1271] -7.205581e-01  1.703998e-01 -4.332514e-01 -3.106508e-01  1.063730e-01
## [1276] -8.546027e-02  7.508181e-02  4.249339e-03 -2.442424e+00 -6.611295e-01
## [1281] -2.476022e-01 -3.628074e-01  6.397356e-01 -7.734917e-01 -1.138638e+00
```

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## [1286]  1.003095e+00 -3.459505e-01  2.211897e-01  3.741492e-01  3.218371e-01
## [1291] -4.142966e-01 -1.009853e+00 -1.129999e+00  2.708141e-01  7.839328e-01
## [1296]  5.728340e-01  3.142086e-01 -4.215367e-01  8.971496e-01  1.045246e+00
## [1301]  1.043258e+00 -9.129035e-01 -5.965387e-02  1.046411e+00 -9.181551e-01
## [1306] -2.114479e-01  5.299058e-01 -4.676965e-01 -3.403103e-01  5.389329e-01
## [1311] -2.312574e-01  5.380782e-01 -1.037602e+00  2.987960e-01  8.646154e-01
## [1316] -3.046998e-01  3.807994e-01 -6.037213e-01 -2.634255e-02 -9.363330e-01
## [1321] -7.079109e-01  1.710214e-01  4.931616e-01 -5.811464e-01 -4.102104e-01
## [1326]  5.010232e-01  6.398910e-01  1.021382e+00  6.023698e-01  1.052748e+00
## [1331]  1.620922e+00  1.282282e+00  1.410330e+00  1.343531e+00  8.375726e-01
## [1336]  2.324405e-01 -1.000706e+00 -1.991028e+00 -2.336666e+00 -2.308052e+00
## [1341] -1.651240e+00  9.496344e-01  1.874102e+00  1.710785e+00  9.227506e-01
## [1346]  1.611994e+00 -1.484057e-01  8.256288e-01  7.061257e-01  5.987088e-01
## [1351]  2.399304e+00  1.502847e+00  2.412335e+00  1.635581e+00  2.487499e+00
## [1356]  1.530093e+00  3.771380e-01  1.527802e+00  2.070316e+00  2.321828e+00
## [1361]  8.551668e-01 -1.182041e-01  1.338846e+00  1.469816e-01 -9.148850e-01
## [1366]  8.398645e-01 -3.938071e-02  4.785829e-01  8.261907e-01  8.149105e-01
## [1371]  1.196803e+00  3.527660e-01  1.162136e+00  1.137584e+00  5.993521e-01
## [1376] -1.960017e-01  9.273547e-01 -1.337670e-01 -8.283800e-01  1.022185e+00
## [1381]  2.613962e-01 -8.137617e-01 -1.238341e-01 -1.405582e+00 -7.685185e-01
## [1386] -2.046640e+00 -1.645216e+00  1.596119e+00  1.330999e+00  1.174931e+00
## [1391]  1.115146e+00  9.626210e-01  2.004395e+00  1.335396e+00  9.184814e-01
## [1396]  1.773207e+00  1.864704e+00  2.028757e+00  1.402220e+00  2.046687e+00
## [1401]  1.856532e+00  1.796637e+00  1.601650e+00  1.633096e+00  2.044900e+00
## [1406]  1.763047e+00  1.517891e+00  5.157365e-01  1.793094e+00  1.568203e-01
## [1411]  1.784844e+00  1.529761e+00  2.215028e+00  1.483524e+00  1.938768e+00
## [1416]  1.255257e+00  2.040503e+00  1.796047e+00  1.565294e+00 -1.998885e-01
## [1421]  1.135655e+00  4.349762e-01  1.647530e+00 -1.032428e+00  5.193565e-01
## [1426] -2.665335e-02  1.242299e+00  1.157375e+00 -1.381608e-01  8.607622e-01
## [1431]  3.966781e-01  4.926954e-01  1.053807e+00 -1.206673e+00  3.212932e-01
## [1436] -2.697109e-01  3.774902e-01  4.687997e-01  1.540090e-01  1.039683e+00
## [1441]  1.607834e+00  5.332927e-01  8.049538e-01  9.050573e-01  8.649261e-01
## [1446]  1.155237e-01  3.021830e-01  1.108916e+00  3.817318e-01  1.333019e+00
## [1451]  3.337850e-01 -5.686546e-01  2.179029e+00  1.503068e+00  1.178272e+00
## [1456]  2.592548e-01  1.516058e+00 -1.802344e-01  2.490162e-01  3.337073e-01
## [1461]  1.541327e-01  5.562101e-01 -6.427964e-01 -7.784326e-01  4.424494e-01
## [1466]  7.068480e-02  1.274290e+00  1.476517e+00  2.193851e+00  1.392370e+00
## [1471]  1.765766e+00  8.845052e-01  1.665864e+00  1.667553e+00  1.708452e+00
## [1476]  8.332494e-01 -3.303838e-01  4.397146e-01  1.136640e+00  1.177540e+00
## [1481]  6.136895e-01  9.609756e-01 -3.041635e-01  4.915559e-02  8.152524e-01
## [1486]  1.307619e+00  1.033485e+00  8.408327e-02  1.137926e+00  1.195174e+00
## [1491] -2.983039e+00 -1.807080e+00  2.020791e+00  1.550382e+00  2.094326e+00
## [1496]  4.745813e-01  4.249979e-02  1.582415e-01  1.156225e+00  5.962210e-01
## [1501]  3.063325e-01  6.597582e-01 -8.055686e-01  6.359317e-01 -8.293950e-01
## [1506]  7.153533e-01  3.500143e-01 -9.871716e-02 -3.528660e-01  4.492912e-01
## [1511]  5.843077e-01  7.232953e-01 -1.131197e+00 -3.488949e-01  8.106591e-01
## [1516]  3.261878e-01  1.346754e+00  8.252259e-01 -6.936764e-01  2.683736e-01
## [1521]  1.176212e+00  5.002193e-01  2.450885e-01  3.478199e-01  1.228091e+00
## [1526]  5.696718e-01  9.305132e-02 -1.205164e-01  2.603704e-01 -1.435181e+00
## [1531]  5.979267e-02  4.925784e-01  1.116270e+00 -1.501154e-01  1.459937e+00
## [1536]  4.107182e-01  1.052769e+00  7.287459e-01  5.959527e-01  8.297819e-01
## [1541]  9.011264e-01 -1.048773e+00 -9.480478e-01 -1.563025e+00 -7.114533e-01
## [1546] -2.221397e+00 -2.949125e+00 -2.886854e+00 -1.770614e+00  1.584520e-01
## [1551]  8.434073e-01 -1.261161e+00 -1.863631e-02  1.347893e-01  2.672718e-01
```

```
## [1556] -5.295795e-01 -1.273186e+00 -2.697896e+00 -2.577827e+00  6.660860e-01
## [1561] -4.090449e-01 -7.777334e-01  1.374813e+00  1.609383e-01  2.917114e-01
## [1566] -1.778164e-02 -1.044298e+00  1.209952e+00  1.217814e+00 -2.158449e-01
## [1571]  1.655366e-01  1.835908e-01 -2.282581e+00  1.015975e+00  6.683391e-01
## [1576]  1.027379e+00 -2.188222e+00  1.309914e+00 -2.570744e-01  1.147256e+00
## [1581]  3.375455e-02 -1.325690e+00 -6.426005e-01  1.280923e+00 -1.268351e+00
## [1586] -2.530399e+00  9.120822e-01  1.917888e+00  5.339832e-01  1.338657e+00
## [1591]  4.919942e-01  4.367341e-01  1.442342e+00 -1.075874e-01 -1.080738e+00
## [1596]  6.876162e-02 -1.567350e+00  5.841424e-01  7.323912e-01  1.089149e+00
## [1601]  3.717706e-01 -1.729638e+00  1.352111e-01  3.118078e-01 -1.267906e+00
## [1606]  1.553132e+00  8.475138e-01  3.516537e-02  3.708050e-01  2.623665e-01
## [1611] -5.977647e-01 -6.705929e-02 -1.440554e-01 -6.920669e-01 -4.398460e-02
## [1616] -4.290906e-01  2.660064e-01  6.011757e-01  2.628618e-01 -1.934716e-01
## [1621]  3.324308e-01  7.292466e-01  3.251618e-02  2.769982e-01  2.470168e-01
## [1626]  1.368696e-01  3.941023e-01 -1.351364e+00  1.401096e+00  6.628222e-01
## [1631] -8.072540e-02 -2.286585e+00 -1.718941e+00  1.264558e+00  1.002077e+00
## [1636]  1.245098e+00  6.054583e-01  1.292360e+00  1.279882e+00  2.316420e-01
## [1641]  1.361459e+00  1.580812e+00  1.571429e+00 -6.145504e-01  7.978749e-01
## [1646]  6.870349e-01  7.595007e-01  8.185481e-01 -1.282735e+00  1.111011e+00
## [1651] -5.972944e-01  1.134258e+00  2.832372e-01  1.891199e+00  1.911154e+00
## [1656]  9.023036e-01  1.138615e+00  1.906376e+00  1.470665e+00 -1.750988e+00
## [1661]  1.575409e+00  2.718561e+00  2.283406e+00  2.200837e+00  1.769316e+00
## [1666]  1.984118e+00  1.862585e+00  2.736629e+00  2.715331e+00  3.509996e-01
## [1671]  8.100775e-01  1.992900e+00  1.320534e+00  1.074744e+00  2.199828e+00
## [1676]  2.040302e-01  1.025990e+00  5.899262e-01  1.105430e+00  5.569186e-01
## [1681] -2.193712e+00  8.242092e-01  4.647595e-01  2.895273e-01  8.405616e-01
## [1686]  5.070539e-01 -1.682388e-01  7.088340e-01  7.069157e-01  3.802724e-01
## [1691]  1.460841e+00  3.133488e-01  7.263976e-01  5.886133e-01  5.289582e-01
## [1696]  6.053703e-01 -6.539643e-01  7.438605e-01 -1.467381e-01  3.089070e-01
## [1701]  1.269963e+00  7.356843e-01  5.483970e-02  4.677873e-01  9.485673e-01
## [1706]  6.065805e-01 -2.503035e-01  7.064105e-01  3.010940e-02  3.912746e-01
## [1711] -1.600282e+00 -6.209577e-01  1.033560e+00  9.443282e-01  7.751521e-01
## [1716]  7.202403e-01  6.490772e-01  1.837350e+00  1.148228e+00  1.900538e+00
## [1721]  7.391162e-01  7.148907e-01  1.400277e+00  1.011151e+00  1.169426e+00
## [1726]  4.853519e-01  9.081922e-01  1.572950e-01  1.184366e+00  1.448426e+00
## [1731]  2.310055e+00  2.120993e+00  1.405930e+00  1.060915e+00  1.767095e+00
## [1736]  1.780621e+00 -4.377910e-02  8.257229e-01  1.102199e+00  1.174978e+00
## [1741]  1.431770e+00  2.761016e-01  5.372350e-01  1.308622e+00  6.735045e-01
## [1746]  1.056372e+00  1.180630e+00  1.867026e+00  1.133188e+00  1.365755e+00
## [1751]  8.898204e-01  1.523728e+00  1.999460e+00  1.202232e+00  8.417728e-01
## [1756]  9.886410e-01  1.114312e+00  9.660307e-01 -1.386631e-01  1.009637e+00
## [1761]  4.026814e-01  7.738398e-01  7.129729e-01  6.489766e-01  6.897563e-01
## [1766] -1.564549e+00  5.356202e-01  3.635164e-01  8.807359e-01  2.160424e-01
## [1771]  2.660082e-01  3.759322e-01  1.542667e-01 -3.835447e-01  9.837961e-01
## [1776] -2.175983e-01  5.993131e-01  1.134399e+00  2.955834e-01  2.782217e-01
## [1781] -5.791676e-01 -9.107575e-01 -3.403421e-01  1.055121e-01 -2.970387e-01
## [1786]  1.465952e-01 -2.288028e-01  1.369049e-01  2.035255e-01  6.950053e-01
## [1791]  5.557074e-01  5.790241e-01  3.361614e-01  5.243145e-01  3.646265e-01
## [1796]  7.244799e-01  6.620988e-01  6.435258e-01  4.552715e-01  4.598140e-01
## [1801]  1.076258e+00  4.817177e-01  9.015301e-01  1.229485e+00  6.372673e-01
## [1806]  6.701738e-01  1.711237e-01 -1.957410e+00  6.991442e-01  9.282788e-01
## [1811] -2.382913e-01 -1.925412e+00  8.021037e-01  3.287929e-01  1.514037e+00
## [1816]  1.433385e+00  1.096648e+00  1.131775e+00  5.858885e-01  1.675441e+00
## [1821]  1.505356e+00 -1.596144e+00 -2.994617e-01  4.564822e-01  6.544269e-01
```

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## [1826]  1.057281e+00  5.267370e-01  1.042341e+00  1.414711e+00  4.428552e-01
## [1831]  8.463148e-01  8.667049e-01  1.939358e-01  1.232311e+00  1.115624e+00
## [1836]  2.771105e-01 -1.206959e-01  7.788866e-01  1.208187e+00  3.739128e-01
## [1841] -7.183648e-01  6.423135e-01  2.276500e-01  4.222219e-02  4.930229e-01
## [1846]  1.002221e-02  1.337754e-01  2.809465e-01  2.942706e-01  4.929217e-01
## [1851]  3.010337e-01  2.770099e-01 -3.899043e-01 -6.471011e-01 -1.086838e-01
## [1856] -4.051466e-01 -1.299822e-01  6.584242e-02 -3.529601e-01  1.005195e+00
## [1861] -1.305334e+00  3.323836e-02  7.250392e-02  2.990761e-02  3.085039e-01
## [1866] -1.344196e+00 -5.596862e-01 -7.549055e-01 -1.525688e+00 -1.254057e+00
## [1871] -4.690807e-02 -6.373095e-01 -1.868118e-01 -1.639993e-01  4.807654e-02
## [1876]  9.955656e-02 -1.137684e-02 -1.759466e+00 -6.124204e-02  4.039932e-01
## [1881] -1.245319e-01 -1.301297e+00  3.235439e-01  2.103893e-01  5.862920e-01
## [1886]  7.023737e-01 -4.037331e-01  1.580010e-01  7.211486e-01 -4.513037e-03
## [1891] -2.369795e-01 -7.944739e-01 -1.037438e+00  8.128647e-02 -2.245637e-01
## [1896]  7.008197e-02  1.501278e-01  3.845119e-01 -1.740893e+00  5.326925e-01
## [1901]  1.446770e-01  6.842044e-01  4.113618e-01  1.926239e-01  9.337385e-01
## [1906]  1.730357e+00  1.778381e+00  1.427560e+00  2.050353e+00  1.118260e-01
## [1911] -2.439115e+00  2.781002e+00  1.770908e+00  1.883348e+00  7.998115e-01
## [1916]  2.954868e-01 -1.705110e+00  1.100899e+00  2.072462e+00 -2.988045e+00
## [1921] -1.107424e+00  1.972669e+00  2.882970e+00  2.224132e+00  2.134889e+00
## [1926]  1.743004e+00  2.232693e+00  1.441450e+00  2.645677e+00  4.702218e-02
## [1931] -1.006397e-01  1.451766e+00  1.224743e+00  1.725448e+00  1.192675e+00
## [1936] -9.048865e-01  1.200490e+00  3.985111e-01 -2.855718e+00 -2.886932e+00
## [1941]  6.030692e-01  1.606001e+00  1.049565e+00  1.198580e+00  1.879495e+00
## [1946]  9.307400e-01  1.918958e+00  1.974456e+00  1.955657e+00  1.489475e+00
## [1951]  1.705871e+00  1.013831e+00  2.271147e+00 -2.769510e-01  2.294343e+00
## [1956]  2.250126e+00  1.589578e+00 -7.686285e-01  1.998580e-01  2.178128e+00
## [1961]  6.373588e-01  8.860565e-01  3.314857e-01  6.055238e-01  5.408753e-01
## [1966]  1.875952e+00  1.826328e+00  1.242253e+00  1.268681e+00  1.790562e+00
## [1971]  2.102075e+00  2.246661e+00  1.819166e+00 -1.902600e+00 -7.957864e-01
## [1976] -4.655088e-01 -3.405443e-01 -5.810857e-01 -8.514047e-01 -7.298722e-01
## [1981] -6.160117e-01 -8.747221e-01 -6.338777e-01 -4.130198e-01  2.886180e-01
## [1986] -2.781633e-01 -1.401772e-01 -7.535931e-01  1.801071e-01  3.371703e-01
## [1991] -2.599943e-01 -3.805169e-01  5.210840e-01  5.131095e-01 -1.501710e-01
## [1996]  5.271967e-02  1.737475e-01 -4.085790e-01 -2.569660e-01 -1.042586e+00
## [2001]  1.698666e-02  5.770053e-01 -7.720655e-01  1.009691e-01  2.990144e-01
## [2006] -8.614987e-01 -1.184307e+00 -4.236609e-02  4.464466e-02 -8.987459e-01
## [2011] -7.295126e-02 -6.056148e-01 -6.498269e-01 -5.622103e-01 -8.879449e-01
## [2016] -6.690053e-01 -1.206917e+00 -3.363048e-01 -1.103050e+00 -6.768786e-01
## [2021] -5.716984e-01 -3.969704e-01  6.281409e-02 -2.044766e-01 -4.630863e-01
## [2026] -1.184753e-01 -3.736531e-01 -3.564931e-01 -4.757043e-01  1.908063e-01
## [2031] -8.313175e-01 -1.193836e-01 -2.650410e-01  1.432640e-01  1.691044e-01
## [2036]  8.532374e-02  2.072598e-01  8.431429e-02  3.990038e-02  1.033256e+00
## [2041]  5.615612e-01  3.430247e-01  1.060163e-01  3.675537e-01 -2.262352e+00
## [2046] -1.089867e-01 -9.737864e-02  1.604235e-01  5.685859e-02 -9.358462e-03
## [2051]  3.192032e-01  5.239099e-01  9.420642e-02  7.013633e-01  9.228816e-02
## [2056]  2.306778e-01 -4.851924e-01 -2.254242e+00 -4.218475e-01 -3.946425e-01
## [2061]  2.712803e-01 -1.655212e-01 -1.857969e-01 -6.203769e-01 -2.415276e-01
## [2066] -6.136031e-01 -2.445261e-01 -4.940785e-01  2.474623e-01 -1.824099e-01
## [2071] -1.829538e-01 -8.335419e-01 -1.618175e-02 -3.564998e-01 -4.069902e-02
## [2076]  3.978895e-01 -4.734143e-01  8.185569e-02 -1.153973e+00 -2.258821e-01
## [2081]  4.399630e-01 -3.924210e-01 -1.559042e-01 -1.820991e-01 -6.663812e-01
## [2086]  8.420864e-01 -2.486900e-01  1.787480e-02 -1.557184e+00  5.237534e-01
## [2091] -1.639990e-01 -3.156694e-01 -9.002880e-01  7.929282e-01  7.185534e-01
```

```
## [2096]  1.027891e+00  1.468919e-02  9.338330e-02  1.052066e+00 -1.603789e-01
## [2101] -1.780587e+00 -1.923541e+00 -1.168841e+00 -5.242042e-01  1.764169e-02
## [2106] -1.441279e+00  1.684574e-01 -1.085704e+00 -1.220564e+00  2.471515e-01
## [2111] -7.813851e-01 -7.058449e-01 -1.597891e-01 -3.717109e-01 -9.039399e-01
## [2116] -5.027948e-01 -1.012883e+00 -2.083306e+00 -7.490062e-01 -1.121781e+00
## [2121] -1.272286e+00 -1.707533e+00 -2.373456e+00 -2.558639e+00 -2.752461e+00
## [2126] -2.926395e+00 -2.988201e+00 -1.535580e+00 -2.180489e+00 -8.550385e-01
## [2131] -1.336525e+00 -1.888307e-01  6.489760e-01  6.350461e-01 -2.309693e+00
## [2136] -4.185712e-01  4.682925e-01  9.617912e-01  1.540649e-01  1.277193e-01
## [2141] -2.722447e-02  8.764606e-02  3.007313e-01  1.061179e-01 -7.678623e-02
## [2146] -1.774607e+00 -1.568385e+00 -1.721210e+00 -2.708954e-01 -3.055178e-01
## [2151] -1.147399e-01 -7.466671e-02 -1.042889e+00 -2.804846e-01  2.657685e-02
## [2156] -3.167223e-01 -2.450545e-01 -1.010487e+00 -5.197136e-01 -8.485782e-01
## [2161] -2.040182e+00 -9.598145e-01 -5.886561e-01 -1.037236e+00 -3.070325e-01
## [2166] -7.174565e-01 -7.875090e-01 -7.304776e-01 -6.427603e-01 -1.034713e+00
## [2171] -6.202507e-01 -1.459066e+00 -5.766439e-01 -4.305829e-01 -3.325700e-01
## [2176] -5.087110e-01 -7.250268e-01 -3.486193e-01 -5.103263e-01 -1.029363e+00
## [2181] -8.546349e-01 -3.606315e-01 -3.637605e-01  1.242874e-01 -2.765480e-01
## [2186] -2.757403e-01 -3.072338e-01 -5.839118e-01 -6.682983e-01 -1.150694e+00
## [2191]  1.225952e+00  1.870720e-01  1.321606e-01 -2.561578e-01 -2.476787e-01
## [2196] -5.242562e-01 -3.481146e-01 -7.031226e-01 -7.213931e-01 -1.513812e-01
## [2201]  1.234403e-02  2.330001e-01  9.935477e-02  3.727613e-02 -1.902437e-01
## [2206] -8.581674e-01 -2.372819e-01 -1.034006e+00 -5.027560e-01 -2.012464e-01
## [2211] -3.086473e-01 -3.265138e-01 -2.729143e-01 -6.164152e-01  9.416346e-03
## [2216] -8.849595e-02  2.460212e-01 -6.687024e-01 -1.767238e+00 -1.124953e+00
## [2221] -4.695465e-01 -5.839123e-01 -1.029363e+00  4.045991e-01 -6.962000e-02
## [2226] -1.054396e+00 -4.139281e-01 -1.196016e+00  6.675072e-02 -7.123532e-02
## [2231] -1.682145e+00 -1.343793e+00 -7.230084e-01 -1.119907e+00 -1.222563e+00
## [2236] -9.074267e-01 -4.971034e-01 -6.033936e-01 -8.990487e-01 -1.064389e+00
## [2241] -9.016730e-01 -1.859902e+00 -1.302104e+00 -1.018966e+00 -8.494869e-01
## [2246] -1.023609e+00 -4.407790e-01 -1.199448e+00 -6.376130e-01 -1.205202e+00
## [2251] -8.466604e-01 -8.448434e-01 -1.224582e+00 -1.012001e+00 -1.250119e+00
## [2256] -1.607953e+00 -1.113648e+00 -7.629805e-01 -8.087068e-01 -5.091150e-01
## [2261] -1.094066e+00 -2.869448e-01 -1.962356e+00 -7.011042e-01 -1.094268e+00
## [2266] -8.109275e-01 -1.134341e+00 -3.856648e-01 -5.300099e-01 -4.375483e-01
## [2271] -7.048390e-01 -5.239532e-01 -1.175828e+00 -5.804805e-01 -5.982902e-02
## [2276]  1.042579e-02 -6.925244e-01 -6.869725e-01 -1.955896e+00 -6.238844e-01
## [2281] -1.010992e+00 -5.994570e-01 -3.536665e-01 -9.125746e-01 -4.377501e-01
## [2286]  4.471959e-01 -3.960621e-01 -5.720013e-01 -3.111709e-01 -6.357959e-01
## [2291] -5.457569e-01 -9.579980e-01 -2.520185e+00  4.641696e-01  5.503922e-02
## [2296] -9.055655e-02  9.599333e-01  4.590733e-01 -1.605343e-01  9.737920e-01
## [2301]  1.829375e-01 -1.856415e-01 -1.705398e-01  3.469442e-01 -1.119659e-01
## [2306]  3.010175e-01 -6.933531e-01  4.018980e-01  7.032963e-01  1.739421e-01
## [2311] -6.040320e-01  4.762729e-01  3.982003e-01  2.209566e-01  1.115929e-01
## [2316]  6.919701e-01  4.280929e-01  6.039698e-01  5.608085e-01  6.597006e-01
## [2321] -2.241174e-02 -1.666593e+00  6.366595e-01 -1.040833e+00  4.459917e-01
## [2326]  3.091900e-01  3.727824e-01  9.333736e-02  4.500002e-01  6.049798e-01
## [2331] -1.807783e-01 -7.903028e-01 -4.181497e-01  2.556347e-01 -1.219490e+00
## [2336] -5.727867e-01  2.842382e-01 -2.764848e-01  7.368325e-02 -1.229947e+00
## [2341] -1.122915e+00  6.174716e-01 -3.350586e-01 -7.147625e-01 -4.698402e-01
## [2346] -1.456340e-01  3.948134e-01 -1.241469e-01 -8.193408e-01 -8.302326e-01
## [2351] -2.041301e-01 -2.793596e-01 -5.724524e-02 -2.814257e-01 -1.423931e-02
## [2356]  2.685150e-01 -7.588927e-02  4.905199e-01  5.686701e-01 -1.850976e-01
## [2361]  7.793805e-01  5.811536e-02  8.233188e-01 -7.566029e-01  9.149390e-01
```

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## [2366]  6.973771e-01 -1.058913e-01 -8.229608e-01 -2.734863e-01 -4.607436e-02
## [2371]  1.313247e-01 -3.676706e-01 -5.999458e-01 -9.829590e-01  3.145193e-01
## [2376] -6.924985e-01 -2.795069e+00 -7.347960e-01  2.395726e+00  2.276988e+00
## [2381]  9.736034e-01 -1.304398e+00 -5.180121e-01 -1.855319e+00 -4.907255e-01
## [2386]  1.028861e+00 -2.032913e+00 -2.791450e+00 -2.919176e+00 -1.318210e+00
## [2391]  1.139636e+00  1.605298e+00 -1.964747e+00  2.032474e+00  3.509109e+00
## [2396]  2.901322e+00  1.773643e+00  2.171883e+00  1.742737e+00  2.499845e+00
## [2401]  3.922570e+00  1.159241e+00  1.054820e+00 -9.588384e-02  1.197487e+00
## [2406]  8.814887e-01  1.616961e+00  8.861539e-01 -4.923944e-01  2.421127e-01
## [2411]  9.306725e-01  1.692487e+00  5.311860e-01  6.465656e-01  1.118321e+00
## [2416]  1.887394e+00 -4.535264e-02  1.761980e+00  1.126324e+00  9.133795e-01
## [2421]  5.601012e-01  1.174845e+00  8.262314e-01  9.423557e-01  4.629997e-01
## [2426]  1.100226e-01  9.153703e-01  9.636905e-02  1.506209e-01  1.316184e+00
## [2431]  1.041810e+00  7.447740e-01  1.523177e+00 -4.398490e-02  5.541495e-01
## [2436]  8.385578e-01  1.284293e+00  7.121586e-01 -1.087553e+00  9.423150e-01
## [2441]  1.405725e+00  9.569537e-01  1.145567e+00  1.307537e+00  1.283413e-01
## [2446] -6.609298e-01 -9.445146e-02  1.676913e-01  1.051080e-01  4.661725e-01
## [2451] -1.036371e-01 -7.651006e-01 -1.473905e+00  7.613862e-02  4.598134e-01
## [2456]  2.940289e-02  3.580657e-01  8.399557e-01  5.198732e-01  3.418140e-01
## [2461]  5.433499e-02  1.975695e-01  2.457182e-01 -1.381589e-01 -9.910057e-01
## [2466]  1.222675e-01 -2.583790e-01 -2.651847e-02 -4.803475e-01  1.631489e-01
## [2471] -5.258715e-01 -1.511218e-02 -2.439444e-01 -4.177641e-01 -1.433024e+00
## [2476] -3.746626e-01 -3.137951e-01  5.712516e-01 -5.173923e-01 -1.896442e+00
## [2481] -1.567314e-01 -1.087849e-01 -4.293722e-01  3.613959e-01 -1.772226e-01
## [2486] -4.198841e-01 -6.517916e-02 -5.883536e-01 -7.385531e-01 -8.306111e-01
## [2491] -1.078925e+00 -7.896290e-01 -9.137858e-01 -8.687660e-01 -8.206179e-01
## [2496] -7.779198e-01 -9.753598e-01 -1.118594e+00 -6.288304e-01 -6.874772e-01
## [2501] -3.851600e-01 -1.049955e+00 -2.769520e-01 -2.617098e-01 -6.341806e-01
## [2506] -3.871789e-01 -7.247244e-01 -3.234855e-01 -2.366765e-01  2.425893e-01
## [2511] -9.324022e-02  1.860197e-02 -1.420955e-01 -3.193471e-01 -3.338226e-02
## [2516] -8.126434e-01  5.100423e-02 -2.589844e-01 -2.242608e-01 -2.327399e-01
## [2521]  1.038973e-01 -2.028612e-01  2.869587e-02  4.642548e-01  3.330319e-01
## [2526]  3.614971e-01  4.535115e-02 -4.135665e-02 -4.866054e-01 -2.255589e+00
## [2531] -4.854948e-01 -6.749604e-01 -6.690048e-01 -5.253667e-01 -5.795717e-01
## [2536] -4.756027e-01 -8.348515e-03  1.636541e-01 -7.845818e-01 -9.939327e-01
## [2541] -3.471052e-01 -3.744603e-01 -7.402691e-01  2.685308e-01 -1.185417e+00
## [2546] -1.265362e+00 -1.212166e+00 -1.191978e+00 -9.656694e-01 -2.188968e+00
## [2551] -1.583527e+00 -1.530634e+00 -9.234762e-01 -1.322191e+00 -7.794340e-01
## [2556] -1.139994e+00 -1.325623e+00 -1.614212e+00 -1.248000e+00 -1.549812e+00
## [2561] -6.548731e-01 -1.167449e+00 -1.429088e+00 -1.331579e+00 -1.764917e+00
## [2566] -1.467748e+00 -1.838906e+00 -1.812359e+00 -1.735038e+00 -1.729487e+00
## [2571] -2.207541e+00 -1.526899e+00 -1.735442e+00 -1.819727e+00 -1.575249e+00
## [2576] -1.629252e+00 -8.603881e-01 -8.217279e-01 -1.690322e+00 -1.452102e+00
## [2581] -7.884174e-01 -4.184706e-01 -4.198836e-01 -1.040769e+00 -7.674218e-01
## [2586] -4.596539e-01 -6.327671e-01 -1.396080e+00 -1.635006e+00 -1.234676e+00
## [2591] -1.078117e+00 -2.056332e+00 -1.320475e+00 -8.927904e-01 -1.098002e+00
## [2596] -1.142517e+00 -9.863620e-01 -7.195760e-01 -1.210551e+00 -9.650636e-01
## [2601] -9.294317e-01 -8.832006e-01 -1.191170e+00 -5.530242e-01 -5.230449e-01
## [2606] -9.794981e-01 -7.501612e-01 -8.348506e-01 -2.918909e-01 -1.127275e+00
## [2611]  8.495571e-01  2.637288e-01  1.524183e+00  9.014561e-01  1.019872e+00
## [2616] -5.116373e-01  5.940437e-01  6.116988e-01  3.545367e-01  4.283530e-01
## [2621]  1.761699e+00 -3.114625e-01 -1.600005e+00 -9.700435e-03  6.782161e-01
## [2626] -1.190004e+00  1.431343e+00  1.731054e+00  1.333196e+00  1.387810e+00
## [2631]  4.496881e-01  1.819207e+00  1.553761e+00  1.868192e+00  6.060079e-01
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## [2636]  5.295170e-01 -4.381426e-01  1.591384e+00  4.384721e-02  5.183010e-02
## [2641]  4.645874e-01 -7.748526e-01  6.748781e-01 -6.745231e-01 -6.228991e-01
## [2646] -3.330106e-01 -4.918536e-01 -1.503411e-01 -2.456469e-01  2.308821e-01
## [2651] -2.575602e-01 -1.413143e+00 -7.499735e-01 -6.983495e-01 -4.243453e-01
## [2656]  2.110267e-01  3.857540e-01  2.983903e-01 -1.349606e+00  3.409035e-01
## [2661] -4.408984e-01  1.331205e+00  1.417026e+00  1.169235e+00  3.055932e-01
## [2666] -4.278881e-01  1.605941e+00 -9.202340e-01 -1.025600e-01  2.347527e-01
## [2671]  3.219416e-01 -4.500647e-01  1.375345e+00  2.118369e+00  7.646542e-01
## [2676]  2.089903e+00 -4.205901e-01 -8.091103e-01 -1.269539e-01 -7.075639e-01
## [2681]  2.012583e+00  2.862806e+00  1.372922e+00  1.337391e+00  5.331977e-01
## [2686]  2.109890e+00 -3.783969e-01  1.242608e+00  4.757284e-02  2.533134e+00
## [2691] -5.082057e-01  5.879078e-01  6.093069e-01  2.395615e-01  6.423145e-01
## [2696]  8.230992e-01  1.809692e+00  5.467235e-01  7.088345e-01  9.417045e-01
## [2701]  6.602822e-01 -6.646641e-01 -1.285853e+00  3.270769e-01  2.500595e-01
## [2706]  1.703806e+00  3.204149e-01  1.025384e+00  4.878407e-02 -1.947013e+00
## [2711]  4.908649e-02  3.688666e-01  2.146294e-01  1.394285e-01  2.492513e-01
## [2716] -3.145016e-01  1.605287e+00 -8.522119e-01  2.016073e-01  1.844314e+00
## [2721]  9.566433e-01  7.624330e-01  1.356771e+00 -1.396725e-01  7.541567e-01
## [2726]  4.086364e-01  9.940923e-01  1.719956e+00  1.843406e+00  1.706430e+00
## [2731]  2.042058e+00  6.134453e-01  3.366802e+00  2.897629e+00  2.685250e+00
## [2736]  9.107796e-02  1.143686e+00  1.408958e+00 -1.248916e+00 -4.257377e-02
## [2741] -4.394397e-01  1.225106e-01  8.583582e-01  1.045997e+00 -6.848372e-01
## [2746]  1.816159e+00  5.044470e-01  3.249785e-01 -2.642180e+00  3.611989e-01
## [2751]  2.183883e+00  1.642359e+00  6.090481e-01  8.979207e-01  1.399140e+00
## [2756]  1.516467e+00  2.383763e-01  5.255403e-01  8.115662e-01  5.766401e-01
## [2761]  3.247308e-01  4.396560e-01  1.223014e+00  7.251364e-01 -3.137202e-01
## [2766]  7.899525e-01  8.909388e-01  5.845876e-01  2.347866e-01  1.699500e+00
## [2771]  1.484070e-01 -2.111944e+00  4.530494e-01 -5.635257e-01  5.650633e-02
## [2776]  5.802549e-01  6.325429e-01  1.742702e+00 -3.801840e-02  4.639189e-01
## [2781]  5.459909e-01  5.250449e-01  3.863773e-01 -1.913429e-01  6.644807e-01
## [2786]  2.868269e-01  7.592531e-01 -6.215323e-01 -5.781073e-01  9.840527e-01
## [2791] -2.126838e-01 -1.471749e-01  1.420456e+00  1.750463e-01  3.101242e-01
## [2796] -2.073570e+00 -2.609301e+00 -1.284831e-01  5.475992e-01  3.799157e-01
## [2801]  9.864040e-01  5.620083e-01  8.479841e-01  2.210703e-01 -8.386996e-02
## [2806]  1.510921e+00  1.708611e+00  1.453112e+00 -4.826170e-01 -1.073088e+00
## [2811] -2.759259e+00 -5.800386e-01  7.491767e-01  2.856136e-01  8.825209e-01
## [2816] -3.053525e-01  8.981433e-01  2.099410e+00  1.347247e+00 -4.478325e-01
## [2821]  2.001996e-01  2.040872e-01  1.794050e+00  1.634511e+00 -6.166791e-01
## [2826]  4.101950e-01  6.657190e-01  9.876925e-01  1.364244e-01  2.533059e-01
## [2831]  2.739038e-01  1.108882e+00  5.706738e-01  1.208159e+00 -1.200688e+00
## [2836]  1.503494e+00 -5.567162e-01  1.016399e-01  1.022972e+00  2.042172e+00
## [2841]  1.151589e+00  5.599046e-01  1.027775e+00 -4.305014e-01  5.502735e-01
## [2846]  2.513746e-01 -2.680913e-01  2.074543e-01  5.299232e-01  3.356004e-01
## [2851]  6.045429e-01 -8.655190e-01 -1.380391e-01  2.501363e-01  7.137244e-01
## [2856] -7.736434e-01  4.479654e-02  3.103719e-01 -1.872578e-01  1.678668e-01
## [2861]  1.578074e-02 -2.400411e-01  4.601316e-01 -5.370588e-01 -1.895840e-01
## [2866] -1.304076e+00  8.487941e-02 -1.139264e+00 -1.670218e+00 -2.932948e-01
## [2871] -2.750482e-01 -3.777431e-01 -1.116474e-01 -8.712626e-01 -6.064052e-01
## [2876] -3.136701e-01 -4.232610e-02 -1.578317e+00 -4.856504e-02 -4.381762e-01
## [2881] -2.563063e-01 -1.063991e-01  5.658708e-01  9.243966e-03  4.063325e-01
## [2886]  4.446816e-01 -4.544557e-02  4.130668e-01  5.554071e-02 -1.057688e+00
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## [2896]  7.282165e-02 -7.015368e-02 -2.673483e-01 -9.132516e-01 -1.574282e+00
## [2901] -1.617682e+00 -2.349653e-01  2.441450e-01  2.161199e-01  1.031613e+00
```

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## [2906]  7.288265e-01  3.717957e-01 -1.307939e+00  3.514204e-01  1.964123e-01
## [2911]  5.239068e-01  3.926915e-01  9.511994e-01 -4.566817e-02  9.908372e-01
## [2916]  1.769776e-01  5.930306e-01  7.312029e-01  7.165962e-01  1.249183e+00
## [2921]  1.145820e+00  4.356211e-01  5.471540e-01  1.024656e+00  8.514515e-01
## [2926]  9.540099e-02  2.815787e-01 -2.416745e-01 -2.961176e-03  2.645704e-01
## [2931]  5.258381e-01  7.596620e-02 -1.064645e+00 -2.773172e+00  2.276322e-01
## [2936]  1.724222e-01  7.046136e-01  8.797382e-02  3.727864e-01  5.536826e-02
## [2941]  3.257216e-01 -1.020032e+00 -1.531411e-01 -1.488334e-01 -4.897714e-01
## [2946]  4.536200e-01 -7.193991e-01 -6.267635e-02 -1.749774e-01  1.429110e-01
## [2951] -2.733897e-01 -1.536364e-01 -7.525000e-01 -3.011922e-01 -4.833349e-01
## [2956] -1.937193e-01 -5.658270e-01 -9.704071e-02 -3.170372e-01 -2.522463e-01
## [2961] -4.528331e-01 -1.608410e-01 -2.306576e-01 -2.549036e-02 -2.882189e-01
## [2966] -2.786630e-01  6.704970e-01 -1.177194e+00  1.001207e-02 -1.173108e+00
## [2971] -1.754443e+00  3.348574e-01 -9.533206e-02  3.699146e-01  3.180467e-01
## [2976]  6.426945e-01 -1.966162e-01  1.412275e-01  4.807296e-01 -2.464776e-01
## [2981] -1.018187e-01 -8.216129e-02  3.801885e-01  3.372948e-02 -2.918338e-01
## [2986]  1.038125e+00  7.216219e-01 -7.589728e-02  7.125111e-01  3.221569e-01
## [2991] -1.656190e-01 -2.964399e+00 -1.222900e+00  5.827837e-01  4.952936e-01
## [2996]  2.068837e-01  9.689991e-01  9.711391e-02  4.803129e-01  2.657397e-01
## [3001]  5.029142e-01  7.251486e-01  3.691754e-01  4.187621e-01  3.881983e-01
## [3006]  1.350851e+00 -4.630968e-01 -1.677095e-01  4.919625e-02  6.436304e-01
## [3011]  1.672502e-01  8.907784e-01  7.357653e-01  4.826455e-01  2.707062e-01
## [3016]  7.224538e-01  2.909952e-01  2.563688e-01 -1.813630e-01  4.207121e-01
## [3021] -7.675130e-01  5.082226e-01 -5.489382e-01  6.110150e-01 -2.175772e-01
## [3026] -3.293986e-01 -1.673879e-01 -3.896021e-01  9.343391e-02  6.635978e-01
## [3031]  1.852676e-01  5.737954e-01  7.400683e-01  1.824915e-01  1.136941e+00
## [3036]  8.472449e-01 -5.728869e-01 -7.229335e-01 -4.762424e-02  1.076900e-01
## [3041]  3.678483e-01 -3.932414e-01 -5.043586e-01  7.250877e-01 -1.668032e+00
## [3046] -1.510667e+00  1.225156e+00  4.549965e-01  1.020235e+00  9.739453e-01
## [3051]  1.567435e+00  2.953387e-01  1.086752e+00  3.126316e-01  4.520614e-01
## [3056]  1.004248e+00  4.879539e-01 -2.366001e-01  1.021521e+00 -5.210083e-01
## [3061]  1.170241e+00 -3.133685e-02  1.124334e+00  9.367257e-01  8.415743e-01
## [3066]  8.256084e-01 -1.258451e-01  2.158250e+00 -1.451127e+00 -1.563886e-01
## [3071]  7.557124e-01  1.364846e+00  2.704049e-01  3.399183e-01  9.755940e-01
## [3076]  2.637084e-01  1.436993e+00  2.973090e-01  5.677421e-01  1.252019e+00
## [3081]  1.373130e+00 -1.290484e+00  6.442533e-01  4.216972e-01  9.975724e-01
## [3086]  1.727093e+00  2.007520e+00  1.157894e+00 -1.517844e-01  1.148926e+00
## [3091]  1.413346e+00  4.939258e-01  6.662316e-01  1.345522e+00  9.196934e-01
## [3096]  4.227433e-01  1.402005e+00  9.821684e-01  1.665220e+00  3.801544e-01
## [3101] -3.879127e-01 -5.745559e-01  5.445383e-01 -5.938394e-01  9.427179e-01
## [3106] -7.060809e-02  7.760015e-01 -1.477828e-01  9.838985e-01  1.000287e-01
## [3111]  5.624337e-01  9.572583e-02  9.446679e-01 -2.891829e-01  7.760218e-01
## [3116]  3.515202e-01  4.286950e-01 -6.530984e-01  7.980001e-01  1.386361e+00
## [3121]  5.544509e-01 -3.982688e-01  5.607851e-01  5.521386e-01  6.316256e-01
## [3126]  7.360870e-01  8.784722e-01  8.615214e-01  8.172634e-01 -2.404114e-01
## [3131]  8.347067e-01  1.026292e+00  1.473257e+00 -1.409909e+00 -1.357359e-01
## [3136]  3.506971e-01  1.118350e+00  9.713409e-02  2.216180e+00 -1.073676e+00
## [3141]  9.930823e-01  1.326086e+00  1.825741e+00  8.806348e-01  2.113927e+00
## [3146]  1.202837e+00  4.728345e-01  5.925500e-01  1.958541e-01  1.097354e+00
## [3151]  7.465859e-01 -2.898237e-03  1.492032e+00  4.731380e-01  1.139346e+00
## [3156]  8.300636e-01  5.626723e-01  1.095840e+00  1.178712e+00  1.108660e+00
## [3161]  5.336013e-01  1.304081e+00  5.261954e-02 -1.269702e+00 -1.469399e-01
## [3166]  3.303070e-01  1.882837e-01  1.247554e+00 -3.423609e-01  6.723945e-01
## [3171]  7.688932e-01  5.625322e-02  3.853201e-01 -3.857654e-01 -5.229438e-01
```

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## [3176] -5.623105e-01 -1.218449e-02 -1.472088e+00  2.673201e-01 -3.181354e-01
## [3181] -3.019848e-01  1.522478e-01  7.431540e-01  3.776481e-01  3.091093e-01
## [3186] -1.846073e+00 -1.485008e+00  2.618693e-01  4.842413e-01  3.208185e-01
## [3191] -1.844256e+00 -1.725045e+00 -5.505006e-01  3.482742e-01  2.415439e-02
## [3196] -1.173001e+00 -1.863738e+00  1.379382e+00  1.229991e+00  1.801314e+00
## [3201] -4.545060e-01 -8.053755e-01 -2.297782e+00 -2.230556e+00 -2.190078e+00
## [3206] -1.157456e+00  6.355513e-01 -1.674373e+00 -3.619434e-01  1.236249e+00
## [3211]  5.789235e-01  7.737392e-01  6.154642e-01 -1.636116e+00 -8.129458e-01
## [3216] -1.701930e+00  6.063797e-01 -4.521842e-01 -4.073667e-01  6.939958e-01
## [3221]  7.918075e-01 -2.498994e-01 -9.051049e-01  3.370702e-01  7.296292e-01
## [3226] -9.707519e-02 -3.072343e-01  9.833931e-01  3.227362e-01 -2.150752e-01
## [3231]  7.135783e-01  1.324976e+00  5.552021e-01 -8.418151e-01 -2.055020e+00
## [3236]  5.012997e-01  2.994194e-01  6.517015e-01  1.083627e+00  4.148948e-01
## [3241]  6.680543e-01  1.165691e+00  7.383091e-01  1.915478e+00 -9.386168e-01
## [3246] -1.379223e+00 -3.376172e-01 -6.992294e-02  2.440028e-01  5.782166e-01
## [3251] -1.706618e-01  1.537185e-02 -7.941149e-02  5.924493e-01 -1.410273e-02
## [3256]  2.559133e-01  5.740781e-01  9.518986e-01  7.124677e-01 -8.052157e-02
## [3261]  4.779823e-01  5.291595e-01  1.236450e+00  2.982072e-01  4.757617e-01
## [3266]  1.088269e+00  7.594047e-01  3.060804e-01  7.335638e-01 -2.563601e-01
## [3271]  1.369044e-01 -1.185764e-01  5.432906e-01  5.040251e-01  4.846444e-01
## [3276] -1.482528e-01  8.518662e-01  7.280124e-01 -9.156029e-01 -1.926662e-01
## [3281] -3.262109e-01 -8.425640e-02 -4.479452e-01  5.966884e-01 -5.861729e-02
## [3286]  1.532567e-01  1.291318e-01 -2.385943e-01 -3.268162e-01 -4.811546e-01
## [3291] -4.448157e-01 -1.817646e-01 -5.330377e-01 -6.296381e-01  2.556109e-01
## [3296] -6.440727e-01 -2.244626e-01 -6.380161e-01 -3.925286e-01  1.330689e-01
## [3301]  6.096093e-01 -8.808793e-01 -2.389983e-01 -3.608333e-01 -3.731888e-02
## [3306] -1.875183e-01 -1.267521e-01 -2.695830e-01  3.212828e-02  8.201715e-01
## [3311]  5.391527e-01  7.192304e-01 -2.346576e-01 -2.783033e-02  2.879702e-02
## [3316]  2.311830e-01  2.062509e-01  8.088239e-02 -5.023933e-02 -2.520609e-02
## [3321]  4.464515e-02 -9.242838e-01  2.741839e-01  7.620295e-01  5.964866e-01
## [3326]  5.487419e-01  3.353537e-01  3.273365e-02  3.701780e-01 -2.322369e+00
## [3331] -9.844187e-01  6.147153e-01 -6.833406e-01 -4.591155e-01  2.827314e-01
## [3336] -2.702700e-03  3.672254e-01  5.615095e-01 -3.400560e-01  6.137098e-01
## [3341]  4.613714e-01  6.695697e-01  3.994989e-01  2.254630e-01  9.483073e-01
## [3346] -1.384321e-01  1.050765e-01  7.494189e-01  4.749639e-01  4.430526e-01
## [3351] -4.381832e-01 -1.733802e-01  7.048597e-01 -1.334946e-03 -4.185375e-01
## [3356] -1.400332e-02  7.920079e-01  4.786439e-01  5.415015e-01  5.914944e-02
## [3361] -2.116459e-01  1.898718e-01 -1.783151e+00 -1.906934e-01 -1.178419e-01
## [3366]  3.209564e-01  2.893668e-01 -7.665076e-01 -1.122782e+00 -1.106474e+00
## [3371] -1.071547e+00 -3.330716e-02 -7.448711e-01 -9.654568e-01  4.416882e-02
## [3376] -4.072572e-01 -8.523490e-01  2.082108e-01 -8.999248e-01 -6.906396e-01
## [3381]  1.488571e+00  1.188457e+00 -1.022180e-01  1.381455e+00  3.738812e-01
## [3386] -1.003360e+00 -2.383236e+00  4.224420e-01 -3.606869e-01 -5.432879e-01
## [3391] -1.851639e+00 -3.613911e-01 -2.023643e+00 -7.535582e-01 -1.728236e+00
## [3396] -2.295820e-01 -1.204300e+00  4.929610e-01 -5.200028e-01 -1.129458e+00
## [3401]  2.457521e-01 -4.764457e-02 -3.274283e-01 -1.092198e+00 -3.919346e-01
## [3406]  2.746875e-01  4.237082e-01  1.160352e-01 -1.649351e+00  8.046153e-01
## [3411]  9.207396e-01  8.089792e-01  3.455890e-01  2.880397e-01 -1.668334e+00
## [3416] -1.680298e+00  5.494641e-01  3.914753e-01 -2.588797e-01  3.023568e-01
## [3421]  2.504782e-01  6.928891e-03 -6.493744e-02  7.503837e-01  5.398325e-01
## [3426] -3.596611e-01  6.815339e-01  5.734128e-01 -3.413628e-01  2.587827e-01
## [3431]  1.089044e+00  1.316265e+00 -8.054096e-02  3.684508e-01  5.288535e-01
## [3436]  8.658445e-01 -1.041284e+00  8.082953e-01  2.650559e-01  1.775657e-01
## [3441]  5.830444e-01  6.649046e-01 -2.404872e+00 -1.221272e+00 -6.394652e-01
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## [3446]  8.075911e-01 -2.156678e-01  4.689717e-01 -7.026614e-02  6.136692e-01
## [3451] -3.869275e-01 -1.225070e-01 -2.106204e-02  2.860287e-01 -3.968202e-02
## [3456]  5.451409e-01  2.268104e-01  5.348458e-01  8.059627e-01 -5.629337e-01
## [3461]  4.825845e-01  8.894513e-01 -9.095360e-01  6.382813e-01 -1.346686e+00
## [3466] -8.160942e-01 -4.050123e-03 -1.190325e+00 -2.525658e-01  5.328145e-01
## [3471] -3.257389e-01 -6.048387e-01 -1.862317e+00 -2.311107e+00  8.278394e-01
## [3476]  1.285771e+00  8.226972e-01  1.339249e+00  1.214706e+00  6.651536e-01
## [3481]  1.106274e+00  4.818812e-01  6.432780e-01  1.767987e+00  5.185018e-01
## [3486]  1.536924e+00  1.246696e+00  7.509323e-01  1.395135e+00  1.317373e+00
## [3491]  1.079302e+00  1.395756e+00  1.021972e+00  9.799759e-01 -1.786345e-01
## [3496] -2.251828e-01  1.315586e+00 -1.510014e+00  1.291224e+00  1.390738e+00
## [3501]  1.348710e+00  1.083777e+00  9.869829e-01  2.504820e+00  8.873456e-01
## [3506]  1.053030e+00  1.321615e+00  1.091717e+00  9.228008e-01  7.521755e-01
## [3511]  5.472607e-01  1.011213e-01  9.768998e-01 -1.037990e+00  2.905459e-01
## [3516]  7.524086e-01  8.337127e-01  6.894377e-01 -2.390413e-01  3.974551e-01
## [3521]  1.993022e+00  7.200297e-01  1.841274e+00  2.115623e+00  2.772038e+00
## [3526]  2.547003e+00  2.312443e+00  1.627177e+00  1.330766e+00  1.350808e+00
## [3531] -4.227798e-01  5.850927e-01  1.500024e+00  1.228596e+00  1.416234e+00
## [3536]  4.617150e-01  1.137597e+00  1.389806e+00  1.625382e-01 -1.747354e-01
## [3541]  1.726213e-01  9.641749e-01  2.769982e-01  1.247084e+00  7.477008e-01
## [3546]  1.297797e+00  2.248097e-01  1.193763e+00  1.811661e+00  9.854608e-01
## [3551]  1.378712e+00  1.030533e+00  1.050031e+00  1.096269e+00  1.324846e+00
## [3556]  1.424205e+00  1.722294e+00 -2.248854e+00  1.189907e+00  1.410411e+00
## [3561]  1.241122e+00  8.475665e-01  6.802677e-01  8.279683e-02  1.532890e+00
## [3566]  8.083359e-01  9.873179e-01  1.330240e+00  4.832684e-01  1.962263e-01
## [3571]  1.564358e+00  1.366133e+00  1.826205e+00  2.010516e+00  1.991916e+00
## [3576]  1.602664e+00  1.725444e+00  1.758682e+00  1.482599e+00  7.011797e-01
## [3581]  1.478960e+00  2.863503e-01  5.871069e-01  1.339229e+00  1.349866e+00
## [3586]  1.174906e+00  1.300320e+00  2.387682e+00  1.047802e+00  1.010220e+00
## [3591]  1.280332e+00  9.962656e-01  1.329898e+00 -1.311535e-01  1.682513e+00
## [3596]  1.313933e+00  4.027963e-01 -2.149636e-01  3.778218e-01  1.284395e+00
## [3601]  1.067448e+00  1.179872e+00 -1.128815e+00  4.050882e-01  3.948134e-01
## [3606]  4.593604e-01  6.309621e-01  5.471315e-01  1.785915e-01  3.625399e-01
## [3611]  1.223043e+00  8.961274e-01  1.294388e+00  8.100049e-01 -2.046482e-01
## [3616]  1.170623e+00  9.832553e-01  9.221073e-01  7.677172e-01  1.426787e-01
## [3621]  1.193827e+00  1.294991e+00  1.413790e+00  1.001936e+00  3.801950e-01
## [3626]  1.712153e+00  4.057721e-01  4.170727e-01  9.945763e-01  7.184522e-01
## [3631]  6.580524e-02  4.603049e-01  2.697210e-01 -1.635623e-02  9.633083e-01
## [3636]  9.413298e-01  9.197341e-01  9.316983e-01  7.837034e-01  6.020876e-01
## [3641]  1.188478e+00  9.420137e-01 -1.958996e+00  1.928193e-01 -1.229814e-01
## [3646]  7.021862e-02 -1.124321e-01 -7.797995e-01 -2.028353e+00 -5.284458e-01
## [3651] -4.616219e-01 -3.764647e-01 -1.722946e+00  1.040421e-01 -1.555158e-01
## [3656] -2.357321e-01  9.610271e-02  4.062950e-01  4.238831e-01  6.667628e-02
## [3661] -1.637478e+00 -3.034107e-01 -3.379334e-01  1.513673e-01 -3.993503e-01
## [3666] -1.803121e-01 -1.903965e+00  3.769463e-01 -3.125615e-01  3.940364e-01
## [3671] -9.647576e-02  7.782150e-01  5.998011e-02  4.849891e-01 -9.875113e-01
## [3676] -7.296853e-02 -9.335676e-01  7.140328e-01  4.092935e-01 -2.366644e-01
## [3681] -3.824615e-01 -2.826688e-01 -7.543125e-03  1.512119e-01  2.916337e-01
## [3686] -8.274355e-01 -5.068492e-01 -6.267623e-01 -5.756078e-03  2.437646e-01
## [3691] -2.204750e-01 -7.713162e-01  3.742586e-01  1.553758e-01 -4.790227e-01
## [3696] -9.287822e-01 -9.048087e-01 -1.981804e+00 -3.547904e-01 -3.856931e-01
## [3701]  6.369703e-01  1.391359e+00 -1.384927e+00  1.433122e+00  1.711768e-01
## [3706]  1.206487e+00  3.572145e-01 -2.509115e-01  1.159939e+00  2.711249e-01
## [3711]  5.395544e-01  5.465614e-01 -8.828555e-01 -7.082995e-01 -7.273319e-01
```

```
## [3716] -4.282328e-01 -3.794631e-01 -6.312370e-01 -2.924412e-01 -5.157210e-01
## [3721] -5.253379e-01 -1.838850e+00  2.945544e-01 -1.368562e+00  3.273313e-01
## [3726]  1.925870e-01  3.353142e-01 -4.560990e-01  8.980526e-03 -1.201565e+00
## [3731]  3.772193e-01  4.533885e-01  5.824621e-01  8.083563e-01  1.169597e+00
## [3736]  6.440130e-01  1.109394e+00  6.087637e-01  5.678031e-01  1.013599e+00
## [3741]  7.394860e-01  7.810085e-01 -6.523739e-01  8.143282e-01  4.035005e-01
## [3746]  6.257147e-01  7.417983e-01  8.778697e-01  9.353986e-01 -2.505549e-01
## [3751]  8.389403e-01  3.525664e-01  3.366209e-01  4.151227e-01  2.956807e-01
## [3756]  1.600191e-03 -8.812642e-01 -3.147193e-01  1.548172e+00  9.922640e-01
## [3761]  4.137956e-01  7.274812e-01  9.480467e-01 -1.400809e-01 -1.134780e-01
## [3766]  1.626054e-01 -2.605284e-01  1.296887e-01 -3.988714e-01  1.186910e+00
## [3771]  2.288418e-01  7.707134e-01  4.224218e-01 -1.240877e+00  1.766415e-01
## [3776]  1.628322e+00  1.776077e+00  6.283891e-01 -9.032221e-01  1.367068e-01
## [3781]  9.612877e-02  5.398529e-01 -2.028952e+00 -1.724255e+00  7.515587e-02
## [3786] -1.041477e-01 -1.107158e+00  3.329409e-01  5.861218e-01  5.384107e-02
## [3791] -4.714216e-01  9.178520e-02  1.013278e+00  2.029227e-01  5.941047e-01
## [3796] -1.622769e+00            NA -2.133735e+00 -4.265780e-02 -7.258888e-01
## [3801] -8.154644e-02 -1.044896e-01 -7.788677e-02  1.220477e-01 -3.310066e-01
## [3806]  2.870139e-01 -4.132088e-01 -5.239841e-01 -2.437978e-02 -3.386575e-03
## [3811]  1.459964e-01 -5.000354e-01  2.351353e-01 -3.909088e-01  4.786915e-02
## [3816] -2.761319e-01 -2.329404e-01 -1.051532e-01 -6.856731e-01 -1.999830e-01
## [3821]  4.247543e-01 -9.397985e-01 -6.251075e-01  6.885926e-01  4.310682e-01
## [3826] -4.660726e-01  1.243600e-01 -1.906730e-01 -8.520611e-02 -2.433912e-02
## [3831]  9.974777e-02 -1.587211e-01 -8.596684e-01 -1.417499e-01  3.445835e-01
## [3836] -4.448391e-01 -8.862305e-01 -6.440693e-01 -1.786885e-01  3.978095e-01
## [3841] -8.852384e-02 -2.652342e-01  1.858499e-01 -3.200886e-01 -9.394972e-01
## [3846]  5.983331e-02  5.583171e-02 -8.019903e-02 -1.431843e+00 -7.292269e-01
## [3851]  1.202091e+00 -3.463089e-01 -2.365601e+00 -1.202249e+00 -1.896066e-01
## [3856] -1.000172e-02  1.963793e-02  4.307466e-01  1.673112e-01 -4.694037e-02
## [3861]  9.912486e-02 -9.714996e-02 -2.461910e-01 -3.023928e-01 -6.177881e-01
## [3866] -1.866714e-01  2.258659e-01  1.569957e-01  5.522913e-02  1.287442e-01
## [3871] -2.371823e-01  3.859981e-02  3.329612e-01  5.212328e-01  2.381314e-01
## [3876] -4.551138e-01 -1.129418e+00  1.826338e-01  6.842490e-01 -7.371895e-01
## [3881]  8.539413e-01 -1.440825e-01 -1.879782e-01 -1.888919e+00 -1.024313e+00
## [3886] -1.607118e-01 -1.008327e+00 -1.078202e+00 -7.545230e-01  3.089719e-01
## [3891] -7.268944e-01 -4.760868e-01 -1.009332e+00 -1.510599e-01 -6.257507e-01
## [3896] -4.670984e-01 -3.736160e-01 -1.224867e-01 -4.800273e-01 -1.161322e-01
## [3901]  2.164950e-01 -3.433331e-01  3.707834e-01  6.452385e-01  1.160555e-01
## [3906]  8.913102e-02  4.384688e-01 -1.763465e+00 -1.789103e+00  2.957010e-01
## [3911]  1.426990e-01  8.935342e-01 -4.657509e-01 -1.809030e+00 -1.802966e-01
## [3916]  5.486687e-02 -1.743450e-01 -2.329297e-02  4.271072e-01  6.090853e-01
## [3921]  2.371463e-01  8.582442e-01  3.055595e-02  2.930265e-01 -1.237935e-01
## [3926] -1.119122e+00  2.788144e-02 -9.918124e-02 -2.864677e-01 -4.102127e-01
## [3931] -1.466429e+00 -2.638065e+00  4.200688e-01  1.110281e-01 -2.425517e-01
## [3936]  2.238550e-01  2.501362e-01 -1.237731e-01 -7.784717e-01 -7.615005e-01
## [3941]  3.119917e-02  3.556304e-02 -3.734942e-02 -1.790102e-01 -5.845295e-01
## [3946] -4.597993e-01 -2.861258e-01  3.146426e-01 -4.764693e-01 -1.693951e+00
## [3951] -8.190498e-01 -2.116256e-01  1.270142e-01  5.528428e-01 -1.277795e+00
## [3956]  1.024223e-01 -1.434526e-02  4.437162e-01 -2.495697e-01 -1.372237e-02
## [3961]  8.943230e-02 -7.206009e-01 -5.742140e-01 -9.720721e-01 -2.322027e+00
## [3966] -2.519023e-01  1.849054e-01  2.461549e-01 -1.429169e+00  5.747805e-01
## [3971]  3.372642e-01 -4.713669e-03 -6.390826e-01 -7.977958e-01  1.702463e-01
## [3976]  7.244071e-02 -3.397141e-01  6.768078e-01  4.949516e-01  2.877181e-01
## [3981] -4.704364e-01  4.130102e-01 -1.643511e-01  3.319761e-01 -2.874528e-01
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## [3986] -6.560742e-01 -9.594036e-01 -1.367835e-01 -7.947388e-01  5.178744e-01
## [3991] -8.683351e-01 -9.245167e-01  2.936697e-01  1.250032e-01 -6.251481e-01
## [3996] -9.471382e-01 -2.977886e-01 -9.943720e-01 -2.591810e-01 -9.777630e-01
## [4001] -4.865005e-02  1.003910e-01  2.121921e-01 -6.300943e-01  4.386685e-01
## [4006] -3.583137e-01 -5.226773e-01  1.077103e-01  3.615547e-01 -1.411067e-01
## [4011]  5.491425e-01  2.417504e-01  4.779397e-01  2.510808e-01 -2.852720e+00
## [4016] -7.993299e-01 -3.471936e-01 -1.556016e-02 -1.019605e-01 -8.576707e-01
## [4021] -2.807581e-01 -5.056379e-01 -1.016348e+00 -1.159224e+00 -1.557417e+00
## [4026] -9.770398e-01 -5.278242e-01 -7.212573e-01 -1.654988e+00  1.458825e-01
## [4031] -7.140173e-01 -1.614748e+00 -1.622376e+00 -8.611353e-01 -7.620007e-02
## [4036] -7.216459e-01 -8.598921e-01 -5.158764e-01 -1.279137e+00 -5.673655e-01
## [4041] -8.568159e-01 -1.362741e+00 -6.367995e-01 -1.111977e+00 -4.051459e-01
## [4046] -8.451789e-01 -9.099050e-01 -1.058266e+00 -8.219824e-01 -1.285367e+00
## [4051] -8.795462e-01 -8.057930e-01 -4.383477e-01 -1.607663e+00 -8.135769e-01
## [4056] -2.090702e+00 -8.256025e-01 -9.821042e-01 -1.434707e+00 -1.041222e+00
## [4061] -5.494667e-01 -7.209148e-01 -9.956061e-01 -1.711542e+00 -4.102881e-01
## [4066] -7.338728e-01 -1.007166e+00 -7.394352e-01 -8.679869e-01 -1.107114e+00
## [4071] -1.389946e+00 -8.242816e-01 -5.564737e-01 -9.826279e-02 -8.283678e-01
## [4076] -1.556407e+00 -5.317550e-01 -2.506784e-01 -7.790542e-01 -1.412987e+00
## [4081] -1.819662e+00 -3.652161e-01 -2.939951e-01 -3.128722e-01 -1.361724e-01
## [4086]  2.374805e-02 -2.049583e+00  5.604431e-01  3.877953e-01  3.921389e-01
## [4091]  3.356154e-01  4.061344e-01  1.143865e-01 -4.431700e-01  6.046808e-01
## [4096]  6.070134e-01  6.542878e-01  5.760670e-01  5.657718e-01  5.065535e-01
## [4101]  1.610325e+00  6.456413e-01  8.970922e-01  2.214411e-01  4.420269e-01
## [4106]  6.588920e-01 -1.206975e+00  1.301968e+00  9.496750e-01  3.269283e-01
## [4111]  1.021883e+00  5.641434e-01  6.096675e-01  1.674489e+00  4.962380e-01
## [4116]  5.654502e-01  8.545033e-01  9.210002e-01 -2.589000e-01  1.038452e+00
## [4121]  3.884183e-01 -1.681987e+00 -2.169340e-01  8.365875e-01 -1.211799e-01
## [4126] -3.184399e-01 -1.015342e-01  2.411072e-01 -1.986966e-01 -1.042994e+00
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## [4136]  1.193732e-01 -5.855350e-01  4.569871e-01 -1.721942e+00  3.768163e-01
## [4141]  1.373093e-01  5.940641e-01  5.594783e-01  5.647663e-01  8.155943e-01
## [4146]  6.912060e-01 -2.888206e-01  1.957694e-02  4.852590e-01 -5.107335e-01
## [4151] -4.042611e-01  3.295825e-01 -6.424614e-01 -6.630719e-01 -6.084985e-01
## [4156] -1.364822e-01  1.093387e-01  3.292406e-01  5.637812e-01  6.159814e-01
## [4161]  4.197066e-01  3.881373e-01 -2.393873e+00 -7.754959e-01  3.216200e-01
## [4166]  4.516991e-01 -4.728230e-02 -1.287125e+00 -4.517961e-01 -1.235227e+00
## [4171] -2.734981e-01 -4.850751e-01 -7.959646e-02  2.035050e-01 -2.708235e-01
## [4176] -8.053962e-01 -4.122236e-01 -1.860079e-01  1.486099e-01 -2.412449e-01
## [4181] -1.481044e-01 -1.551566e+00 -2.006669e-01 -1.467455e+00  4.613307e-01
## [4186] -1.007342e+00 -3.410209e-01 -5.815536e-01 -1.142025e-01 -7.901143e-01
## [4191] -1.182021e+00 -1.290765e+00 -3.985904e-01 -1.033965e+00 -9.055344e-01
## [4196] -4.857590e-01 -9.504966e-01 -1.713597e+00 -2.158689e+00 -1.225937e+00
## [4201]  2.281579e-01  2.081701e-01 -3.290567e-01 -8.979341e-01 -8.556464e-01
## [4206] -6.420787e-01 -5.326508e-01 -1.913163e-01 -3.187615e-01 -5.026489e-01
## [4211]  3.851851e-02 -3.064554e-01 -5.629541e-01 -8.742867e-01 -1.818340e+00
## [4216] -2.621094e+00  2.530917e-01  4.457069e-01 -2.360763e-03  5.657921e-01
## [4221] -3.839111e-01 -5.169660e-01 -7.238779e-01  4.344265e-01 -9.551211e-01
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## [4241]  2.667452e-01  1.403054e-01  5.345648e-01 -5.605605e-01  3.199713e-01
## [4246] -1.214609e-01  2.434804e-01  2.128556e-01  1.180461e-01  1.140445e-01
## [4251]  7.952850e-01  6.233414e-01 -6.680587e-01  2.558272e-01 -1.001048e+00
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## [4256] -1.193643e+00 -7.255807e-02 -7.049567e-01 -7.611788e-01 -4.341816e-01
## [4261]  4.753262e-01 -1.104819e-01  5.295576e-01  2.651168e-01 -1.939704e-01
## [4266] -5.256531e-01 -1.813112e+00  2.774026e-01  9.261466e-03 -8.173807e-01
## [4271] -3.127489e-01 -4.484784e-01 -1.539924e+00 -7.555285e-01 -1.735127e+00
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## [4281]  8.014114e-01  5.481613e-01  4.057511e-01  2.759104e-01  5.874695e-01
## [4286]  7.893859e-01  6.665521e-01  8.909575e-02  1.552204e-01 -1.692966e-01
## [4291] -3.937817e-02  4.370423e-01 -5.646827e-02  7.531539e-01  4.004535e-01
## [4296]  1.645277e+00 -6.533456e-01  3.340957e-01  9.492286e-01  3.051037e-01
## [4301]  1.054040e+00  1.317995e+00  4.284354e-01  8.071293e-01  1.174186e+00
## [4306] -1.610405e-02  5.154256e-01  5.124272e-01  7.532633e-01  7.786034e-01
## [4311]  2.021889e-01  1.812917e-01  1.062176e-01  9.864390e-01  7.393730e-01
## [4316]  1.878325e-01  5.084187e-01 -1.652881e-01 -5.194187e-01  1.069530e+00
## [4321]  1.433744e+00  1.491696e+00  1.542175e+00  2.179558e+00  1.323557e+00
## [4326]  1.882416e+00  7.701202e-01  7.048503e-01  3.515202e-02  6.236238e-01
## [4331]  3.591569e-01  1.550192e+00  1.178546e-01  1.028777e+00  5.593639e-01
## [4336]  8.683131e-01  4.624143e-01  6.709491e-01  6.715707e-01  1.182902e+00
## [4341] -4.828759e-01  1.017451e+00 -1.692189e-01  1.013210e+00 -2.372543e-01
## [4346]  5.547339e-01  6.793547e-01  4.430710e-01  6.280985e-01  1.550348e+00
## [4351]  7.446022e-02  6.091437e-01  9.000704e-01  1.243387e+00  8.814265e-01
## [4356]  9.157160e-01 -9.557360e-01 -5.924664e-01 -3.539428e-02 -2.640062e-01
## [4361] -5.788003e-01 -6.689922e-01 -1.212671e+00 -2.346820e+00 -7.534907e-01
## [4366]  1.716792e-01 -1.668573e-01 -9.708631e-01  4.965495e-01  2.000021e-01
## [4371] -4.149292e-01 -5.102220e-01  9.804879e-01  1.061817e+00 -6.121488e-01
## [4376] -2.253843e-01 -9.576172e-01 -4.511495e-01 -5.730315e-01 -3.366055e-02
## [4381] -5.113600e-01 -3.052773e-01 -1.069721e+00  1.383306e-01 -2.276534e+00
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## [4391] -2.921065e-01 -6.987761e-01 -4.274572e-01 -5.941249e-01 -5.871930e-01
## [4396] -1.164938e+00 -6.970674e-01 -1.486108e-01 -1.575445e+00 -2.522724e+00
## [4401] -2.592293e+00 -2.634034e+00 -2.613164e+00 -9.494971e-01 -1.265232e+00
## [4406] -8.292986e-01 -9.768293e-01 -1.346808e+00 -8.331109e-01 -4.907370e-01
## [4411] -1.417120e+00 -1.852558e+00 -1.759964e+00 -8.561606e-01  1.107507e-01
## [4416] -3.561545e-01 -9.883666e-01 -5.053939e-01 -5.454516e-01 -4.118347e-01
## [4421] -9.262249e-01 -5.524918e-02 -8.117060e-02 -2.270930e-01 -2.143362e+00
## [4426] -1.034168e+00 -1.193261e+00 -1.138299e+00 -6.580003e-01 -8.169102e-02
## [4431] -5.905351e-01 -6.855803e-01 -3.446422e-01  1.010915e+00 -2.618273e-01
## [4436] -8.422467e-01 -2.004447e+00 -2.689194e+00 -2.396575e+00 -1.582034e-01
## [4441] -5.980811e-01  3.404811e-01 -4.413462e-01 -3.976667e-02 -8.552620e-01
## [4446]  1.113598e-01 -1.255455e-01 -2.198534e-01  1.653035e-01 -5.949273e-01
## [4451] -7.469861e-01  1.041197e-01  1.211639e-01 -6.623728e-01 -1.431794e-01
## [4456] -4.727927e-01 -4.297091e-01 -4.677363e-02  1.239293e-01 -1.017274e-01
## [4461]  7.739734e-01 -6.757192e-01  4.444378e-01  8.299055e-01  1.249073e+00
## [4466]  1.272612e+00 -2.829796e-01  1.092649e+00  2.373015e-01  4.284037e-01
## [4471]  1.007328e-01 -1.511188e-01 -1.144946e+00 -3.516366e-01  6.797114e-01
## [4476]  1.074393e+00  3.421965e-02 -3.985733e-01  3.750815e-01  2.736572e-01
## [4481] -7.559354e-01 -7.509169e-01  7.839105e-02 -5.851549e-01 -1.563786e-02
## [4486]  2.304877e-02 -2.642025e-02 -5.393600e-02  4.836683e-01  8.253071e-01
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## [4496]  1.033997e+00  5.460175e-01 -9.083511e-01  6.953887e-01  5.165911e-01
## [4501]  5.904220e-01  2.250428e-01 -7.219155e-02  1.138622e+00 -7.523155e-01
## [4506] -3.280516e-01 -7.505284e-01 -1.366846e-01 -4.673080e-01 -6.893446e-01
## [4511] -5.423043e-01  2.866928e-01 -1.018958e+00  9.113968e-01 -5.078216e-02
## [4516]  1.139238e-01  5.035555e-01 -3.519474e-01  6.208586e-01  4.308900e-01
## [4521]  4.466910e-01 -2.611463e+00  3.535515e-01  1.305950e+00  4.030772e-01
```

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## [4526]  6.110353e-01 -4.028458e-02  5.314873e-01 -4.221972e-01  6.349636e-01
## [4531]  7.929930e-01  6.978009e-01  1.036160e+00  2.218237e-01  1.994831e-01
## [4536]  9.476640e-01  3.495296e-01  7.351018e-01  1.179831e+00  4.150617e-01
## [4541]  5.080429e-02  6.130260e-01 -2.262643e-01  9.433206e-01  5.608054e-01
## [4546]  6.642207e-01  7.447335e-01  3.349112e-01  1.036823e+00  1.402648e+00
## [4551]  1.617282e+00  8.837806e-01  8.142266e-01  9.246802e-01  7.031500e-01
## [4556]  4.951919e-01  7.723011e-01  1.403352e+00  6.093256e-01 -2.397211e+00
## [4561]  6.111977e-02  3.671441e-01  5.630973e-01 -6.141691e-01  5.776138e-02
## [4566] -9.725157e-02 -4.431903e-01 -1.647947e-01 -2.648923e-01  5.950085e-01
## [4571] -1.069576e+00 -1.437514e+00  9.319589e-01  3.022958e-01  2.733604e-01
## [4576]  4.732746e-01 -3.008254e-01 -6.983009e-01  4.234272e-01  2.969468e-01
## [4581] -9.498127e-01 -3.069363e-02  2.182821e-02 -2.945116e-01 -4.774748e-01
## [4586] -7.632102e-01  3.830895e-01 -1.016350e+00 -4.614887e-01 -2.905100e-01
## [4591] -5.416799e-01  2.224059e-01 -8.430390e-01 -6.966928e-01 -1.971462e-02
## [4596] -1.393618e+00  4.752246e-01  4.915119e-01  7.638134e-02  1.919434e-02
## [4601]  5.803902e-01  1.934705e-01  4.939055e-01 -2.138078e+00  5.797470e-01
## [4606]  4.763316e-01  1.058856e-02  6.483362e-01  8.162782e-01 -4.351871e-01
## [4611] -1.390347e-01 -1.632421e+00 -1.919504e+00  1.314576e+00  1.608355e+00
## [4616]  1.234104e+00  7.919876e-01  1.931008e+00  9.224086e-01  8.835200e-01
## [4621]  6.745564e-01  5.482623e-02  1.097369e+00  5.255358e-01  2.076370e+00
## [4626]  2.320582e+00  1.292357e+00 -7.595301e-01 -1.953585e-01  1.305286e+00
## [4631]  1.083756e+00  1.678552e+00  1.110961e+00  6.995310e-01  9.107254e-01
## [4636]  5.920531e-01 -6.567377e-01 -1.373289e+00  1.054438e+00  1.521508e+00
## [4641]  9.929072e-01  2.159940e+00 -4.212120e-01 -1.372625e+00  4.290572e-01
## [4646]  5.544712e-01 -7.362453e-02  5.867447e-01  9.463370e-01  6.978619e-01
## [4651]  1.186849e+00  1.566429e+00  3.821653e-01  3.199306e-01 -1.401622e-01
## [4656]  1.263080e+00  1.701858e+00  2.980336e-01  7.204835e-01  5.827634e-01
## [4661]  1.289963e+00 -1.687959e+00  1.499574e-01 -6.262519e-02  1.075109e+00
## [4666]  1.080319e-01  1.139937e+00  1.405103e+00  1.453000e+00  1.849257e-01
## [4671]  1.081041e+00  1.075411e+00  1.092040e+00 -8.755933e-03  9.217247e-01
## [4676] -1.201304e+00  4.503517e-01  4.862442e-01  8.937948e-01  4.354117e-01
## [4681]  5.066145e-01  4.879336e-01  3.505351e-01  5.997143e-01  1.336151e+00
## [4686]  1.098032e+00 -2.519953e+00 -8.404711e-01 -8.369288e-01 -2.298129e-01
## [4691] -1.058033e+00 -1.447587e+00 -4.574580e-01 -1.104814e+00 -6.576650e-01
## [4696] -9.292483e-01 -2.671009e-01 -1.148799e+00 -3.332256e-01 -1.145800e+00
## [4701] -1.603421e+00 -8.364626e-01 -7.089987e-01 -6.461833e-01 -4.496740e-01
## [4706] -5.043170e-01 -9.926077e-01 -6.807060e-01  3.602130e-01 -1.084383e+00
## [4711] -7.425891e-01 -1.316115e+00 -1.173860e+00  1.855792e-01  5.742326e-01
## [4716] -7.912034e-01  4.009292e-02 -5.029961e-01 -7.958701e-02 -4.077558e-01
## [4721] -5.577168e-01 -1.880960e-01  4.306569e-01 -1.024333e+00 -8.678314e-01
## [4726] -1.273031e+00 -1.426612e+00 -1.156816e+00 -4.536048e-01 -1.133775e+00
## [4731] -4.643872e-01  2.705033e-01 -1.240140e+00  5.125049e-01 -2.472138e-01
## [4736]  3.562821e-01 -8.091022e-01 -9.578978e-01 -1.076102e+00 -5.469344e-01
## [4741] -2.952383e-01 -2.194425e+00 -2.446743e+00  1.304335e-02  8.166685e-01
## [4746]  7.594156e-01  4.873660e-01  9.395800e-01 -3.998942e-01  1.793995e+00
## [4751]  3.134316e-01  2.476177e-01  6.115206e-01  1.102344e+00  1.034153e+00
## [4756]  9.245560e-01  4.724974e-01  8.804623e-01  6.837976e-01  6.414909e-01
## [4761]  1.618389e-01  2.860712e-01  1.060348e+00  3.783131e-01 -3.104954e-01
## [4766]  1.075294e+00  2.466076e-01  8.206771e-01  9.312522e-01  5.171809e-01
## [4771]  1.002162e+00  5.617408e-01  1.044081e+00  7.671995e-01 -2.509939e-02
## [4776]  7.400723e-01  2.408191e-04  2.056218e-01  3.061915e-01  9.297299e-01
## [4781]  5.618962e-01  1.227741e+00 -1.308952e+00 -9.995369e-01  6.231576e-01
## [4786] -1.589027e-01 -5.620362e-01 -4.713165e-01 -5.962481e-01 -3.372341e-01
## [4791]  4.886869e-01  1.376491e+00  1.042248e+00  1.433666e+00 -7.345720e-01
```

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## [4796]  1.038705e+00  1.886890e+00  4.089050e-01  6.220159e-02 -2.899866e-01
## [4801]  1.028746e+00 -9.670885e-02  4.335777e-01  6.813430e-01  6.573697e-01
## [4806]  9.026121e-02  4.795454e-02  1.593843e-01  1.037819e+00  1.173766e+00
## [4811]  2.880596e-01 -4.153844e-01  8.286576e-02  1.090606e-01 -9.184565e-02
## [4816]  3.834094e-01 -7.713244e-02  7.014633e-01 -3.730777e-01 -1.236807e-01
## [4821] -2.644133e-01 -1.976148e+00  1.106207e+00  1.509955e+00  2.390982e+00
## [4826]  8.293174e-01  1.181272e+00  1.593736e+00  1.525800e+00  1.341108e+00
## [4831]  2.097883e-02  1.413994e+00  1.304095e+00  1.217048e+00 -6.260877e-01
## [4836]  8.600168e-01  8.655378e-01 -3.816056e-01 -6.757516e-01 -2.467984e+00
## [4841]  9.070314e-01  9.099283e-01 -5.265122e-01 -7.877798e-01  1.372030e+00
## [4846] -7.693107e-01 -1.141468e+00 -2.689690e+00 -2.745345e+00 -6.889474e-01
## [4851] -1.611443e+00 -1.469604e-02 -1.989926e-01 -1.231596e-01  8.634090e-01
## [4856] -1.070920e-01  6.342767e-01 -1.197925e-01  6.400874e-02 -2.054542e-01
## [4861]  3.241132e-01  5.426738e-01 -1.168776e+00 -4.569182e-01 -7.721825e-01
## [4866]  3.876157e-01 -5.071889e-02 -4.679852e-01  6.270972e-01 -2.337771e-01
## [4871] -6.694875e-01 -9.547704e-01 -8.693314e-01  8.185230e-01 -2.873035e-01
## [4876] -1.644074e+00 -2.511880e+00 -2.141208e+00  7.928494e-01  3.002955e-01
## [4881]  5.474267e-01  5.771963e-02 -2.505878e-01 -9.466002e-01  3.012611e-01
## [4886] -9.894688e-02  5.677770e-01  4.065802e-01  1.148667e+00  4.147253e-01
## [4891]  9.516446e-01  7.497551e-02  1.224004e+00  7.194429e-01  4.171268e-01
## [4896]  7.482362e-01  9.375082e-01  1.168127e+00  9.057209e-01 -1.545519e-01
## [4901]  4.186380e-01 -3.893387e-02  2.029240e-01  9.032191e-01  6.256362e-01
## [4906] -1.299323e+00 -9.045139e-01 -3.112686e-01 -8.038725e-01 -1.195950e-01
## [4911] -7.064509e-01 -1.413976e+00  2.991073e-01  5.015752e-01 -6.349759e-01
## [4916]  1.087293e+00 -3.496679e-01  7.785405e-01  7.260048e-01 -1.345150e+00
## [4921] -1.092497e+00 -1.651278e+00 -1.295238e+00 -1.216533e+00 -1.129213e+00
## [4926] -6.973402e-01 -7.520548e-01 -2.078348e+00 -1.617459e+00 -8.988676e-01
## [4931] -1.243173e+00 -9.458823e-01 -1.602580e+00 -1.674550e+00 -9.010214e-01
## [4936] -1.407514e+00 -1.560591e+00 -9.708381e-01 -6.860505e-01 -3.993318e-01
## [4941] -3.899734e-01 -3.249347e-01 -6.577526e-01  6.205854e-01  1.713241e+00
## [4946]  2.045761e+00 -6.946910e-01  7.098368e-01  4.296047e-01 -8.671667e-02
## [4951] -3.220629e-01 -5.027697e-01  6.325931e-01  1.460054e-01  1.137847e+00
## [4956]  9.730608e-01  2.120877e+00  1.756691e+00  1.163349e+00  1.828217e+00
## [4961] -2.139524e+00  8.302830e-01 -1.562026e+00  1.616347e-01  6.414052e-01
## [4966]  1.208893e+00 -4.675276e-01  1.276181e-01  2.367344e-01 -6.932309e-01
## [4971]  1.281228e-01  2.864985e-01 -1.191675e+00  1.477598e+00 -6.041002e-01
## [4976]  1.279956e+00  8.885728e-02  1.163269e+00  2.033237e-01  1.623456e+00
## [4981] -6.203514e-01  6.866273e-01  2.228050e-01 -1.040407e-01  3.501919e-01
## [4986]  7.406304e-01 -2.816958e-01 -1.268895e+00 -1.494699e+00  3.381803e-01
## [4991]  8.409652e-01  5.157348e-01  4.570886e-01  3.451452e-01  3.250580e-01
## [4996] -4.509098e-02  3.021054e-02 -1.518865e-01 -1.410855e-01 -4.176630e-01
## [5001] -8.334710e-02 -7.601544e-01 -1.280805e+00 -1.244466e+00 -1.099111e+00
## [5006] -7.985107e-01 -6.548109e-02 -3.040037e-01 -7.089764e-01 -1.437869e+00
## [5011]  3.296000e-01 -3.689089e-01 -1.790392e-01  2.336060e-01 -1.558190e+00
## [5016]  4.164090e-01 -3.714325e-01 -1.055548e-01 -7.011046e-01 -5.494912e-01
## [5021]  3.152666e-01  4.605204e-01  1.098869e+00  9.052645e-01  1.109468e+00
## [5026]  1.687554e+00  1.277735e+00  2.489488e-01  1.595092e+00  1.585301e+00
## [5031]  3.627088e-01  7.815113e-01  9.679485e-01  1.710226e-01  1.113504e+00
## [5036]  5.167442e-01  1.113202e+00  5.553038e-01 -3.045084e-01  1.428541e+00
## [5041] -8.045678e-01  1.072725e+00  1.152367e+00  1.063034e+00  2.057805e+00
## [5046]  1.078277e+00 -1.121018e+00 -1.014067e-02  1.273137e-01 -1.717505e+00
## [5051] -1.334837e-01 -2.455119e-01 -1.930014e-01  3.600859e-01 -2.215218e-01
## [5056]  2.352819e-01  1.587561e-01 -9.317821e-02  4.347056e-01  1.244419e-01
## [5061] -1.584646e-01  2.664767e-01  9.387466e-01  1.420086e+00  2.969453e-02
```

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## [5066]  3.715982e-01  5.532958e-01  1.049885e+00  7.684390e-01  6.105843e-01
## [5071]  8.159240e-01  5.505462e-01 -3.343795e-02  5.781512e-01  1.059961e+00
## [5076]  5.606979e-01  1.436791e-01 -5.068046e-01 -1.459802e+00 -1.780340e+00
## [5081]  5.799239e-02 -3.235239e-01 -4.232969e-01 -2.198382e-01 -4.861816e-01
## [5086]  4.090068e-01 -7.217755e-01 -4.124524e-01  1.558321e-02 -6.641891e-01
## [5091] -5.428025e-01 -7.702512e-01 -3.539756e-01 -1.322075e+00 -8.765360e-01
## [5096] -9.045860e-01 -1.136145e+00 -9.199609e-01 -9.540274e-01 -1.331211e+00
## [5101] -6.723593e-01 -5.202733e-01 -1.017853e+00 -6.694624e-01 -3.719494e-01
## [5106] -1.962210e+00 -2.285867e+00 -8.090957e-01 -5.271800e-01 -6.510184e-01
## [5111] -2.008988e-01 -4.756099e-01 -7.704989e-01  3.284209e-01  1.434315e-01
## [5116] -7.620810e-01 -6.877341e-01 -5.596131e-01  2.719726e-01 -8.979020e-01
## [5121] -1.343441e+00 -2.957545e-02  1.853703e-01  4.667907e-01 -2.061972e-01
## [5126]  2.115645e-01 -1.469408e+00  6.616258e-02 -2.930220e-01 -3.107732e-01
## [5131] -2.529391e-01 -1.476451e-01 -9.133822e-01 -2.070002e-01 -9.535975e-02
## [5136]  6.402531e-02 -4.496611e-01 -1.708636e-01 -7.482435e-01  8.219428e-02
## [5141] -2.264815e-01  1.394280e-01  1.866684e-01  5.654984e-01  6.070852e-01
## [5146]  3.019426e-01  4.196391e-01 -5.665506e-01  9.727929e-01  4.421487e-01
## [5151]  1.256999e-01 -4.418890e-01  2.579317e-01  5.741788e-01  2.859523e-02
## [5156] -2.278363e-02  1.906046e-01  5.723616e-01 -1.923638e-01 -7.291657e-01
## [5161]  1.998908e-01  6.816803e-01  6.411023e-01 -4.301798e-01  3.313160e-01
## [5166] -2.488905e-01 -4.362360e-01 -8.817877e-01  2.747892e-01 -6.891931e-01
## [5171]  3.441353e-01 -3.081426e-01  5.073558e-01 -2.203247e-01 -5.632193e-01
## [5176] -3.667888e-01 -5.562543e-01 -3.502347e-01 -7.999248e-01 -7.767081e-01
## [5181] -4.336112e-01 -3.853618e-01 -6.774839e-01 -9.231732e-01 -5.659447e-01
## [5186] -4.979105e-01 -4.013106e-01 -5.749285e-01 -5.617051e-01 -6.396313e-01
## [5191] -2.688765e-01 -9.424917e-02  2.965929e-01 -1.060595e-01  1.231768e-01
## [5196]  3.240486e-01  3.495432e-02 -3.388698e-02  1.455853e-01 -3.995946e-01
## [5201] -4.063578e-01 -3.513448e-01 -7.265410e-01 -8.559467e-01 -3.000670e-01
## [5206] -8.417144e-01 -1.672455e+00 -5.131528e-01  7.486042e-01  8.764959e-01
## [5211] -1.174658e-01  5.716152e-02 -9.638523e-01 -5.364701e-01 -1.294775e-01
## [5216] -1.672700e+00 -4.051189e-02  4.809806e-01  5.486275e-01  8.143693e-01
## [5221] -1.444278e+00 -3.515906e-01  1.160296e+00  3.554051e-02  3.009398e-01
## [5226] -4.770343e-01  4.286368e-01 -1.309651e+00  1.144495e+00  2.386683e-01
## [5231] -5.377519e-01  4.986523e-02  5.409990e-01 -3.210447e-01 -2.349794e+00
## [5236]  5.016907e-01  5.718299e-02  2.896136e-01  5.412320e-01 -3.921879e-01
## [5241]  2.904682e-01  6.554589e-01 -4.183828e-01  2.067190e-02  2.288960e-01
## [5246]  7.646673e-01  3.928249e-01  1.702444e-01 -1.779810e+00 -1.656044e+00
## [5251] -4.754027e-01 -6.004897e-01 -2.325005e-01  4.454478e-01  4.801259e-01
## [5256] -2.357720e-02 -6.105728e-01  9.641350e-02 -1.667448e+00  5.114171e-01
## [5261]  3.697062e-01  2.457070e-01  6.794323e-01 -2.140578e-01  2.816283e-01
## [5266]  1.366376e+00  5.806179e-01 -3.171139e-01 -1.978224e-01  1.175864e+00
## [5271] -6.887230e-01  6.482188e-01  1.576290e-01  1.256345e+00 -1.554418e+00
## [5276] -2.193095e-01  1.107828e+00  8.131262e-01  6.990783e-02  1.114556e+00
## [5281]  5.961858e-01  4.275031e-01  5.665263e-01  8.263949e-01  7.241159e-01
## [5286]  1.828916e-01  2.778988e-01  5.827157e-01  4.262599e-01  4.470018e-01
## [5291]  6.104646e-01  6.088330e-01 -1.083139e+00 -1.445257e-01  5.249646e-02
## [5296]  1.760370e-01 -4.077246e-01 -4.221086e-01 -7.287324e-01  2.497412e-01
## [5301] -3.707612e-01  6.074398e-01  3.300543e-01 -1.163255e+00  5.011300e-01
## [5306] -4.707899e-02 -1.133059e-01 -2.495971e-01  2.091881e-01  1.002177e+00
## [5311] -9.245413e-01  4.244066e-01  3.992533e-01  9.280194e-02  1.376628e-01
## [5316] -1.315273e-01 -1.869850e-01 -6.217299e-01 -1.180511e+00  2.461264e-01
## [5321] -2.183773e-01  2.301038e-02 -2.793057e-01 -1.062466e+00 -6.881542e-01
## [5326] -4.484501e-01 -1.016639e+00 -1.077345e+00 -1.942527e+00 -2.336744e+00
## [5331] -9.912134e-01 -8.373936e-01 -1.088858e+00 -3.872489e-01 -6.024675e-01
```

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## [5336] -7.253652e-01 -1.680294e+00 -1.326630e+00 -1.204996e+00 -9.904954e-01
## [5341] -8.894840e-01 -8.422217e-01 -6.106878e-01 -7.258607e-01 -1.060560e+00
## [5346] -1.963645e+00 -1.347279e+00 -1.332844e+00 -6.454723e-01 -7.094952e-01
## [5351] -6.183376e-01 -9.602413e-01 -1.337895e+00 -1.121488e+00 -5.430250e-01
## [5356] -7.663887e-01 -6.361139e-01 -8.997831e-01 -2.430551e+00 -1.110207e+00
## [5361] -5.054085e-01 -3.863824e-01 -5.101244e-01  3.559456e-01  5.994143e-01
## [5366]  9.881363e-01  5.793270e-01  6.343401e-01  6.473233e-02  9.348402e-01
## [5371] -2.306199e-01  1.355056e+00  7.487054e-01  1.000956e+00  1.120369e+00
## [5376]  1.052940e+00 -2.279411e+00 -3.182365e-01  1.224842e+00  6.257609e-01
## [5381]  1.463939e-01  9.534132e-01  1.063202e-01  4.948405e-01  3.745192e-01
## [5386]  5.006953e-01  5.020077e-01 -1.079768e-01  1.800911e+00  7.301329e-01
## [5391]  7.377032e-01  1.778869e-01 -8.274122e-02 -1.198842e+00  3.113304e-01
## [5396]  1.342843e+00 -5.340466e-01  6.968218e-01  1.346837e-01 -3.297869e-02
## [5401]  3.068886e-01  3.516049e-01  7.870622e-01 -2.531295e-01 -6.493212e-01
## [5406] -2.324360e-01 -9.525811e-02  4.774782e-01  2.749915e-01  6.043603e-01
## [5411]  8.915971e-02  3.140548e-01  9.661314e-01  6.010296e-01  1.755646e-01
## [5416]  6.450394e-01 -3.456927e-01 -1.271556e-01  4.989789e-01 -8.728422e-02
## [5421]  6.242462e-01  8.545921e-01  7.794924e-01  2.530878e-01  1.549265e+00
## [5426] -3.734508e-01  9.626995e-01  2.084716e-01  8.547944e-01  1.320736e+00
## [5431]  7.374003e-01  1.128242e+00  9.232321e-01  1.081709e+00 -2.315282e-01
## [5436]  1.349605e+00  1.131371e+00 -9.313858e-02  1.522113e+00  1.776281e+00
## [5441]  1.328004e+00  2.073551e+00 -2.863748e-02 -6.244898e-01  7.490088e-01
## [5446]  1.707238e+00  1.677561e+00  1.206068e+00  1.533822e+00 -1.042419e-01
## [5451]  1.356469e+00  1.027872e-01  1.976245e+00  2.628624e+00  1.640112e+00
## [5456]  2.688380e+00  4.645582e-01  1.058594e+00  1.922544e+00  3.156039e+00
## [5461]  2.727747e+00  1.892262e+00  1.438635e+00  8.738722e-01  2.615198e+00
## [5466]  1.210573e-01  1.271477e+00  1.469988e-01  1.466797e+00  9.562043e-02
## [5471]  1.775373e+00  6.504907e-01  9.291877e-01  2.488821e+00  6.191996e-01
## [5476]  7.042925e-01  9.151576e-01 -1.870131e-01 -5.832048e-01  2.452413e-03
## [5481]  3.424880e-02 -3.091510e-01  2.861594e+00 -1.067316e+00  6.617953e-01
## [5486] -2.002370e-01 -1.060250e+00 -1.087100e+00 -1.136763e+00 -1.436557e+00
## [5491] -9.935287e-01 -4.559570e-02 -1.574442e+00 -1.674676e+00 -9.246874e-01
## [5496] -1.458461e+00 -1.927633e+00 -1.767945e+00 -7.988147e-01 -1.872318e+00
## [5501] -4.104957e-01 -3.723402e-01 -1.917574e-01  1.410371e+00  2.495281e+00
## [5506]  2.663650e+00  1.874295e+00  2.147137e+00  1.860365e+00  1.919011e+00
## [5511]  2.395653e+00  2.478928e+00  2.918828e+00  4.832324e-01  2.050840e+00
## [5516]  2.278562e+00  2.976061e+00  1.284398e+00  1.635065e+00  1.140053e+00
## [5521]  2.205849e-01  1.882975e+00  1.330225e+00  1.045774e+00  6.730003e-01
## [5526]  2.175299e+00  1.505962e+00  2.449757e+00 -2.361275e+00  4.601611e-01
## [5531]  6.139292e-01  3.669868e-01  6.545266e-01  4.871329e-01  4.616751e-02
## [5536]  1.176718e+00  3.200500e-01  4.513671e-01  6.795101e-01 -2.956909e+00
## [5541] -1.315424e-01  5.296726e-01  8.793028e-02  2.786758e-01  4.859992e-01
## [5546]  7.359083e-01 -8.285029e-02  2.402222e-01 -6.148685e-02 -2.348774e-01
## [5551]  5.580431e-01  7.667333e-01 -5.194762e-02  1.472034e-01 -6.234153e-02
## [5556]  4.890754e-01  3.367834e-01  2.522478e-01  8.486590e-01 -1.346185e-01
## [5561]  3.153198e-02  8.882780e-01 -6.491817e-01 -6.183568e-01  4.694990e-01
## [5566]  1.473441e+00  2.017687e-01 -2.623931e-01 -8.114014e-01  6.352244e-02
## [5571] -4.997646e-01  4.601211e-02 -2.976151e-01 -2.911521e-01  2.137942e-01
## [5576] -1.538064e-01 -1.015308e-02  7.122868e-02  1.983358e-01  8.674125e-01
## [5581]  1.663487e+00  6.546043e-01 -2.116897e+00  3.988996e-01 -3.223815e-03
## [5586] -3.517143e-01  1.076149e+00  8.132039e-01  6.358825e-01  1.858900e-01
## [5591]  7.282859e-02  1.457219e+00  1.018041e+00  8.518128e-01 -7.270212e-01
## [5596] -4.245433e-02  8.566760e-01  4.910955e-01  9.567018e-01  1.223500e+00
## [5601]  3.122120e-02 -8.908030e-02  3.055699e-01  1.064745e+00  7.752942e-01
```

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## [5606]  3.612230e-01  5.100962e-01 -9.551324e-01 -4.367161e-01 -2.263814e+00
## [5611] -2.022749e-01  2.617381e-01  5.568038e-01  8.285639e-01 -8.182739e-02
## [5616] -1.038464e-01 -1.713489e-01  2.943332e-01  3.288853e-02 -2.418881e-01
## [5621] -4.544707e-01  6.715266e-02 -7.804827e-01 -3.539905e-01  2.344717e-01
## [5626] -2.289388e-01  2.338285e-01 -4.432107e-01 -1.567508e-01 -4.893780e-01
## [5631] -3.380450e-01  8.213329e-02 -3.137138e-01 -4.830845e-01  2.338082e-01
## [5636] -1.738204e-02  1.313577e-01  4.856416e-01  2.507591e-01  8.742134e-02
## [5641] -6.791323e-02 -5.875663e-01 -5.928543e-01 -1.630850e-01 -8.822256e-02
## [5646] -1.876972e-01 -1.324365e+00  2.710888e-01 -1.087191e+00 -4.599586e-02
## [5651]  2.610746e-01 -8.094181e-01 -1.295430e+00 -7.771446e-01 -7.302527e-01
## [5656] -2.023156e-01 -9.587604e-01 -2.196975e+00 -2.468393e+00  5.601418e-01
## [5661]  5.371783e-01 -1.081696e-01  2.736820e-01  1.892286e-01 -4.155007e-01
## [5666]  3.140197e-01 -3.523011e-01 -4.857183e-01 -3.260606e-01  5.847540e-01
## [5671] -8.177633e-01  1.852473e-01 -2.086294e-01  5.782235e-02 -7.778285e-01
## [5676] -3.926185e-01  4.952123e-01  1.133607e-01 -4.092275e-01 -7.136031e-01
## [5681] -1.197986e+00  4.986520e-01 -1.167075e-02  1.369674e-01 -1.066218e+00
## [5686]  1.459017e-02 -1.547243e+00 -9.794523e-01  6.276443e-01  2.234724e-01
## [5691]  3.754689e-01  2.354569e-01 -1.945463e+00 -1.136094e+00  4.297208e-01
## [5696]  8.182688e-01 -3.260402e-01 -5.349631e-01 -1.084879e+00 -3.184196e-01
## [5701] -1.627024e-01 -8.453513e-01 -3.232201e-02  3.220466e-02 -4.019082e-01
## [5706] -5.055606e-03 -5.758627e-01 -7.724355e-02  5.681687e-02 -3.609882e-01
## [5711] -6.041549e-01  3.952400e-02 -1.197204e-02 -8.426564e-01 -9.527885e-01
## [5716] -5.075930e-03 -6.767051e-01 -4.508110e-01 -7.003118e-01 -1.198122e-01
## [5721]  1.825728e-01 -6.564161e-01 -8.330249e-01 -5.958707e-01  2.304498e-01
## [5726] -1.102172e+00 -2.096349e-01 -6.088200e-01 -6.859711e-02 -1.513361e+00
## [5731] -7.792742e-02 -9.461734e-01 -1.780656e-01 -9.357160e-02 -4.930783e-01
## [5736]  3.721512e-01 -1.931830e+00 -1.626107e+00 -1.541935e+00 -2.087849e+00
## [5741] -2.500842e+00  1.208709e+00  3.953573e-01  9.180929e-01  1.173020e+00
## [5746]  8.779300e-01  1.605181e-01  1.490965e+00  3.195062e-01 -1.335225e+00
## [5751]  7.657233e-01  1.389883e+00  8.488921e-01  8.042545e-01  1.696229e-01
## [5756]  1.200381e+00  1.014032e+00  1.220268e+00  3.385704e-01  1.250938e+00
## [5761]  1.077392e+00  7.407716e-01  8.753977e-01  1.727747e+00  4.084388e-01
## [5766]  5.774641e-01  1.420398e+00  1.224121e+00  9.181706e-01  1.344733e+00
## [5771]  1.005037e+00  1.414012e+00  8.609953e-01  9.313616e-01  5.388552e-01
## [5776]  1.109227e+00  1.478304e+00  1.162860e+00  8.513467e-01 -6.210843e-02
## [5781] -6.311593e-01 -6.496479e-01 -7.067596e-01 -2.955633e-01  6.976102e-01
## [5786] -6.873245e-01  6.089106e-01  3.129971e-01  1.197693e+00 -4.915051e-02
## [5791]  6.714153e-01 -1.894946e-01  1.179159e+00  1.076848e+00  1.498392e+00
## [5796]  4.193307e-01  3.892745e-02  9.997078e-01  3.886611e-01  4.305015e-01
## [5801]  6.681061e-01  1.444604e+00  2.748226e-01  5.672256e-01  1.311454e+00
## [5806]  1.355516e+00  1.593120e+00  1.536256e+00  1.322003e+00  1.178583e+00
## [5811]  8.116040e-01  1.616861e+00  9.096050e-02  1.472819e+00  1.007259e+00
## [5816]  1.139430e+00  8.356503e-02  1.830470e-01  7.944044e-01  7.624140e-01
## [5821]  8.809602e-01  4.989254e-01  7.484001e-01  8.457383e-01  8.054199e-01
## [5826] -2.450674e+00  6.062689e-01  6.233908e-01 -1.633774e-01  4.991585e-01
## [5831]  1.921977e-01 -1.690176e-01  5.542676e-01  5.216557e-01  5.678154e-01
## [5836] -1.161299e-01  1.387118e+00  8.617499e-02  5.651277e-01 -2.217958e-01
## [5841]  7.861543e-01  9.707158e-01  1.358437e+00  1.275493e-01  1.208243e+00
## [5846]  1.019129e+00  4.739108e-04  1.085020e+00  1.158696e+00  9.904476e-01
## [5851] -1.467163e+00  6.722382e-01 -1.587543e+00  8.583536e-01  2.519370e-01
## [5856] -1.200366e+00 -2.201642e-01  3.072793e-01  1.115457e+00  2.759881e-01
## [5861]  1.973953e-02 -7.969990e-01 -3.363017e-01  1.942874e-02 -1.695818e+00
## [5866]  1.822700e-01 -1.372435e+00 -1.052004e+00  1.681783e-01  3.733262e-01
## [5871]  1.280396e+00 -3.101069e-01 -3.018568e-01 -1.171373e+00  7.774698e-01
```

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## [5876]  1.306125e+00  1.054428e+00 -2.874543e-01 -4.138304e-01  7.340436e-01
## [5881]  7.992676e-01  5.850150e-01  5.540345e-01  3.138200e-01  1.329166e+00
## [5886]  7.482447e-01 -5.331441e-02 -4.254675e-01  8.135147e-01  4.933947e-01
## [5891]  7.124012e-01  7.440031e-01  3.863301e-01 -3.429979e-01  5.748541e-01
## [5896] -2.387305e-01  1.651022e-01 -8.744865e-02  7.139550e-01  5.109509e-01
## [5901]  1.441272e-01 -7.037470e-01  3.184502e-01  1.012977e+00  5.330136e-01
## [5906]  4.283578e-01 -1.988399e+00  2.032770e+00  1.523122e+00  1.629210e+00
## [5911]  1.271577e+00  7.029791e-01  7.644105e-02  8.991067e-01 -1.279796e+00
## [5916] -4.651052e-01 -5.169883e-01 -3.722396e-01  1.310238e+00  3.153677e-01
## [5921]  9.582582e-01  1.742527e-01  2.294266e-02  1.417134e+00 -3.698171e-01
## [5926]  5.443614e-02  6.056727e-01 -3.989888e-01  1.893938e-01  7.987719e-01
## [5931] -3.713313e-01  1.454846e-01  2.912428e-01  2.247233e-01  4.807083e-01
## [5936]  6.967213e-01  1.847507e-01 -1.864646e+00  4.897927e-01  7.841355e-01
## [5941] -2.441457e-01 -6.224709e-01  2.025161e-01  6.792104e-03  8.870946e-01
## [5946]  2.837731e-01  3.154683e-01  2.546575e-02  2.822589e-01 -2.474770e-01
## [5951]  5.024102e-01  5.302311e-02 -5.787640e-01 -4.421920e-01 -2.421273e-01
## [5956]  3.828556e-02 -1.033299e+00 -6.425586e-01  6.816373e-02 -3.498311e-01
## [5961] -4.581403e-01 -6.477069e-01 -8.865319e-01  2.093793e-01  8.633318e-02
## [5966]  8.234016e-01  1.791988e-01 -1.104967e+00 -8.690690e-01 -3.946486e-01
## [5971]  6.673473e-01  8.520685e-01  1.148026e+00 -2.716019e-01  3.674531e-01
## [5976]  1.118956e+00  1.378070e+00  8.764555e-02 -2.492941e-01  3.668472e-01
## [5981] -5.444445e-01  2.669160e-01  7.180196e-01  1.176492e+00 -3.401408e-01
## [5986]  2.054432e-01  1.169183e-01 -4.154423e-01  2.561151e-01 -1.634733e+00
## [5991]  1.015850e+00  3.791489e-01 -1.517986e+00  5.219237e-02  9.174219e-01
## [5996]  1.639732e-01  3.925011e-01  4.836510e-01 -4.707784e-01  9.120728e-01
## [6001]  3.452064e-01  1.166219e+00  6.509497e-01 -5.283480e-01  7.933350e-01
## [6006]  3.485647e-01  6.449575e-01  6.100298e-01  1.149890e-01  8.652014e-01
## [6011]  5.927166e-01  4.686297e-01  1.240384e-01  2.617585e-01 -7.954633e-01
## [6016]  8.818306e-01  6.419614e-01  5.624541e-01  3.122897e-01  8.522114e-01
## [6021]  5.817173e-01  2.900100e-01  3.961202e-01  1.259680e-01 -5.100699e-01
## [6026]  5.278481e-01  1.380832e+00  1.408420e+00 -1.075264e-01  2.161327e-01
## [6031] -1.089523e+00 -1.679333e+00  7.905587e-02 -5.938598e-01 -2.536493e-02
## [6036] -1.116448e+00  4.041030e-01  6.180127e-01  6.309417e-01  3.775409e-01
## [6041]  5.558389e-01 -1.677908e-01  7.264555e-01  1.385477e+00  8.159972e-01
## [6046] -4.372184e-01 -6.906600e-01 -3.197467e-01 -4.832845e-02  2.404437e-01
## [6051] -1.577563e-01  5.198448e-01 -1.477086e+00  1.020194e-01 -1.584845e+00
## [6056] -7.974337e-01  1.822309e-01  6.226779e-01  5.774144e-01  7.976379e-01
## [6061]  4.536288e-01 -2.672248e-01 -4.055882e-01  8.528545e-01  9.606337e-01
## [6066]  1.925260e-01 -3.906075e-01 -5.799253e-01  1.349767e-01  3.083690e-02
## [6071]  2.390962e-01  6.544298e-02  6.244686e-02  2.351149e-01 -2.159353e+00
## [6076]  5.019290e-01  4.038221e-01  7.853725e-01  8.026856e-01  4.214772e-01
## [6081] -6.011588e-01 -1.004989e+00 -3.167302e-01 -1.156041e+00 -7.665278e-01
## [6086]  2.460940e-01 -7.062837e-01 -1.224664e-01  4.207527e-01 -4.528219e-01
## [6091] -1.935235e-02 -1.475739e+00 -2.369281e+00  6.522768e-01  3.290885e-02
## [6096]  5.518849e-02 -5.293261e-02  4.460691e-01 -1.130081e+00  1.676125e-01
## [6101] -1.110476e+00  8.709973e-02 -1.018558e-01 -3.497619e-02 -8.217039e-01
## [6106]  3.218433e-02  5.714222e-01 -8.325613e-02  1.699451e-01  1.832160e-01
## [6111] -1.175406e-01  5.551347e-01 -9.290805e-02 -6.893905e-02  1.396825e-01
## [6116]  3.947931e-01 -4.199052e-01 -3.247334e-01 -1.866961e+00 -1.336011e-02
## [6121]  3.728554e-01  6.948455e-01 -4.211917e-01 -1.161728e-01 -3.610492e-01
## [6126] -3.100947e-01  1.127993e+00  9.112165e-02 -5.602186e-01 -1.198288e+00
## [6131]  9.593676e-01  9.150690e-01  2.241563e-01  3.199510e-01 -1.861311e+00
## [6136] -3.165846e-02  6.772106e-01 -9.121902e-01 -3.403776e-01 -4.501678e-01
## [6141]  9.839392e-01  1.379932e-01  4.234069e-01 -2.422504e-01 -2.675058e-01
```

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## [6146]  2.444249e-01 -6.118162e-01 -4.733998e-03  7.572112e-03 -7.625839e-02
## [6151] -1.008706e-01 -8.895890e-01 -1.511412e-01 -1.042310e+00 -2.504333e-02
## [6156]  7.270376e-01  6.438707e-01 -3.320935e-01 -1.933800e+00 -4.019285e-01
## [6161] -2.216398e-01 -8.662835e-01  4.344062e-01 -7.392005e-01 -3.373408e-01
## [6166] -3.713240e-01 -6.417367e-01 -1.053590e+00 -8.522644e-02 -7.964281e-01
## [6171] -5.625511e-01 -2.043062e-01 -2.342268e-01 -1.540560e-01  3.143210e-01
## [6176] -2.189449e-01 -5.213299e-01 -2.083282e-01 -7.324193e-02 -9.029005e-01
## [6181] -1.161525e-01  1.073887e-01  3.269219e-03 -3.077622e-01  3.169345e-01
## [6186] -2.225843e-01 -1.102493e+00  2.918820e-02  1.912396e-01  3.562057e-01
## [6191] -4.950486e-01 -2.282752e-01  1.569754e-01 -3.982891e-01 -4.109169e-01
## [6196] -6.344377e-01 -4.670780e-01 -4.904038e-01 -3.506728e-01  6.049686e-02
## [6201] -9.138796e-01  4.137346e-01  5.225397e-01  5.840905e-01 -2.401751e-02
## [6206] -5.269802e-01 -1.300457e+00  8.504809e-02  8.356227e-01 -1.583792e-01
## [6211] -1.111803e+00  6.323907e-01  4.387295e-01  3.325583e-01 -1.051258e+00
## [6216]  1.277184e-01  4.101360e-01 -4.681039e-01  2.201546e-01  2.890249e-01
## [6221] -2.208939e+00 -4.851769e-05 -3.320528e-01 -1.042290e+00 -9.225057e-01
## [6226] -6.018223e-01  2.434398e-01 -3.004428e-01 -3.001212e-01  3.288783e-01
## [6231]  1.799389e-01  5.654299e-01  8.344006e-02  2.803988e-01  7.151548e-01
## [6236]  7.593721e-01  3.851412e-01 -2.620430e+00 -3.603044e-01  2.796946e-01
## [6241]  3.109829e-01  1.559496e-01 -1.989572e-01 -1.037283e+00  3.636064e-01
## [6246] -1.560466e-01 -2.112836e-01  6.417686e-02  3.156277e-01  8.975391e-02
## [6251]  7.678425e-02  3.349315e-01  2.913574e-01  1.666070e-01 -7.039512e-01
## [6256] -5.894519e-02 -3.227428e-01 -1.041680e-01  3.269893e-01 -1.929650e-01
## [6261]  4.058331e-01  5.498467e-01  2.970281e-01  3.128047e-02  6.233618e-01
## [6266]  3.761731e-01 -1.766299e-02 -2.328794e-01  7.644232e-02 -6.397665e-01
## [6271] -4.434916e-01 -1.723591e+00 -1.372283e+00 -4.064684e-02  1.915612e-01
## [6276] -2.419084e-01  1.726399e-01 -3.270660e-01 -1.053248e+00 -1.923217e-01
## [6281] -2.002843e-01 -4.474933e-01  1.695828e-01 -4.624332e-01 -6.806660e-01
## [6286] -3.061338e-01 -1.264477e-01  1.918624e-01 -1.173313e+00 -1.152060e+00
## [6291]  4.836103e-01  1.758630e-02 -7.690161e-02 -1.893663e-01 -3.333799e-01
## [6296] -5.266586e-01  2.580582e-01 -1.673676e-01 -4.172104e-01  1.093050e-02
## [6301] -1.464150e-01  9.241149e-03 -6.121581e-01  3.408628e-01 -7.235970e-01
## [6306] -1.806995e-01 -8.430594e-01 -3.400357e-01 -8.932689e-01  1.416325e-01
## [6311]  1.190516e-01 -4.388468e-01  2.154725e-02 -8.233932e-01  3.209158e-01
## [6316]  1.183068e-01  7.160586e-01 -2.323032e+00  4.553384e-01  5.734534e-01
## [6321] -1.171783e-01  7.674160e-01  4.314508e-01 -1.154483e-01  3.529083e-01
## [6326] -5.463247e-01  3.322774e-01  4.726720e-01  1.177881e+00  4.999384e-01
## [6331]  3.362790e-01  4.074615e-01  5.624744e-01  5.621325e-01  4.400159e-01
## [6336] -3.912508e-01  3.186238e-01 -3.177561e-01  6.519756e-01  5.235655e-01
## [6341]  6.683105e-02 -4.311855e-01  6.665533e-01  8.442284e-01  5.168486e-01
## [6346]  3.471970e-01  1.582822e-01  2.251414e-01  4.215785e-02 -8.250623e-01
## [6351]  2.693588e-01  5.937424e-01  2.587420e-01  1.340556e+00  6.120407e-01
## [6356]  4.806345e-01 -4.358304e-01 -9.880581e-01 -1.665720e+00 -1.550818e-01
## [6361] -3.769743e-01  7.444119e-01  6.253117e-01  7.115154e-01  1.323632e-01
## [6366] -1.036961e+00  4.104169e-01  2.481253e-01 -2.846646e+00 -1.331605e+00
## [6371]  2.281229e+00  3.002417e+00  3.485068e+00  2.276755e+00  2.144739e+00
## [6376]  2.108461e+00  2.118855e+00  1.687584e+00  2.499102e+00  1.811382e+00
## [6381]  2.679344e+00  2.401453e+00  1.974968e+00  2.013189e+00  2.112003e+00
## [6386]  1.689837e+00  1.629197e+00  1.580396e+00  1.914561e+00 -2.995829e+00
## [6391]  1.952860e+00  1.306047e+00  1.558132e+00  1.757484e+00  1.946863e+00
## [6396]  1.931683e+00  9.022920e-01  1.396378e+00  1.803442e+00  1.575098e+00
## [6401]  1.777791e+00  1.788496e+00  2.648949e-01  1.433433e+00  1.655314e+00
## [6406]  1.682053e+00  4.108474e-01  1.009201e+00  8.908880e-01  1.654304e+00
## [6411]  1.070540e+00  1.294917e-01  1.097978e+00  2.114334e+00  1.491728e+00
```

```
## [6416]  1.909264e+00  1.863337e+00  2.350851e+00  1.152621e+00  2.511439e+00
## [6421]  1.579774e+00  8.461267e-01  5.970405e-01  1.638892e+00  1.357691e+00
## [6426]  4.419832e-01  1.294721e+00  1.535712e+00  1.775305e+00  1.804219e+00
## [6431]  2.074559e+00  1.512360e+00  1.005581e+00  8.535222e-01  6.391917e-01
## [6436]  5.283058e-01  2.199103e+00  1.814691e+00  1.055183e-01  6.325733e-01
## [6441]  2.022138e+00  1.202479e+00  1.604524e+00  9.577896e-01  4.826899e-01
## [6446]  1.070074e+00  1.195783e+00  1.618104e+00  1.463979e+00  1.866491e+00
## [6451] -2.445966e+00 -1.168919e+00 -1.969934e+00 -7.432883e-01 -4.423563e-01
## [6456]  8.878496e-02 -8.744500e-01 -8.630890e-03 -1.228037e+00 -2.123802e-01
## [6461] -9.836583e-01 -8.348309e-01 -1.327208e+00  9.616427e-01 -4.059688e-01
## [6466]  8.870348e-01  9.022142e-01 -6.349347e-01 -7.459760e-01  4.408495e-01
## [6471] -1.126690e+00  1.743307e-01 -6.699236e-01  2.735335e-01 -1.868069e-01
## [6476] -5.189525e-01  3.823216e-01  6.260008e-01  2.164042e-01 -5.112463e-01
## [6481]  5.691363e-01 -5.408281e-01 -1.973787e+00 -5.960927e-01 -8.749938e-01
## [6486] -7.895258e-01  2.291290e-01 -2.342088e+00 -1.869520e+00 -1.753382e+00
## [6491] -1.841072e+00 -1.663828e+00 -1.209516e+00 -1.889329e+00 -1.753615e+00
## [6496] -2.384974e-01  9.484517e-01  1.585337e+00  8.298596e-01  6.317186e-01
## [6501]  1.222087e+00  7.163320e-01  9.442101e-01  4.123237e-01  1.046489e+00
## [6506]  2.697263e-01  3.493529e-01  2.453962e-01 -7.764902e-01 -2.737971e-01
## [6511] -3.168030e-01  2.832282e-01  1.778730e-01  1.602390e-01  9.182483e-01
## [6516]  7.243490e-01 -1.888708e+00 -1.891838e-01 -1.465920e+00 -3.421433e-01
## [6521] -1.924930e-01  6.311747e-01  4.882207e-01  2.891474e-01 -2.477257e+00
## [6526] -1.901590e+00  6.392419e-02  9.706734e-01  4.270076e-01  1.088269e+00
## [6531]  8.595377e-01  4.203456e-01  7.275077e-01 -5.054227e-02  1.823277e-01
## [6536]  3.763780e-03  9.931830e-01  8.804912e-02 -1.093561e+00  9.376658e-01
## [6541] -8.404020e-01  7.310978e-02 -1.985210e-01 -1.798732e+00  5.070534e-01
## [6546]  1.371062e-01 -1.824976e+00  1.022819e-01 -7.092803e-01 -5.428292e-01
## [6551] -1.311996e+00 -4.731215e-02 -1.393859e+00 -9.682937e-01  1.300406e-01
## [6556] -1.382655e+00  2.665124e-01 -1.124449e+00 -7.158412e-01 -5.940062e-01
## [6561]  1.524496e-01 -4.039349e-01  5.817496e-01 -1.745637e+00 -9.920151e-01
## [6566]  4.571887e-01 -3.231826e-01 -6.297393e-01 -9.883808e-01 -1.463508e+00
## [6571] -1.245779e+00 -1.548399e+00 -1.394667e+00 -5.403056e-01 -1.176736e+00
## [6576] -1.190565e+00 -7.260363e-01 -1.092896e-01 -3.772868e-01  1.526509e-01
## [6581] -1.305536e+00 -9.995853e-01  5.393545e-01  3.051727e-01  2.225021e-01
## [6586] -4.798422e-01 -6.024848e-01 -1.585243e+00 -8.269768e-01 -2.134604e-01
## [6591]  1.642594e-01 -4.816593e-01 -1.873166e-01 -2.631228e-01  1.630482e-01
## [6596] -4.287663e-01 -1.141810e+00 -1.853988e-01 -2.746302e-01  3.818493e-02
## [6601] -2.522212e-01 -1.358025e+00  6.157666e-01  7.003549e-01 -1.978145e-01
## [6606]  9.652823e-02  5.683249e-01  2.610617e-01 -2.108107e+00  1.729175e-01
## [6611]  2.186658e+00  8.727423e-01  1.701234e+00  4.799866e-01 -3.628467e-02
## [6616]  1.160254e+00  2.827920e-01  1.268395e+00  7.218445e-01  1.759488e+00
## [6621]  1.012896e+00  2.539999e+00  8.801444e-01  2.480506e+00  1.097097e+00
## [6626]  1.778230e+00  4.428256e-01  9.665491e-01  7.376394e-01  1.130223e+00
## [6631] -2.539549e-01  1.767906e+00 -1.492680e+00 -1.591761e+00  1.740807e-01
## [6636]  1.853453e-01  7.371690e-01  9.049277e-01  8.823735e-01  1.028246e+00
## [6641]  1.226851e+00  9.134096e-02  1.012376e+00  1.478865e-01  8.542481e-01
## [6646]  1.296445e+00  4.147504e-01  2.250929e+00  5.680246e-01  1.218706e+00
## [6651]  1.037877e+00  1.051493e+00  1.644854e-02 -2.289740e-01  6.508145e-01
## [6656] -4.759942e-02  1.106925e+00  6.820343e-01  6.079100e-01 -1.384935e+00
## [6661] -1.305264e+00 -3.016625e-01  1.158265e-01  1.266208e-01  7.223649e-01
## [6666] -5.739971e-01 -1.834203e-01  2.424865e-01  1.820283e-01  2.048051e-01
## [6671] -2.332817e-01 -2.743302e-01 -8.652713e-01  1.501612e+00  2.044746e+00
## [6676]  5.469565e-01 -4.838052e-01  3.406010e-01  1.579104e+00 -3.189434e-01
## [6681] -7.601748e-01 -9.695470e-03 -2.062503e+00  2.304789e-01  6.791626e-01
```

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## [6686] -7.769855e-01  2.559300e-01  7.261773e-01 -3.679124e-03  3.739496e-01
## [6691] -2.340582e+00  1.210288e+00  4.315109e-01  2.229710e+00  1.817792e+00
## [6696]  9.921978e-01  1.735993e+00 -7.933008e-01  1.317093e+00  3.155950e-01
## [6701]  6.179363e-01  1.705046e+00  4.145027e-01  3.947951e-01  8.965099e-01
## [6706]  2.030965e-01 -1.479955e+00 -4.672422e-01  4.708758e-01 -4.331681e-02
## [6711] -3.904687e-01  4.475785e-01  9.250411e-02 -1.740368e-01  2.021309e-01
## [6716] -6.597090e-01  2.822464e-01 -2.771944e-02 -3.931430e-01  2.319148e-01
## [6721] -1.277957e+00 -1.044679e-01 -5.819197e-01 -1.634902e-01 -5.555531e-01
## [6726]  5.665637e-01 -9.391730e-01 -2.075006e+00 -4.159198e-01 -2.551431e-01
## [6731]  5.574780e-01  4.264852e-01 -7.995397e-01 -1.625246e-01  1.099498e+00
## [6736] -6.428482e-01  3.209185e-01 -1.721307e-01  3.079453e-01 -2.093167e-01
## [6741]  5.164546e-01 -1.515730e+00 -1.540324e+00  6.040574e-01  1.749935e+00
## [6746]  8.538856e-01  4.763676e-01  1.131573e+00  1.543209e+00  7.611212e-01
## [6751] -1.138316e-01  9.916698e-01  1.995524e+00  1.169224e+00  5.374373e-01
## [6756]  1.295400e+00 -4.734831e-01  9.504856e-01  1.072280e-01  2.042320e-01
## [6761]  1.097455e+00 -1.651358e+00 -6.914138e-01 -8.244532e-01  1.278644e+00
## [6766] -6.054125e-01  3.029520e-01 -7.510695e-01  6.865261e-01  3.063839e-01
## [6771] -1.253390e-01 -2.305192e-01  1.962576e-01  2.587398e-01  1.831354e-01
## [6776] -5.065914e-01  4.507290e-01  1.743539e-01  2.718222e-02  1.061924e+00
## [6781]  9.238981e-02  5.796868e-02  3.310130e-01 -1.642011e-01 -1.805534e-01
## [6786]  4.173178e-01 -7.782037e-04 -4.791751e-02 -3.263115e-01  9.141471e-01
## [6791] -4.195807e-01  8.007523e-02  4.775788e-01 -9.961534e-01  1.315083e+00
## [6796] -8.207184e-01 -4.088814e-01  1.952472e-01 -2.470744e-01 -1.588170e+00
## [6801] -1.886245e+00  4.014692e-01 -6.374136e-01  8.944380e-01  9.024006e-01
## [6806]  7.208458e-01 -1.262814e+00 -1.402204e+00 -2.894232e-01  2.634275e-01
## [6811] -3.927908e-02  3.938079e-01  2.604110e-01 -1.248193e-01 -3.739579e-01
## [6816]  1.383554e-01  1.039518e+00  3.412454e-01  6.409762e-01  3.495702e-01
## [6821]  6.615868e-01  7.045177e-01  2.075676e-01  9.527119e-01  3.818641e-01
## [6826]  8.392621e-01  8.410360e-02  1.479965e+00  8.248839e-01  8.768643e-01
## [6831]  1.625920e-02  2.887236e-01  2.567717e-01 -3.962782e-01 -3.117841e-01
## [6836]  6.552526e-01  2.787297e-01  9.380731e-01  4.622046e-02  3.116668e-01
## [6841] -6.304159e-01 -5.762249e-01  2.261266e-01 -1.287789e+00 -2.368810e-01
## [6846] -2.335836e-01  2.710685e-01  7.047040e-02 -7.402060e-01  4.260204e-01
## [6851]  1.206597e-01 -2.683268e+00 -1.881279e+00 -3.017902e-01  2.929858e-01
## [6856] -1.447663e-01  4.017908e-01  8.014264e-02  4.726516e-01 -3.859220e-01
## [6861] -1.267624e-02 -4.727690e-01 -4.404589e-02  1.652799e-01  1.865744e-01
## [6866]  3.561651e-01 -7.934930e-01  2.740442e-01  7.004755e-01 -5.379592e-01
## [6871] -1.411270e-01  3.229471e-01  3.668835e-01  1.918828e-01 -1.979043e+00
## [6876]  2.794136e-01  7.697079e-01 -2.134299e-02  4.058127e-01  1.222119e+00
## [6881] -3.131652e-02 -1.519293e+00  4.460488e-01 -8.234136e-01 -5.659229e-02
## [6886]  4.487030e-01  7.051812e-01  4.430730e-01  5.321712e-01  6.672372e-01
## [6891]  4.314101e-01  4.024747e-01 -7.904766e-01 -1.311758e+00  2.328230e-01
## [6896] -6.370920e-01 -5.622498e-01  8.628687e-01 -6.558066e-02 -1.304696e-01
## [6901]  5.544915e-01  6.473104e-01  2.477630e-01  2.420924e-01  3.648521e-01
## [6906]  8.671309e-01 -1.394376e-01 -6.214681e-01  7.479362e-02  7.803653e-01
## [6911]  7.673551e-01  1.438040e+00 -5.479327e-01  4.486420e-01 -3.296999e-01
## [6916] -5.708962e-01 -6.580852e-01 -5.549508e-01 -8.393669e-03  1.766009e-01
## [6921]  1.506412e-01  2.767391e-01 -3.121057e-01 -1.017677e+00 -2.643716e+00
## [6926] -2.094484e+00 -2.768124e+00 -2.935464e+00 -2.028974e+00  5.364006e-01
## [6931] -6.304600e-01  1.665467e-01  9.071551e-01 -3.113501e-01 -4.947001e-01
## [6936]  7.735072e-01 -1.043599e+00 -2.791265e-01  5.144933e-01  1.068676e+00
## [6941]  4.051296e-01 -9.213091e-01  9.414447e-01 -1.616681e-01 -3.999976e-02
## [6946]  4.170315e-01 -4.294760e-01  3.059584e-01  2.837721e-01  7.541639e-01
## [6951]  9.779558e-01  6.415687e-01 -3.267626e-01  1.791929e+00 -4.761020e-01
```

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## [6956]  7.591047e-01  1.250782e+00  1.941402e-01  6.273993e-01  1.193296e+00
## [6961]  5.876249e-01  6.755015e-01  3.044822e-01  1.203690e+00 -1.807481e+00
## [6966]  8.455510e-01 -3.916441e-01  1.718720e+00  1.058592e+00 -1.532707e-02
## [6971] -7.054564e-01 -2.052179e-01  8.483483e-01 -1.729943e-01  2.407661e-01
## [6976]  8.773085e-01  6.038144e-01 -5.153325e-01  4.147005e-01 -4.522063e-01
## [6981]  7.419052e-01  2.405330e-01 -6.524451e-01  8.602183e-01  6.080560e-01
## [6986]  2.373792e-01  6.277100e-01  4.019757e-01  1.126162e+00  7.473123e-01
## [6991]  1.720727e-02  1.189055e+00  2.318944e-01  5.138717e-01 -6.588304e-01
## [6996]  3.604460e-01 -1.738490e-01 -6.540449e-01 -2.119140e-01  1.791161e-01
## [7001]  3.386481e-01  1.048190e-01 -5.438266e-01  7.419370e-01 -3.745999e-01
## [7006]  7.231058e-01 -1.162995e-01 -2.435184e+00  7.329476e-02  5.275289e-01
## [7011] -1.173730e-01  2.400668e-01  1.582966e-01 -2.039288e-01  1.050310e+00
## [7016]  1.717666e-01  4.493010e-01  3.022607e-01  7.037402e-02  7.107235e-01
## [7021]  6.798208e-01  1.170799e+00  4.684889e-01  8.061192e-01  9.757897e-02
## [7026] -1.400621e-02 -3.867809e-01  7.718296e-01  5.080302e-01 -6.236861e-01
## [7031]  1.187553e-01  4.110805e-01  3.448005e-01  1.549873e-01  7.201850e-01
## [7036]  7.689866e-01  6.138515e-01  5.474938e-01  3.203609e-01 -4.685511e-01
## [7041]  3.969112e-01  1.278687e+00  2.712026e-01  1.169223e-01 -9.102159e-01
## [7046]  5.119610e-01 -8.605914e-01 -4.438007e-01  1.861231e-01 -8.083016e-02
## [7051]  5.861027e-01 -1.695197e+00 -6.037990e-01  5.194342e-01  4.739736e-01
## [7056]  2.682818e-01  8.363227e-01  1.050498e+00  4.153998e-01 -5.480682e-01
## [7061]  1.282151e+00  1.001495e+00  1.793492e-01  4.623366e-01  5.868019e-01
## [7066]  5.849373e-01  6.310970e-01  8.480374e-01 -5.917733e-01 -4.529738e-02
## [7071]  2.709695e-01  7.127897e-01  1.474365e-01  2.329045e-01  4.864654e-01
## [7076]  3.267003e-01  1.164479e-02  4.503887e-01  6.140847e-01  2.682042e-01
## [7081]  3.408696e-01  9.819961e-01  1.001339e+00  1.099889e+00  1.405172e+00
## [7086]  4.705090e-01 -2.101407e+00 -8.009312e-03  1.284040e-01  5.480376e-01
## [7091]  2.779765e-01  5.749378e-02  3.054145e-01  6.556920e-01  3.458105e-01
## [7096] -4.769566e-01  3.283779e-01  3.111324e-01 -8.469448e-04  2.352813e-01
## [7101]  1.495403e-02  3.482651e-01  4.733521e-01  7.424809e-01 -2.200865e-01
## [7106]  4.807818e-02  1.111791e+00  7.270367e-01 -2.830573e-01 -1.308431e-01
## [7111]  9.620312e-01  9.908361e-01 -5.037731e-01  7.334538e-01  2.104850e-01
## [7116] -2.886657e-01 -4.027880e-02  1.480581e-01  5.033142e-02 -1.625841e+00
## [7121]  4.375085e-01  8.708453e-01 -3.903232e-01  7.722181e-01  6.711046e-01
## [7126] -3.061761e-01 -3.130277e-01 -4.597571e-01  8.146720e-02 -1.580892e+00
## [7131]  4.499226e-01  3.188387e-01 -8.829332e-01  4.608603e-01  5.902666e-01
## [7136]  5.225880e-01  1.055960e-01  6.167723e-01  2.657178e-01 -1.239208e+00
## [7141] -2.130795e-01  2.070981e-01 -6.877130e-01  6.144413e-01  1.931301e-01
## [7146]  1.343801e+00  7.915614e-01 -2.130018e-01  1.781061e-01  3.031931e-01
## [7151] -4.133642e-01  2.875475e-01 -2.548423e-01 -7.312627e-01  3.543715e-01
## [7156] -1.089759e+00  8.648577e-02 -1.164367e+00  1.197971e-01  2.752888e-01
## [7161]  6.395025e-01  3.458882e-01 -3.640506e-01  5.710787e-01 -2.263626e+00
## [7166]  9.482963e-01  7.459138e-01  1.209253e+00  1.006637e+00  1.321848e+00
## [7171]  7.839788e-01  2.250994e+00  9.389584e-01  1.762580e+00  1.363766e+00
## [7176]  1.602660e+00  1.537934e+00  1.033842e+00  9.061451e-01  1.188122e+00
## [7181]  1.285383e+00  1.162394e+00  1.108761e+00 -2.750802e-02  1.304648e+00
## [7186]  1.815281e+00  1.772586e+00  9.235459e-01  1.538788e+00  1.106197e+00
## [7191]  1.290790e+00  1.040771e+00  2.011200e+00  1.232838e+00  1.232061e+00
## [7196]  1.296942e+00  7.536518e-01  5.361675e-01  7.137997e-01  1.589959e-01
## [7201]  6.163838e-01  3.291548e-01 -6.156455e-02  1.011345e+00  1.168701e+00
## [7206] -1.193614e-01  2.204904e-01  1.019440e+00  4.961600e-01  8.400981e-01
## [7211] -1.618235e-01  9.996300e-01 -1.311951e+00  5.861804e-01  4.660343e-01
## [7216]  5.908883e-01  1.244708e+00  3.460436e-01 -6.022767e-01  8.935755e-01
## [7221]  3.873402e-01  3.230803e-01 -5.324226e-01 -7.660962e-01 -1.021646e+00
```

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## [7226] -5.540968e-01 -1.660651e-01 -3.754546e-01  8.600312e-01 -1.641484e-02
## [7231]  1.147214e+00  1.144371e+00  8.886266e-02  1.206200e-01  4.580950e-01
## [7236]  3.536721e-01  4.695767e-01  1.160716e+00 -2.721655e-01  5.288497e-01
## [7241] -1.585919e-01 -3.667383e-01 -9.395645e-01  4.461471e-01  3.407919e-01
## [7246] -7.573022e-01 -1.322733e+00 -2.009668e+00 -2.981306e-01 -1.205648e+00
## [7251]  6.256537e-01  4.749843e-01  8.109901e-01 -3.456657e-01  1.938937e-01
## [7256] -4.528016e-01 -4.195430e-01 -1.976389e+00 -1.659998e-01  3.183022e-01
## [7261]  5.118688e-02 -1.193342e+00 -3.819611e-01 -2.871313e-01 -1.582533e+00
## [7266] -8.297477e-01 -3.759485e-01 -6.304768e-01 -4.231587e-02 -1.789425e+00
## [7271] -1.114136e+00 -2.321363e+00 -2.649708e+00 -6.164004e-02  1.030790e+00
## [7276]  1.042111e+00  8.854293e-01 -2.467066e+00 -2.286114e+00  3.745244e-01
## [7281] -2.272139e+00 -9.421514e-01  4.859429e-01 -1.308420e+00 -2.832329e+00
## [7286] -5.865201e-01  4.926393e-01 -1.672356e+00 -2.187303e+00  3.511986e-01
## [7291] -2.062211e+00 -2.212920e+00 -2.124445e+00  9.835972e-01  1.257920e-02
## [7296] -2.424156e+00 -2.126758e+00 -1.645733e+00 -7.761595e-01  4.293788e-01
## [7301]  6.988063e-01  1.852270e-01 -8.942541e-01  8.714745e-01 -5.299360e-02
## [7306] -1.508676e+00  5.454828e-01  4.477178e-01  1.356606e-01 -5.595753e-01
## [7311] -2.299170e-02 -1.434392e-01  1.106658e-01 -4.564613e-01  7.914048e-03
## [7316] -5.449569e-01  1.665867e-01 -5.815334e-01  2.058242e-02 -6.018630e-01
## [7321] -2.572107e-01 -1.031290e+00 -6.763632e-01 -5.971978e-01 -5.389444e-01
## [7326] -6.623880e-01 -2.232682e-01 -1.992991e-01 -6.590500e-01 -4.993515e-01
## [7331] -6.138068e-01  5.188800e-01 -2.352526e-01  5.551010e-02  1.685367e-01
## [7336] -3.670008e-01  5.058900e-01 -9.421718e-01 -9.075657e-01  2.876774e-01
## [7341]  1.423367e-01 -7.024582e-02 -1.373972e+00 -4.192214e-01 -1.282965e+00
## [7346] -9.857865e-01 -1.078866e+00 -8.220661e-01 -1.745529e+00 -7.116328e-01
## [7351] -6.520929e-01 -2.665410e-01  2.494524e-01 -9.002667e-01 -1.311778e+00
## [7356] -2.130417e+00 -1.499728e+00 -2.187966e+00 -2.490372e+00 -2.021311e+00
## [7361] -2.195286e+00 -2.254162e+00 -1.920493e+00 -3.069358e-01  7.943354e-01
## [7366] -4.576111e-01  1.055380e+00 -1.703969e-01  9.706843e-01  2.370325e-02
## [7371]  5.366324e-01  8.427609e-01  9.217133e-01  6.582919e-01  1.121335e+00
## [7376]  8.583833e-01  1.286667e+00  8.149333e-01  1.792886e+00  2.036169e-01
## [7381]  4.766445e-01  3.075252e-01  3.185671e-01  3.808732e-02  9.421138e-01
## [7386]  1.421931e-01  7.907205e-01  4.207416e-01  4.281939e-01  2.120097e-01
## [7391]  1.147008e+00  6.995379e-01  3.235426e-01  9.288928e-01  1.011446e-01
## [7396] -6.802490e-02  4.149228e-01  2.405803e-01 -2.685866e-01  1.518125e+00
## [7401] -3.345658e-01  2.108466e-01 -1.467947e+00 -3.120116e-01  1.656628e-01
## [7406] -4.969760e-01  2.028739e-01 -7.918399e-01 -3.031848e-02 -5.420845e-01
## [7411]  1.575428e-01 -1.974217e+00 -3.734104e-01 -1.278923e+00  5.759974e-01
## [7416] -9.883415e-01  1.897031e-01 -2.198076e+00  6.714627e-01  6.110044e-01
## [7421]  6.947349e-01  6.263542e-01  7.009738e-01  8.372148e-01  1.102370e+00
## [7426] -4.480049e-01  9.730859e-01 -1.915404e-01  9.224062e-01 -5.118917e-02
## [7431]  1.292449e-01  2.845616e-02  6.854015e-01  6.076623e-01  4.744906e-01
## [7436]  9.970510e-01  2.006917e+00  1.177980e+00  3.967766e-01  3.509250e-01
## [7441]  7.360309e-01  1.945062e-01 -1.865656e+00  1.448123e+00  6.575558e-01
## [7446]  1.471843e+00  6.101140e-01  1.001561e+00  1.852549e-01  1.399974e+00
## [7451]  5.863932e-01  7.329590e-01  9.757211e-01  6.003231e-01  1.126425e+00
## [7456]  1.030936e+00  6.630071e-01  8.696326e-01  1.478910e+00  1.178409e+00
## [7461] -3.611357e-01  7.090363e-01  1.141667e+00  5.918440e-01 -1.870299e+00
## [7466]  1.322755e+00 -3.883255e-02  6.647235e-01  5.223968e-01  4.355878e-01
## [7471]  8.289534e-01  4.662742e-01  7.173136e-01  4.911056e-01  7.183231e-01
## [7476] -3.056185e-01 -2.014477e-01 -3.163182e-01  2.552073e-01 -1.808563e-01
## [7481]  1.018419e+00 -1.031319e-01  5.710503e-01  4.579968e-01  3.585704e-01
## [7486]  6.994396e-03  6.702750e-01  8.110870e-01 -5.641276e-01 -4.633887e-01
## [7491]  8.912334e-01  4.703114e-01  6.563450e-01  7.590016e-01  6.447360e-01
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## [7496]  1.191733e+00  8.990055e-01 -4.549555e-02  3.593775e-01 -2.030640e-01
## [7501] -2.041736e-01  1.682962e-01  7.302330e-01  2.928581e-01  4.576939e-01
## [7506]  1.572986e+00  7.138812e-01  1.436414e+00  1.592165e+00  8.986673e-02
## [7511]  1.268146e+00  6.374691e-01  2.457188e-01  1.336748e-01  3.925874e-01
## [7516]  7.469900e-01  1.308017e+00  1.517470e+00  2.357901e+00  1.283287e+00
## [7521]  8.693296e-01  8.634753e-01  1.463870e+00  1.908008e+00 -9.126758e-01
## [7526]  5.544557e-02  6.364596e-01  5.749864e-01  1.008325e+00  2.213551e-02
## [7531] -3.782360e-02  3.380791e-01  5.444017e-01  1.051124e+00  6.075904e-01
## [7536]  7.279118e-01 -2.168923e-01 -1.923632e-01  4.030849e-01  9.195979e-01
## [7541] -8.082400e-02  4.691002e-01 -3.031960e-01 -8.647657e-02 -6.158089e-01
## [7546] -1.117116e-01 -7.090780e-01 -1.797457e-01 -1.862060e-01 -2.405120e-01
## [7551]  1.194045e-02  1.292334e-01  1.263062e-01 -2.217372e-01 -2.651795e-02
## [7556] -4.821635e-01 -1.796107e+00 -1.289083e+00 -8.876420e-01 -8.304466e-02
## [7561] -4.953232e-02  4.678890e-01 -7.151347e-01 -9.606626e-02 -5.800763e-01
## [7566] -8.975341e-01 -1.605674e-01 -4.424944e-01 -1.090836e+00 -3.039025e-01
## [7571] -3.039020e-01 -2.383925e-01 -3.530607e-01 -3.737538e-01 -9.856555e-01
## [7576]  2.157389e-01 -1.632340e-02 -1.296048e+00 -3.556854e-01 -8.047697e-01
## [7581] -8.469629e-01  1.112658e-01  2.984100e-01  6.492795e-01  1.551745e-01
## [7586] -6.286287e-01 -4.677294e-01  5.903298e-01  6.871321e-01  3.366661e-01
## [7591]  1.613328e-01 -2.417232e-01  9.826860e-01  5.010984e-01 -2.868437e-01
## [7596]  5.400615e-01 -1.017188e-01  3.140553e-01 -7.840154e-02 -7.890232e-01
## [7601] -2.315144e+00  6.401945e-01  5.377397e-01  3.039614e-01 -2.377465e+00
## [7606] -9.246182e-01 -1.596020e-01  1.811045e-01 -3.635844e-01  3.236701e-01
## [7611] -3.847925e-01 -1.300979e-01  7.769177e-02  5.341474e-01  7.950260e-01
## [7616]  2.634964e-01  5.008361e-01  1.202315e-01 -4.229893e-02  5.765317e-01
## [7621]  3.525067e-01 -1.673859e-01 -4.661824e-02 -8.428479e-01  2.983299e-01
## [7626] -2.674894e-01  6.033684e-02  7.278136e-01  1.898208e-01  1.093714e-01
## [7631]  8.169793e-01  3.476435e-01  2.692602e-01  1.233272e+00  7.080818e-01
## [7636]  7.128673e-01  6.151406e-01  8.501352e-01  4.220183e-01 -2.578408e-01
## [7641]  1.801262e-01  5.099409e-01  7.721404e-01  2.974752e-01 -3.953358e-02
## [7646] -1.529668e+00 -1.091934e+00 -2.438804e+00 -8.587266e-01 -8.051714e-01
## [7651] -2.784272e-01  3.555828e-01  7.236038e-01 -2.001216e-01  1.383032e+00
## [7656]  6.925916e-01 -8.137323e-01 -1.146422e+00  7.719850e-01  1.360325e-01
## [7661] -3.181699e-01 -6.886453e-01  1.945286e-01 -1.184409e+00 -1.709366e+00
## [7666] -1.343397e+00 -1.246836e+00  2.074960e-02  6.040474e-01 -1.122060e+00
## [7671] -1.114742e+00  1.356440e-01  4.832798e-01 -2.132349e-01 -3.181239e-01
## [7676] -1.682089e-01 -2.815034e-01 -1.000181e-01 -6.919309e-02 -4.183051e-01
## [7681]  1.340441e-01 -1.602955e+00 -2.735262e-02  2.349705e-01  3.226918e-01
## [7686]  2.013025e-01  2.511600e-01  3.013343e-02  1.981946e-01 -2.018309e-01
## [7691] -2.686549e-01  8.676482e-02  2.743565e-01  1.127584e-01 -5.428482e-01
## [7696]  6.189079e-02 -6.161353e-01  2.372238e-01 -4.493632e-01 -9.827259e-01
## [7701] -5.341319e-01 -7.359706e-01 -8.409373e-01  5.072532e-01 -2.627039e-01
## [7706] -2.217181e-01 -1.226706e-01  4.596172e-01 -7.351936e-01 -2.863666e-01
## [7711] -3.217439e-01 -1.271453e-01 -2.634032e-01 -6.385548e-01 -1.028730e+00
## [7716] -9.524448e-01 -9.518232e-01  3.720054e-01  7.800256e-02  7.621552e-02
## [7721] -5.716754e-02 -7.171712e-01  2.577008e-01 -1.423847e+00 -1.858971e+00
## [7726] -1.289065e+00 -1.242672e+00 -2.288028e-01 -6.741652e-01 -3.361464e-01
## [7731] -2.926330e-02 -1.400650e+00 -2.172644e+00 -1.558222e+00 -4.338194e-01
## [7736]  7.970150e-01  7.633081e-03  2.970484e-01 -4.986880e-01  8.712004e-02
## [7741] -5.080183e-01 -8.031043e-01  2.969671e-01 -2.715277e-01 -1.690366e-01
## [7746] -7.198966e-01 -4.661132e-01 -2.276117e-01  2.860084e-01 -6.780728e-01
## [7751] -2.598649e-01 -2.615542e-01 -6.211668e-01  6.183749e-01 -1.750289e-01
## [7756] -9.610930e-01 -8.493326e-01  2.624017e-01 -5.826132e-02 -3.027551e-01
## [7761] -7.625263e-01 -2.426126e-01 -7.056743e-02 -2.102985e-01  4.729733e-01
```

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## [7766]  8.096223e-01  1.471258e+00 -1.261667e-01 -1.015666e+00 -1.390219e+00
## [7771] -2.611716e-01 -8.376900e-01 -1.339045e+00 -1.937802e+00 -7.149912e-01
## [7776] -1.434189e-01 -1.860627e+00 -2.123440e+00 -8.726380e-01 -1.764149e+00
## [7781] -9.355770e-01 -7.648183e-01 -1.670666e+00 -3.023617e+00 -3.626572e-01
## [7786] -1.482073e+00 -9.248382e-01 -2.758306e-01 -6.866380e-01 -9.234908e-01
## [7791] -3.952524e-01 -1.184011e+00 -7.408898e-01  5.195435e-01  2.311337e-01
## [7796] -2.814809e-01  1.293061e-01  5.475141e-01 -6.859947e-01 -1.700218e-01
## [7801] -1.424541e-01 -2.342471e-01 -3.011470e-01  1.745696e-01  7.680459e-02
## [7806]  3.621980e-01 -4.255352e-01 -7.033080e-01 -6.683803e-01  8.505220e-01
## [7811] -4.657916e-01  3.881979e-02 -5.133876e-01  8.255988e-03 -1.105489e+00
## [7816]  2.597068e-01 -7.449117e-01 -3.643466e-01 -2.761929e-01  9.280183e-01
## [7821] -5.106522e-01 -1.120108e+00  5.228816e-01 -1.074857e-01 -1.209951e+00
## [7826] -1.303413e+00 -9.115266e-01 -1.740437e-01 -1.402887e+00 -4.085843e-01
## [7831] -2.133755e+00 -3.829277e-01 -6.244631e-01 -1.104581e+00 -6.389433e-01
## [7836] -3.413203e-01  1.349447e-01 -7.953214e-01 -2.713696e+00 -3.064092e-01
## [7841]  1.110808e-01 -2.853565e-01  6.200815e-01 -4.728577e-02 -9.341115e-01
## [7846]  6.558852e-02 -2.042855e-01 -1.027642e+00 -7.582346e-01  2.020018e-01
## [7851] -2.187030e+00 -4.797997e-01  7.123234e-01  6.457846e-02 -5.576391e-01
## [7856]  4.153741e-02 -7.191595e-01  3.460814e-02  1.335002e-01 -3.406988e-01
## [7861] -7.931613e-03 -6.351678e-01 -3.248201e-01  3.724716e-01 -3.453289e-01
## [7866]  9.965999e-01 -1.398273e+00 -9.001266e-02  2.107640e-01 -7.858281e-01
## [7871] -1.776244e-01 -9.062073e-01 -2.557747e-01  1.455258e-01 -3.559559e-01
## [7876] -4.748588e-01 -3.207339e-01 -7.306412e-01  1.224071e-01  8.415485e-02
## [7881] -1.001836e+00 -2.252605e-01 -2.016482e+00  5.185794e-01  4.830467e-01
## [7886] -5.499329e-01 -3.329148e-01 -8.208170e-01 -1.679629e+00  3.916054e-02
## [7891] -7.422006e-01  4.640142e-01  5.416982e-01  2.889143e-01  5.882465e-01
## [7896]  5.927989e-01  4.671680e-01  7.547855e-01  2.161711e-01  8.427858e-01
## [7901]  1.014421e+00  1.080506e-01  4.252499e-01  1.639591e+00 -1.729167e-01
## [7906] -1.871401e-02 -3.019345e-01 -4.606118e-01  2.758327e-01  7.941713e-01
## [7911]  9.516056e-01 -6.498033e-01  1.440362e+00  1.238757e+00 -8.145174e-02
## [7916]  1.599817e+00  9.168038e-01  2.143381e-01  5.236757e-01 -8.195739e-01
## [7921] -4.545278e-02  1.498113e+00  1.472508e+00  6.160730e-01  1.491458e-01
## [7926]  1.138809e+00  1.105808e+00 -5.214848e-01 -9.404192e-01  7.571164e-01
## [7931] -2.894427e-01 -4.992207e-01 -6.549537e-02  9.275862e-01  9.607881e-01
## [7936] -2.700994e-01  1.779345e+00  1.093271e+00  9.486848e-01  4.020534e-01
## [7941]  3.240126e-01  8.979726e-01  7.841660e-01  1.308126e-01  6.126861e-01
## [7946]  8.269388e-01 -2.389636e-01  6.979986e-01  8.917426e-01  8.142916e-01
## [7951]  3.415371e-01 -1.485088e-01  7.520978e-01  3.370165e-01 -3.715238e-01
## [7956]  1.713322e-01 -2.115256e-01 -2.930627e-01  4.992362e-01 -1.329091e-01
## [7961]  3.660085e-01  4.075382e-01  2.838498e-01  5.276843e-01  5.173681e-01
## [7966]  5.439515e-01  3.649207e-01 -6.520523e-01 -4.475136e-01 -7.123097e-02
## [7971] -3.513363e-01  3.791692e-01 -6.757130e-02  3.622183e-01  4.241111e-01
## [7976]  5.830647e-01 -8.712703e-01  8.136443e-01  2.441237e-01  2.161734e-01
## [7981]  9.010735e-01 -1.168567e-01  4.959368e-01  1.453125e-01 -3.294393e-01
## [7986]  1.242990e-01  1.276777e-01  2.161531e-01  4.087682e-01  1.971911e-01
## [7991]  3.163116e-01  5.508115e-01  1.005897e+00  7.567586e-01  1.639220e+00
## [7996]  9.067442e-01  6.838664e-01  2.723955e-01 -6.796809e-01 -1.231706e-01
## [8001]  4.995965e-01  5.072374e-01 -6.328874e-02 -1.032617e+00 -6.474278e-01
## [8006]  7.915749e-02  3.599060e-01 -5.565996e-01 -5.263133e-02  2.553836e-01
## [8011] -3.530460e-01  2.447669e-01  7.723418e-01 -4.458445e-01 -7.282621e-01
## [8016]  9.615376e-01  5.264803e-01  1.323022e-01  3.855034e-01 -4.658119e-01
## [8021] -2.186030e-01  3.259026e-01  6.801865e-01  1.383351e-01  8.609425e-02
## [8026] -3.906278e-01  2.274537e-01  1.828944e-01  4.879332e-02  4.380049e-01
## [8031] -1.032032e-01 -8.324223e-01 -7.858520e-01  3.654751e-01 -1.294844e-01
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## [8036]  4.746220e-01 -7.838207e-01 -7.478469e-01  4.018754e-02  1.732425e-01
## [8041]  8.335304e-01  3.122490e-01  6.178331e-02  4.496678e-01  3.056135e-01
## [8046]  8.016394e-01  3.129532e-01  6.441718e-02 -2.732574e+00 -2.318425e+00
## [8051] -4.999977e-01 -8.242400e-03 -2.758172e-01 -9.857360e-02  3.394711e-01
## [8056]  2.884481e-01  2.203350e-01  2.392898e-01  2.093195e-01  1.081283e-01
## [8061]  1.704775e-01  7.644861e-02  1.435057e-01  4.821143e-01 -4.763351e-01
## [8066] -8.550290e-01  6.150230e-02  4.201076e-01 -1.722247e+00  6.458879e-01
## [8071]  2.312728e-01  6.210139e-01 -2.163111e-01 -2.711872e-01  9.639419e-01
## [8076]  5.196673e-01  5.704571e-01  2.640402e-01  3.871071e-01  4.491456e-01
## [8081]  2.097857e-01 -9.468871e-02 -1.854861e-01  8.776969e-01  1.278609e+00
## [8086] -7.817419e-01  7.675940e-02 -2.833532e+00 -8.352970e-01 -8.928705e-04
## [8091] -4.719381e-01  1.304700e-01 -9.393314e-01 -1.031651e+00 -6.205006e-01
## [8096] -5.382181e-01 -4.075227e-01 -1.912816e-01 -3.633513e-01 -5.299680e-01
## [8101] -2.763709e+00 -9.566864e-01 -8.370842e-01 -1.911262e-01 -2.840674e-01
## [8106]  2.184703e-01 -4.765682e-01  3.011729e-01  1.928970e-01  4.847560e-01
## [8111]  3.278340e-01  2.899244e-01  3.879618e-01  3.807217e-01  4.917630e-01
## [8116]  3.213709e-01  3.331634e-01  7.488663e-01  3.554274e-01  3.688515e-01
## [8121]  6.343285e-01 -7.382320e-02  5.494822e-01  2.667279e-01  7.345874e-01
## [8126]  2.947875e-01  3.558159e-01 -4.404915e-01  3.773347e-01  5.351574e-01
## [8131] -6.176575e-01  1.472042e+00  6.234685e-01 -1.146266e+00  1.185823e+00
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## [8141] -2.796704e-01 -1.378500e-01 -1.292297e+00  6.990088e-01 -2.673105e-02
## [8146] -1.614999e-02 -8.030736e-01  1.548319e-01 -6.042651e-01  9.186111e-02
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## [8156]  1.981723e-02 -2.161557e-01 -6.106505e-01 -9.897328e-01 -2.794373e-01
## [8161]  1.201538e-01  1.707106e-01 -5.574060e-01  1.366492e-02  5.456290e-01
## [8166] -1.221386e+00 -8.356856e-01 -5.099254e-01 -1.704621e-01  1.771737e-01
## [8171] -2.160003e-01 -3.510927e-01 -4.913591e-01  1.210085e-01  4.652574e-01
## [8176]  6.636550e-02  1.519112e-01 -2.543071e+00 -1.988811e+00 -9.533771e-01
## [8181] -7.889360e-01 -1.854573e+00 -2.539218e+00 -1.159302e+00 -6.292486e-01
## [8186] -4.357378e-01 -5.334644e-01 -5.281350e-01 -7.363591e-01 -1.318057e+00
## [8191] -1.011096e+00 -8.483327e-01 -4.573025e-01 -4.794889e-01 -6.700791e-01
## [8196] -1.019735e+00 -6.738544e-01 -7.524709e-01 -6.361779e-01 -5.073155e-01
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## [8206] -1.018647e+00 -6.396425e-01 -1.080297e+00 -7.246444e-01 -5.638691e-01
## [8211] -5.829793e-01 -1.052704e+00 -1.436261e+00 -1.236831e+00 -2.025199e+00
## [8216] -1.602100e+00 -1.134785e+00 -9.136804e-01 -1.896725e+00 -1.570576e+00
## [8221] -8.367734e-01 -2.389490e+00 -1.179946e-01 -2.620445e+00 -2.531512e+00
## [8226] -9.641595e-01 -4.134419e-01 -4.389279e-03 -3.017790e-01  3.145970e-01
## [8231] -3.829041e-02  4.726528e-01  3.404034e-01  5.078748e-01  1.145738e+00
## [8236]  5.934205e-01  8.637607e-01  6.944563e-01  1.889662e-01  9.548689e-01
## [8241]  3.830986e-01  1.423474e+00  5.687220e-02  4.220960e-01  3.552720e-01
## [8246]  8.750092e-01 -1.250016e-01  9.759675e-01 -1.357840e-01  3.693177e-01
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## [8271]  1.400309e+00 -1.335846e+00 -1.209552e-02 -3.447073e-01  9.213244e-01
## [8276]  9.112413e-01  2.845584e-02  6.621009e-02  1.351818e+00  4.188645e-01
## [8281]  1.821698e+00 -1.055469e+00  7.478102e-01  4.462248e-01  1.296476e+00
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## [8296]  8.938404e-01 -2.523572e+00 -2.488972e+00 -3.757654e-01 -2.128005e-01
## [8301] -1.316969e+00 -1.924474e+00 -8.554951e-01 -1.169845e-01 -3.857248e-01
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## [8306]  4.486793e-01  4.916596e-02 -9.701964e-02  7.143002e-02  2.117741e-01
## [8311] -8.939109e-02 -2.169327e-01 -4.313407e-01  6.592026e-01  1.386627e-02
## [8316]  3.776138e-01  7.023640e-01  4.328784e-01  1.962062e-01  8.824107e-02
## [8321] -2.344430e-01  4.179321e-01 -8.631493e-02 -6.243077e-01 -4.802659e-01
## [8326] -5.848840e-02 -8.685308e-01 -1.155164e-02 -4.046797e-01 -1.239915e-01
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## [8341]  2.038665e-01 -3.164146e-01 -2.715757e-01 -1.551273e-01 -6.296311e-02
## [8346]  1.391864e-01 -5.541226e-02  2.311951e-01  2.735795e-01  3.711508e-01
## [8351]  1.448725e-01 -1.962228e+00 -4.381146e-01  3.610676e-01  1.266169e-01
## [8356] -4.062134e-02  1.233854e-01  2.439200e-01  5.653608e-01  4.720312e-01
## [8361] -5.853103e-01  7.968016e-02  2.315059e-01  1.956623e-01  1.231523e-01
## [8366] -2.381029e-02 -6.820269e-01 -1.330186e-01  2.859935e-01  4.681004e-01
## [8371]  2.531802e-01 -2.589826e+00 -2.200614e+00 -1.039896e+00 -6.204423e-01
## [8376]  2.448278e-01  2.497536e-01 -7.598518e-01  5.249365e-02 -2.927612e-01
## [8381]  5.617364e-02  3.389128e-01  9.039713e-02  1.190167e+00  4.784882e-02
## [8386]  7.064677e-01  7.144912e-01  6.862193e-01 -5.759777e-02  1.179530e+00
## [8391]  5.185787e-01 -2.851610e-01 -7.345963e-01  1.221694e-02  1.531201e+00
## [8396]  1.702870e-01  1.360482e+00  9.473018e-01  1.720095e+00  4.795884e-01
## [8401] -4.115804e-01  2.956603e-01  8.491949e-01  1.107643e+00  3.665212e-01
## [8406] -4.029340e-01  4.679662e-01  1.522899e-01  9.513441e-01 -1.120791e+00
## [8411] -1.793788e+00  1.203380e-01 -5.176905e-01 -1.855641e+00 -2.026640e+00
## [8416]  5.012042e-02 -1.628761e+00  6.115972e-01  5.879905e-01 -2.169543e-01
## [8421] -6.813906e-01 -1.019668e+00 -1.790305e-01 -1.284993e-01 -8.446877e-01
## [8426] -2.971658e-01 -2.818432e-01 -7.764646e-02  6.878104e-02  9.702451e-01
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## [8441]  3.612128e-01 -4.565020e-01  2.397598e-01  1.121145e-02 -1.042652e+00
## [8446] -2.601469e+00 -2.188972e+00 -1.198931e+00 -1.084154e+00 -2.093499e+00
## [8451] -1.605798e+00 -1.385615e+00 -1.172006e+00 -1.375922e+00 -1.032919e+00
## [8456] -6.880057e-01 -5.315844e-01 -8.469797e-01 -7.864343e-01 -1.226560e+00
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## [8506] -5.140105e-01 -4.977232e-01 -8.539977e-01 -9.195095e-01 -1.013997e+00
## [8511] -1.633768e+00 -7.298905e-01 -2.089839e+00 -2.536942e+00 -2.559885e+00
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## [8521]  8.618836e-01  1.259078e+00  6.153585e-01  3.655360e-01  1.652572e+00
## [8526]  1.166560e+00  8.648594e-01  4.114224e-01  8.754761e-01  7.706931e-01
## [8531]  6.579475e-01  8.775074e-01  6.489591e-01  1.297090e-01  2.763768e-01
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## [8581] -5.113361e-01 -5.642201e-01 -5.748572e-01 -5.023883e-01 -6.470451e-01
## [8586] -1.070883e+00 -2.395758e-01 -1.022302e+00 -7.109489e-01 -7.395221e-01
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## [8641] -7.862166e-01 -8.157984e-01 -1.254232e+00 -8.141208e-01 -1.068971e+00
## [8646] -1.343941e+00 -8.597367e-01 -6.227537e-01 -1.062508e+00 -9.041412e-01
## [8651] -1.703369e+00 -9.886768e-01 -8.865532e-01 -1.120460e+00 -1.989977e+00
## [8656] -8.242039e-01 -1.734272e+00 -7.097757e-01  2.175697e-01 -3.090968e-01
## [8661] -1.820362e+00 -7.244889e-01 -6.550550e-01  7.247783e-03  3.328728e-02
## [8666] -6.875116e-01 -9.885214e-01 -1.035070e+00 -9.231184e-02 -4.733366e-01
## [8671] -6.090506e-01 -1.359198e+00 -1.292607e+00 -5.852326e-01 -7.388136e-01
## [8676] -5.228834e-01 -9.977499e-01 -3.296833e-01 -1.154283e+00 -9.248514e-01
## [8681] -1.973632e+00 -1.134474e+00 -1.164406e-01 -2.097703e-01 -1.270421e+00
## [8686] -8.959687e-01 -5.767494e-01 -6.243854e-01 -3.992726e-01 -6.074190e-01
## [8691] -2.527270e+00 -5.118679e-01 -9.334123e-01 -2.984192e+00 -8.025615e-01
## [8696] -9.930739e-01 -1.023821e+00 -1.386792e+00 -7.901474e-01 -1.181566e+00
## [8701] -7.678056e-01 -7.138619e-01 -5.466236e-01 -9.574633e-01 -1.014561e+00
## [8706] -7.307966e-01 -9.288598e-01 -6.001790e-01 -1.099485e+00 -6.420971e-01
## [8711] -6.702344e-01 -3.833939e-01 -1.441512e+00 -4.561371e-01 -1.177091e+00
## [8716] -9.001327e-01 -1.754315e+00 -1.564657e+00 -1.204219e+00 -1.301635e+00
## [8721] -1.201298e+00 -1.707611e+00 -7.411905e-01 -1.088392e+00 -8.164708e-03
## [8726] -4.349608e-01 -1.534298e+00 -2.218865e+00 -2.132465e+00 -2.875761e+00
## [8731] -2.976486e+00 -2.457093e+00 -2.389248e+00  1.086955e-01 -8.788063e-02
## [8736] -9.933665e-01 -8.872360e-01 -8.353574e-01 -9.810604e-01 -6.836825e-01
## [8741] -8.130574e-01 -9.168553e-01 -5.445946e-01 -1.041948e+00 -1.143413e+00
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## [8751] -5.908636e-01 -1.029642e+00 -7.502201e-01 -5.356266e-01 -1.328709e+00
## [8756] -1.067907e+00 -1.366612e+00 -1.212243e+00 -1.879247e+00 -5.672365e-01
## [8761] -1.841665e+00 -1.321048e+00 -8.985570e-01 -6.553903e-01 -7.881236e-01
## [8766] -1.230541e+00 -8.630064e-01 -1.215259e+00 -1.194499e-01 -9.607307e-01
## [8771] -1.195634e+00 -5.971369e-01 -1.601133e+00 -1.385253e+00 -2.493602e+00
## [8776] -1.982426e+00 -4.069012e-01 -3.594205e-01 -1.406368e+00 -4.804213e-01
## [8781] -3.491043e-01  8.547571e-02 -6.511242e-01 -3.773193e-01 -5.096464e-01
## [8786] -4.934569e-01 -3.358673e-01 -1.912040e-01 -4.620880e-01 -8.131108e-01
## [8791] -4.489747e-01 -3.565775e-01 -4.537602e-01 -5.533976e-01 -2.560078e-01
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## [8806] -5.081701e-01 -3.004029e-02 -5.657339e-01 -1.258784e+00 -5.513774e-01
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## [8816] -6.973616e-01 -3.547445e-01 -4.210245e-01 -9.740812e-02  1.848023e-01
## [8821]  3.316970e-03 -3.340803e-01  1.459602e-01 -7.005155e-01 -9.329461e-01
## [8826]  2.324383e-01 -7.043626e-02  1.932855e-01  4.184820e-02  1.494249e-01
## [8831]  3.216817e-01  4.728858e-01  5.302942e-01 -3.867890e-02  2.443084e-01
## [8836] -1.131855e-02 -8.588043e-01  9.858904e-02  4.870917e-03 -1.258745e+00
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## [8846] -1.042708e+00 -1.195117e+00 -6.790435e-01 -6.655999e-01 -6.073207e-01
## [8851] -1.092670e+00 -1.308161e+00 -3.882647e-01 -2.798011e-01 -4.868745e-01
## [8856] -6.089792e-01 -1.321580e+00 -6.533698e-01 -3.424132e-01 -1.256814e+00
## [8861] -1.123667e+00 -9.638561e-01 -1.115027e+00 -9.118157e-01 -8.973565e-01
## [8866] -1.109283e+00 -9.338495e-01 -3.287220e-01 -6.522066e-01 -7.143484e-01
## [8871] -1.359261e+00 -9.156532e-01 -9.849995e-01 -1.099677e+00 -1.213389e+00
## [8876] -1.113120e+00 -1.068210e+00 -1.783707e+00 -1.353517e+00 -8.395725e-01
## [8881] -9.789832e-01 -1.114061e+00 -1.165879e+00 -1.219132e+00 -1.172613e+00
## [8886] -3.232762e-01 -1.072815e+00 -1.673807e+00 -9.398910e-01 -2.606391e-01
## [8891] -8.933465e-01 -8.705446e-01 -1.519027e-01 -4.329029e-01 -6.872137e-01
## [8896] -1.018571e+00 -8.736390e-01 -8.530411e-01 -1.214107e+00 -1.113343e+00
## [8901] -1.063184e+00 -5.629551e-01 -7.676271e-01 -2.428645e+00 -4.271342e-01
## [8906] -2.690119e-02 -1.150529e+00  7.695689e-02 -6.934777e-01 -7.126648e-01
## [8911] -1.410386e+00 -1.935103e+00 -7.433985e-01 -5.429308e-01 -4.497623e-01
## [8916] -6.189389e-01 -7.169518e-01 -7.420861e-01 -3.732495e-01 -3.393331e-01
## [8921] -3.842947e-02 -1.102545e+00  1.829331e-01 -7.182642e-01  9.440820e-02
## [8926] -1.218065e-01 -5.155170e-02 -5.667523e-01 -2.319323e-01 -2.051831e-01
## [8931] -3.937398e-01 -2.144698e-01 -9.835359e-01 -2.489916e-01 -4.253349e-01
## [8936] -7.332029e-01 -9.398285e-01 -8.010353e-01 -1.145142e+00 -6.655729e-01
## [8941] -1.048642e+00 -7.463253e-01 -8.172866e-01 -1.140902e+00 -1.144334e+00
## [8946] -9.454811e-01 -4.508723e-01 -6.668853e-01 -7.747908e-01 -7.199801e-01
## [8951] -1.288982e+00 -1.352474e+00 -6.036965e-01 -5.570620e-01 -7.574291e-01
## [8956] -3.444815e-01 -2.836140e-01 -5.281933e-01 -2.224447e-01 -1.814627e-01
## [8961] -5.515106e-01 -7.512718e-01 -1.170983e+00 -1.120210e+00 -6.510376e-01
## [8966] -3.876836e-01 -2.806869e-01 -5.061879e-01 -7.086750e-01 -6.016783e-01
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## [8976] -1.901585e+00 -1.770540e+00 -1.488593e+00 -1.710974e+00 -1.250329e+00
## [8981] -1.667292e+00 -1.294011e+00 -3.727213e-01 -6.109859e-01 -2.257916e-01
## [8986] -1.543122e-01 -2.337337e-01 -1.741676e-01 -2.326674e-02 -3.925767e-01
## [8991]  9.983658e-02  2.835724e-02 -1.699060e+00 -9.683826e-01 -3.290395e-01
## [8996] -5.831883e-01 -5.350407e-01  1.594888e+00 -1.054714e+00  5.445622e-01
## [9001] -7.253437e-01  1.712758e-01 -7.033857e-01 -1.259656e+00 -2.481344e+00
## [9006] -2.558251e+00 -4.677741e-01 -4.920584e-01 -2.992054e+00 -1.297393e+00
## [9011] -8.295333e-01 -2.056412e+00 -8.731608e-01 -1.089013e+00 -8.836325e-01
## [9016] -8.253694e-01 -9.492910e-01 -1.347872e+00 -1.048851e+00 -7.711149e-01
## [9021] -9.646257e-01 -1.417150e+00 -1.049394e+00 -8.915718e-01 -1.541305e+00
## [9026] -4.421231e-01 -5.549515e-01 -1.022189e+00 -1.201453e+00 -7.910021e-01
## [9031] -1.707766e+00 -1.235898e+00 -1.151052e+00 -8.013960e-01 -2.737194e-01
## [9036] -6.468048e-01 -9.103712e-01 -6.063312e-01 -4.243020e-01 -1.293617e+00
## [9041] -5.168087e-01 -1.315104e+00 -1.603732e+00 -1.048928e+00 -3.526466e-01
## [9046] -7.516162e-01 -7.521600e-01 -7.012925e-01 -1.220020e+00 -1.184798e+00
## [9051] -1.029352e+00 -5.881534e-01 -1.746065e+00 -1.201376e+00 -8.245147e-01
## [9056] -4.171396e-01 -6.471156e-01 -4.456655e-01 -5.188748e-01 -7.747349e-01
## [9061] -7.912352e-01 -2.788934e-01 -1.056168e+00 -2.474468e-01 -2.643374e+00
## [9066] -2.355648e+00 -5.699314e-01 -4.880916e-01 -9.348321e-01 -6.347594e-01
## [9071] -9.504762e-01 -3.293580e-01 -1.061790e-01 -8.323410e-01  5.375406e-01
## [9076] -8.586629e-01  2.913168e-01  5.727695e-01 -1.494315e-01  5.873676e-01
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## [9106] -6.331310e-01  8.597924e-03 -1.137099e+00  2.367840e-01  2.241359e-01
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## [9121] -1.487679e-01  5.114623e-02  3.010094e-01  1.056994e-01  3.741418e-01
## [9126] -2.794923e+00 -2.702059e+00 -3.687584e-01 -1.450442e-01  3.367577e-02
## [9131] -5.710137e-03  3.322310e-01  2.639625e-01  1.759623e-01  1.502336e-01
## [9136]  1.468149e-01  1.675568e-01 -4.498294e-01 -1.194013e-02  3.467429e-01
## [9141] -5.689654e-01  3.050261e-01 -6.448530e-02 -2.976929e-01 -1.858738e+00
## [9146]  2.613209e-01  2.001370e-01  1.653812e-01  5.527137e-01 -2.805190e-02
## [9151] -9.216975e-01 -8.939487e-01 -8.434695e-01  1.039405e+00  4.573180e-01
## [9156]  3.560808e-01 -7.370583e-01  3.390886e-02 -3.796185e-01  1.234360e+00
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## [9166] -1.335147e+00 -2.678779e-01  1.674014e-01 -3.720676e-01  2.133281e-01
## [9171]  1.389961e+00  7.662671e-01  3.684631e-01  1.136587e+00  6.819848e-02
## [9176]  2.292844e-01  2.500722e-01  4.647135e-01  7.284352e-01  9.914576e-01
## [9181]  1.121641e+00  5.106401e-01  9.224899e-01  8.079063e-01 -1.872822e+00
## [9186] -6.197460e-01 -6.376125e-01  3.071476e-02  2.029196e-01  1.163125e-01
## [9191]  3.328301e-01  1.943394e-01  2.820566e-01 -3.103633e-01  3.364193e-02
## [9196]  1.640572e-01  1.424563e-01 -2.786680e-01  5.140781e-02 -6.936000e-03
## [9201] -4.285645e-01  4.234746e-01 -1.715701e-01  4.134813e-01  1.910618e-02
## [9206] -1.846923e-01 -1.882248e-01 -2.788697e-01 -8.072335e-02 -7.740839e-01
## [9211] -7.818559e-01 -3.327717e-01 -4.624805e-01  3.458517e-01 -6.326041e-02
## [9216] -3.876831e-01  3.656360e-01 -1.817651e-01 -3.291380e-01 -3.662846e-01
## [9221]  2.713574e-01 -2.328406e-01  2.565192e-01  4.874365e-03 -1.470416e-01
## [9226]  1.417498e-01  2.109947e-01 -3.650728e-01  4.815154e-01  5.633783e-01
## [9231] -5.946121e-01  4.620341e-01  2.555097e-01  8.451658e-02 -4.210104e-03
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## [9241]  7.426488e-01  1.628459e-01  2.719627e-01  1.285264e-01  3.979973e-02
## [9246] -2.019590e+00 -1.708896e+00 -1.086193e+00 -4.271515e-01 -4.378513e-01
## [9251] -1.539617e+00 -2.002375e-01  9.673001e-02  2.677814e-02 -8.146623e-01
## [9256] -4.994252e-01 -4.952863e-01 -1.521246e+00 -6.680965e-01 -2.723084e-01
## [9261] -8.006318e-01 -4.186137e-02 -7.460228e-01 -3.731938e-02 -4.625821e-01
## [9266] -7.993194e-01 -7.813517e-01 -1.032290e+00 -1.483091e+00 -1.168156e+00
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## [9286] -6.906062e-01 -4.588467e-01 -5.114369e-01 -1.208835e+00 -4.107991e-01
## [9291]  4.215568e-01 -4.217007e-01 -3.873807e-01 -4.822647e-01 -8.785575e-01
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## [9356] -6.598815e-01 -1.037287e+00 -4.373692e-02 -6.229430e-01 -3.180028e-01
## [9361] -5.250512e-01 -3.693253e-01 -1.089378e+00 -8.911927e-01 -3.784611e-01
## [9366] -1.016912e+00 -5.996709e-01 -1.245301e+00 -1.270480e+00 -7.320996e-01
## [9371] -4.748920e-01 -6.845895e-01 -2.675709e-01 -4.506541e-01 -5.617670e-01
## [9376] -4.991298e-01  4.027929e-01 -2.642650e+00 -5.228974e-01  2.355045e-01
## [9381] -8.974065e-01 -1.747709e+00 -9.463919e-02  6.575238e-01  1.257130e+00
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## [9436] -9.547995e-01 -1.157066e+00 -1.435462e+00 -1.446783e+00 -8.786099e-01
## [9441] -1.086829e+00 -9.458111e-01 -1.240856e+00 -1.359293e+00 -1.469063e+00
## [9446] -9.255018e-01 -1.480384e+00 -8.969286e-01 -2.237491e+00 -1.981497e+00
## [9451] -1.002948e+00 -9.518484e-01 -8.719555e-01 -1.770486e+00 -1.115967e+00
## [9456] -8.087277e-02 -4.642952e-01 -5.857320e-01 -5.044032e-01 -7.798322e-01
## [9461] -1.415634e+00 -5.682034e-01 -6.498051e-01 -8.438551e-01 -8.748022e-01
## [9466] -1.143102e+00 -1.208141e+00 -1.432693e+00 -1.146469e+00 -9.051316e-01
## [9471] -9.770770e-01 -1.208611e+00 -1.496518e+00 -1.012084e+00 -1.230917e+00
## [9476] -1.286102e+00 -8.976542e-01 -1.070661e+00 -1.587453e+00 -1.126291e+00
## [9481] -1.436530e+00 -1.265479e+00 -1.071602e+00 -8.741344e-01 -4.989072e-01
## [9486] -1.396695e+00 -2.203350e+00 -1.481168e+00 -7.601497e-01 -1.865036e+00
## [9491] -6.061575e-01 -8.695790e-01 -1.068730e+00 -8.511098e-01 -9.593258e-01
## [9496] -8.242228e-01 -7.023909e-01 -3.652402e-01 -5.561959e-01 -2.301874e-01
## [9501] -3.853929e-01 -3.839570e-01 -1.238320e+00 -1.037535e+00
```

```r
# See all distinct values in phonecall
unique(performance_labeled_p2$phonecall)
```

```
##    [1] -1.132194042  0.312170953  1.097151995  1.411144376 -0.190216869
##    [6]  1.678037882 -0.896699727 -1.917175055 -0.724003911  0.992487788
##   [11]  0.469167143  1.165183663  0.913989723  0.390669048  0.793625951
##   [16] -0.143118009  0.280771732  0.254605681  0.013878186  0.772693157
##   [21]  0.092376284  0.333103776  0.123775527  0.432534695 -1.011830330
##   [26] -0.535608470 -0.022754259 -0.300114214 -1.257791042  0.322637379
##   [31]  0.212740034  0.275538504  0.160407975 -1.106027961 -1.069395542
##   [36]  0.259838879  0.631396532 -0.331513435  1.133784413 -1.278723836
##   [41] -1.833443761 -0.137884796 -0.294880986 -0.682138264 -0.184983656
##   [46] -0.033220671 -0.886233330 -0.729237139  1.369278669 -0.054153498
##   [51] -1.639815092 -0.755403161  0.908756495  1.421610713 -0.446643978
##   [56]  1.159950376  0.034811012 -0.027987465  1.023887038  1.384978294
##   [61]  0.961088538  0.929689348  1.808868051  0.647096157  1.086685538
##   [66]  0.568598092  1.803634763  0.652329385  1.102385163  1.081452370
##   [71]  1.222748876  1.641405463  0.872124076  1.123317957  0.531965613
##   [76]  1.505342007  1.541974545  0.877357244  1.651871800  0.730827451
##   [81] -3.053884506 -0.566262722  0.782955825  1.401347637  1.464592338
##   [86]  1.520809770  1.057015896 -0.608425796  1.331075907  0.579167604
##   [91]  0.501868606 -3.011721373 -0.538154006  0.213754252  0.445651203
##   [96]  0.979716837  0.916472256 -1.859263778  1.429456353  1.071070194
##  [101]  1.274858475  0.438624024  0.797010183 -1.936562777  1.246749759
##  [106]           NA -0.095441662 -1.550067902 -2.238731623  0.276998878
##  [111]  0.719711185 -3.032802820  1.366211772  0.108346559  0.150509641
##  [116] -0.137604743  0.319161952 -0.510045290  1.338103056  1.169450760
##  [121]  1.204586625  1.492701054  1.295939922 -0.369501680 -2.041970491
##  [126]  0.677548110  0.410515279  0.129428089  0.965662479 -1.304116607
```

```
## [131] -1.943589926 -1.318171024 -1.135464311  0.593221962 -0.341392964
## [136] -0.081387304 -0.123550378 -0.945730448 -0.545181155 -0.376528859
## [141] -2.477655649  0.607276320  0.775928676 -1.641421199  0.052129116
## [146] -0.741942227 -0.488963723 -0.615453005 -2.547927380 -1.451687336
## [151] -1.416551471 -1.374388456 -1.051138163 -0.643561721 -0.264093965
## [156] -0.285175532 -0.011115503 -1.880345345 -0.952757597 -0.699779153
## [161]  0.600249171 -0.221930906 -3.004694223  0.192672715 -0.917621732
## [166] -0.727887869 -0.243012443 -0.313284248  0.712684035  0.262944520
## [171] -0.053278584 -0.327338606  0.466732740 -0.320311427  0.368352205
## [176] -1.866717219  0.325589418  1.361843705  1.469662070 -0.602846444
## [181] -1.513312578  1.397783160  1.948854685 -1.351585031  0.307619691
## [186]  0.649044514  0.673004150  1.355853796  2.002763987  0.547216058
## [191]  0.044063706  1.847026229  0.247720599  0.259700418  1.116257429
## [196]  1.325904250  0.960519731  0.457367420 -0.812493265 -2.735254049
## [201]  0.397468328  0.085993066  0.385488510 -0.267411560  0.846711516
## [206] -0.243451923  0.337569237  0.403458238  0.091982976 -0.542947352
## [211] -0.357260197  0.505286694 -0.087714292  2.044693232  0.151882067
## [216]  1.283974886  0.864681244  0.565185785  0.427417874 -0.225482196
## [221]  0.145892158  0.157871976  1.104277611  0.625084877  0.056043524
## [226]  0.535236239  1.152196884  0.756862879 -0.075734474 -1.345595121
## [231]  0.571175694  0.265690327  0.900620699  0.990469277  1.062348247
## [236]  0.906610608  0.978489459  1.098287702  1.146206975  2.194441080
## [241]  1.128237247  1.427732706  1.763167500  0.762852788 -0.459088624
## [246]  0.014114161  1.224075794  2.242360353  2.086622715  1.936874866
## [251]  1.918905139  1.481641769  1.385803342 -2.299199104 -0.959498227
## [256]  2.583382607  2.033895969  2.023429394  3.148568869  2.091461182
## [261]  0.354036599  2.264157057  1.882132888  3.671889544  1.971097469
## [266]  1.149484038  2.258923769  1.259381294  1.290780544  1.039586663
## [271]  1.191349626  0.610463738  1.353579044  1.374511838 -0.164050832
## [276]  0.955855370  0.599997342  0.683728635  0.306937754 -0.472810030
## [281]  2.384520769  0.547665238  1.013420582  0.924456120  0.636629760
## [286]  0.751760304  0.448234320  0.139475137 -0.101252355  0.427301496
## [291]  0.416835099  0.788392723  0.982021391  1.510575294  0.374969423
## [296]  1.630939007  1.348345876 -0.765869558  1.615239382  2.007729769
## [301]  1.453009963  1.306480169  2.363587856  1.316946626  3.059604406
## [306]  1.719903469  2.531050444  1.426844001  1.767002344  1.238448501
## [311]  1.254148126  0.720361054  0.129008725  1.761769176  2.855509281
## [316] -0.666438639  1.887366176  2.536283731 -2.428465366  0.846200466
## [321]  0.558086097 -0.770050943 -2.287921906  0.551058888 -2.393329382
## [326]  0.487814277  0.073210657  0.930526614  0.164563999  1.042961478
## [331] -0.720860660 -0.060305763  0.944580972  0.417542487  1.324048638
## [336] -0.587344229  0.635385036  1.120260477  1.134314775  0.705656826
## [341] -0.397610396  0.515922964  0.909445047  0.480787098 -2.175486803
## [346] -0.460855007  0.761874318 -0.186794996  0.832146108 -1.184654593
## [351]  0.038074758  0.586194813 -1.001947880  0.459705561 -0.383556038
## [356] -0.404637575 -1.613312483 -0.807735264  2.018196344  1.568140507
## [361]  0.825025201  0.668029010 -0.519908905 -1.713079929  1.693737507
## [366]  1.301247001  0.746527076  0.819791973  1.018653870 -0.132651597
## [371]  0.474400371  0.579064488  0.662795782 -1.796811223 -1.336289048
## [376]  0.490099967  1.170416832  0.202273622 -0.996130645 -0.792035639
## [381] -0.090785943  0.296471328 -0.038453877  1.044819832 -0.488509625
## [386]  0.809325576  0.066210255 -1.482818842 -0.430944353 -0.258248568
## [391]  0.223206446 -0.216382906 -0.420477957  0.060977045  0.134241939
## [396]  0.186573997 -1.817744136 -1.488052130  0.238906071  0.170874387
```

```
## [401]  0.118542314  0.102842696  0.327870578  0.024344599  0.997721016
## [406] -0.007054640  0.458700746  0.176107585  0.270305306 -0.640272617
## [411]  1.746069551  0.898290098  0.286004931  0.804092348  1.000798464
## [416]  1.155396342  1.007825613  0.199699894  0.312134773  0.122400917
## [421] -0.931676090 -2.561981916  2.328935385  2.778674841  0.565113246
## [426] -1.922508478 -3.039829969 -1.027529955  1.180883288  1.275080919
## [431]  1.091918707  0.945388973  1.714670300  2.190891981  1.034353495
## [436]  1.405911088  1.929231763  1.479176044  0.401135474  0.526732445
## [441]  0.777926326 -0.075086325  0.516265988  0.249372482  0.584297717
## [446]  0.301704556 -0.085552737  0.542432070 -1.786344886  0.500566363
## [451]  0.181340799 -0.399545133 -0.912399352 -0.341979861 -0.734470367
## [456] -0.368145883 -2.293965816 -1.430486798  0.437767923 -0.572240949
## [461] -1.215925336  0.008644980 -0.938565373 -0.833901286 -0.211149693
## [466]  0.338337004  0.715127885  0.380202651  0.798859179  1.285547376
## [471]  0.903523266  0.814558804  1.060519457  0.443001121  0.840724826
## [476] -0.043687087  1.264614582  1.589073300  1.029120207  1.610006213
## [481] -2.022454739  1.769157410  2.434037447  1.631389499  0.696963787
## [486]  1.218085885  2.463986874  1.523571134  0.481327057  1.439712524
## [491]  1.547530770  2.290279627  0.840721607  1.421742797  2.230380535
## [496]  1.625399590  0.810772061  2.188451052  0.493306875 -0.369240016
## [501]  0.301629782  0.637064695  0.415438056 -1.495342851  0.008124253
## [506]  0.798792243  0.133912340  1.122247338  0.283660054 -0.141623467
## [511]  1.008439064  1.930884957  0.487316966  0.876661062 -0.429139107
## [516]  0.613105059 -0.411169380  0.720923424  0.229750887  0.097972885
## [521] -0.405179471  1.260015249  0.601125240 -0.974220812 -0.093704201
## [526] -2.208142042  0.774832606  0.750872970 -2.112303495  1.134227157
## [531]  1.870985866  0.355538964 -0.051774837  0.631074786  0.726913333
## [536]  1.894945502  3.757807255  2.535865784  1.793117046  2.026723623
## [541]  1.475651979  2.499926329 -2.166194201 -1.478120685 -1.899843097
## [546]  0.948633313  0.778464615  0.793261886  1.917855144  0.904241502
## [551]  0.401133955  1.111403465  1.562720418  1.296369433  0.371539384
## [556]  0.911640108  1.407348990  1.133599281  1.052214265  1.081808805
## [561]  1.214984417  0.874646902  0.223566592  1.555321813  0.186573386
## [566]  1.459139466  1.237180233  1.651504159  1.044815660  1.140998006
## [571]  1.821672916 -0.997209013  0.815457821  0.201370671  0.808059156
## [576] -0.020588532  1.703294635 -0.420115083  0.889444232 -0.190757260
## [581]  0.171776116  0.423329890 -0.804844379  0.356742114  0.304951638
## [586]  0.452924430 -0.013189891 -1.692681193 -0.064980373  0.667484999
## [591]  0.882045567  0.763667345  0.127384275 -1.759268999 -0.035385814
## [596] -0.198155895  0.090391070 -0.767851174  0.630491793  0.068195149
## [601]  0.867248297  0.290154368  1.015221119  0.238363877  0.771065950
## [606]  0.009006029  0.119985633  0.623093188  0.023803309 -0.146365419
## [611] -0.412716448  0.260559797  0.001607389  0.704478204  0.674883664
## [616]  1.348159909 -0.309135497  1.766761065  1.078097343  2.497587681
## [621]  2.090011358  1.935413361  0.839173257  2.132174492 -1.128437161
## [626]  2.300826788  2.364071369  1.345130205  0.508895814  0.874309182
## [631]  1.485673785 -1.992780209 -1.044110894  1.626217365  0.698629677
## [636]  0.452678382  1.534864068  2.279745102  2.610022545  2.799756527
## [641]  0.347270668  1.619190216  1.675407648  2.097038507  1.471619487
## [646]  0.811064541  1.787842512 -2.554954529  1.288912773  1.513782501
## [651] -0.278148353  1.239722490 -0.074360125  1.612163067  1.415402055
## [656]  0.241862968  0.972689688  2.764620543  0.529977381 -0.594371438
## [661]  0.621330678  1.352157354  0.396460921  1.373238921 -2.669301748
## [666] -0.982411742 -0.649472952 -0.760452569 -0.523696065 -0.508898795
```

```
## [671] -0.501500130 -1.344945073 -0.960215807 -1.330147862 -0.893628061
## [676] -0.938019931 -0.849236250 -0.827040315 -0.952817202 -1.048999548
## [681] -0.471905589 -0.331331402 -0.723459363 -0.101973571 -0.242547736
## [686] -0.050183091 -0.249946371 -0.161162689 -0.479304224 -0.294338226
## [691] -0.486702859 -0.553290606 -0.686466157 -0.516297400 -0.042784452
## [696] -1.108188629 -0.619878352 -0.886229396 -0.878830791 -0.923222601
## [701] -0.782648444 -1.300553322 -1.337546468 -0.819641650 -0.967614472
## [706] -1.174776435 -1.263560057 -1.640890718 -0.568087876 -0.930621266
## [711] -0.301736861 -0.072379015 -0.427513748 -0.864033520 -0.494101495
## [716] -0.205554530 -1.026803613 -0.708662033 -0.383121908 -0.368324608
## [721] -0.597682476 -0.353527337 -0.457108289 -1.529911160 -1.485519290
## [726] -1.581701636 -0.390520543 -0.346128702 -0.738256633  1.251977563
## [731]  1.577517748  1.510929942  1.399950385  0.615694523 -0.397919178
## [736]  1.873463392 -3.113220215 -3.098422766  0.060796510  0.475120366
## [741] -1.618694782  1.799476981 -2.787679911  1.466538191  2.576334238
## [746] -0.257345021  0.845052361 -0.442311019  1.688497305  0.926437378
## [751]  0.149580196  1.007822394  1.414747596  1.540524483  0.526910841
## [756]  1.000423789  0.319748908  0.445525795  1.037417054 -1.707478523
## [761]  0.956031978 -1.285755992  1.281572104  0.919038773  1.385153055
## [766] -0.989810407  1.473936796 -2.617511272 -1.145181775  3.367988586
## [771]  0.297553003  0.556505382  0.053397872 -0.124169491  0.719275475
## [776]  0.859849632  1.126200676  1.064043045  0.726738393  0.656466603
## [781]  1.014852762  0.248890162  0.993771255 -2.048997641  1.710543633
## [786]  0.298080415 -0.861404300 -0.601398587  0.255917341 -0.531126797
## [791] -0.200849354  0.206727073 -0.334365785 -1.156545877  0.354297847
## [796] -1.353306890 -1.100328445 -2.147378206 -0.439773470 -0.418691933
## [801] -0.362474501  0.537004530 -1.008975029  0.740792751 -1.887372494
## [806]  2.729484558  1.851087213  1.359184623  2.047848225  1.253776908
## [811]  1.436483622  1.640271783  2.082984209  2.307853937 -0.453827828
## [816]  0.684575319  0.888363540  1.837032795  0.937553763  1.724597931
## [821] -1.472768903  0.951608121  1.668380499  2.258663654  1.893250227
## [826]  0.902417898  0.431596845  2.392179966  1.499728203  0.522950172
## [831] -0.973839164 -0.847349942  1.021879911  2.040821075 -1.107355595
## [836] -2.969558239 -2.639280796 -0.067332938 -0.257066786 -0.657616079
## [841] -1.788992047 -0.622480154 -1.669529915 -0.446800649 -0.495990932
## [846] -2.449547052 -0.552208364 -1.381415606 -2.716579676 -0.671670437
## [851]  0.305107594 -0.432746291 -1.507904768 -0.172740638  0.080237836
## [856]  0.066183478 -0.144631922 -0.193822175 -2.154405355 -3.025775671
## [861] -1.283035040  0.157536820  0.670520961  0.614303529 -0.517072439
## [866]  0.291053236  0.382406563  0.572140455 -0.151659101 -0.158686280
## [871] -2.070079327  0.143482462 -0.390583217 -0.791132450 -0.875458658
## [876]  0.016993217 -2.611171961 -0.130577564 -0.889513016 -1.016002178
## [881] -0.228958085 -0.819241166 -0.748969376 -0.355447322  0.284026057
## [886] -0.046251401 -0.840322733 -2.330084801 -2.273867369 -1.760883331
## [891] -0.763023734 -2.920367956 -1.697638631 -0.481936544 -1.023029447
## [896] -2.033018589  0.645289063  0.267958432  0.364140749 -0.701263428
## [901]  0.586099982  0.312350273 -0.220351815  0.193972036 -0.323932767
## [906] -1.307951927 -0.560689270 -0.841837585 -0.464506924 -0.094574936
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## [916]  0.504714906  0.978227913  0.164377466  0.682282269 -1.093391299
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## [1886] -0.692751944 -1.574302912  0.896842837  1.718091846 -0.664270222
## [1891]  1.318565369  0.726674139 -0.168561339  1.266774893 -1.022140026
## [1896] -0.524977624 -1.088029027 -2.303980589 -0.914321721 -1.117978573
## [1901]  0.972499549 -0.207512468 -0.758584082 -0.387209743 -1.267726302
## [1906] -2.315960407 -0.566906989 -0.782543719 -0.554927170 -0.153603286
## [1911] -1.477373123 -1.010160208 -1.255746484 -0.746604264 -0.423149198
## [1916] -1.507322669 -1.764888763 -0.884372175 -1.058079481 -0.584876716
## [1921] -0.992190540 -2.100323677 -0.932291448 -0.824473083 -0.441118896
## [1926] -0.770563900 -1.980525494 -2.627435684 -2.351160288 -0.945418537
## [1931] -0.338730067  0.637890458  0.578701317 -1.152580500  1.851267457
## [1936] -0.449709654  0.652687728  0.393735319 -2.358193636 -1.142491460
## [1941] -0.910594523 -1.718720198 -2.182514191 -1.564122319 -1.824127913
## [1946]  1.654326081  1.197559476  2.378125668  1.773788214  0.789983034
## [1951]  1.380266070  2.483533382 -1.402497172  1.527836919 -1.486823320
## [1956] -2.573119402 -1.226566911 -1.374539733 -1.774066210 -1.211769581
## [1961] -0.316534132 -1.352343798 -1.818458080 -2.432545185  2.302584410
## [1966]  0.993025184  0.482519001  0.512113571 -0.834438920  0.734072745
## [1971]  1.777281046 -2.046414375  1.080317974  2.104592323  0.708943605
## [1976]  1.535550952  0.912600517 -0.776553810  0.661024332 -0.560917079
## [1981] -0.818483174 -2.429768562 -0.638785899  1.230065703 -1.405494213
## [1986] -0.830462992 -1.573211670  0.894630790  0.062033433  0.780822515
## [1991] -0.045784928 -0.686705172 -0.632795990 -0.980210721 -0.722644627
## [1996] -1.609151125 -2.393829107 -2.136263132 -0.309340924  0.349549055
## [2001]  0.583155513  0.702953696  0.828741789  0.163861886 -1.441433668
## [2006] -1.818797946 -0.944271266 -0.231472105  1.271995068 -1.489352942
## [2011] -1.177877665 -1.663060308 -1.393514395 -0.938281357 -2.082353830
## [2016] -1.704989672 -1.333615303 -0.896351993 -1.681030035 -0.890362084
```

```
## [2021] -1.435443759 -0.704674900  1.805096865  1.038388610  2.200430870
## [2026]  2.008753777  2.266319990 -1.367688298 -1.205458879  1.672804713
## [2031] -1.147893667 -1.467119217 -0.336746663 -1.901475430 -1.331055880
## [2036] -0.106485561 -1.273490667 -1.472352505 -1.508984923 -0.263481766
## [2041]  0.756993532  1.269847751  1.599539757  1.379745126  0.866890848
## [2046] -1.776868582 -0.057764746  0.792802334 -0.279391378  1.086307883
## [2051]  1.445702434  0.541226149 -1.375544667 -1.657070398 -0.009845474
## [2056] -0.572896898 -0.489038169 -0.692695081 -0.656755626 -1.315645576
## [2061] -0.626806080 -1.872707129 -0.650765717 -0.327310652 -0.596856534
## [2066] -1.285696030 -1.447423577  0.020104071  1.395444751  0.605230510
## [2071]  0.688961804 -0.200683281 -0.383845508 -0.907166183 -0.525142074
## [2076] -1.603897572  1.429544926 -2.365957499 -1.959032297 -1.862849951
## [2081] -1.159907937 -0.291371197  0.870671153 -1.100008845  1.655349135
## [2086] -0.962240994 -0.986200631 -0.866402447 -0.908331811 -1.794838309
## [2091] -0.512997806 -0.710664809 -0.453098714 -0.956251085 -1.848747492
## [2096] -1.279706120 -0.998180449 -0.435129017 -2.357889652  0.934922516
## [2101]  1.327413082 -0.551308095 -1.242091417  1.233215332 -0.781569183
## [2106]  1.667571425  0.950622141  1.725136757  1.458243132  2.070528269
## [2111]  2.237990856  2.410686731  2.426386356 -1.252557755 -1.399087548
## [2116] -1.294423461 -1.561316967 -1.665981054 -1.686913967 -0.875766933
## [2121] -1.728779554 -1.849143386 -0.451877207  1.871666551  2.149026394
## [2126]  1.578606963  2.337421894  0.861657619 -0.109372213  0.134782910
## [2131] -2.247579098  1.954848409 -1.137783170 -0.545892000 -2.224677086
## [2136] -2.372247934 -1.339252472 -1.276007891 -0.826268375 -1.985753059
## [2141] -2.506531715  1.229781628  2.199003458 -2.484335661  1.200187087
## [2146] -2.425146580  1.496132731 -1.463323355 -1.130384564  1.074410200
## [2151] -1.648289323 -1.219168186 -1.911941767  2.138560057 -1.822977304
## [2156] -0.844367683  1.196582913  1.569999933 -1.557095051 -0.882485807
## [2161] -2.442519665 -1.037083745 -1.212763309 -1.774937630  0.002938857
## [2166] -2.618199348 -1.831155062 -1.121409893 -0.987893522 -2.323057652
## [2171] -1.873318195 -2.899286509  2.162010193  2.679915190  3.412380457
## [2176]  2.272989988  2.213800669  1.710693240  2.176807642  2.687313795
## [2181]  2.243395329  1.932652473  1.843868732  2.051030636  1.030018330
## [2186] -2.580518007 -2.070011854 -1.433728814 -2.077410460 -1.922039032
## [2191] -1.803660750 -2.151396990 -1.611296177 -1.855451226 -1.063796759
## [2196] -1.700079799 -2.550923347  0.563364863 -1.707846761 -0.587940574
## [2201] -1.320589423 -1.179292917 -1.697380304 -0.975197852 -1.650281429
## [2206] -1.043229580  0.217973247 -2.166212559  2.553835630  1.715248227
## [2211]  1.571490407  2.404087782  2.410077810  1.649359226 -1.465393305
## [2216]  0.984479368  0.924580336  1.349863887  0.948539913 -0.147613376
## [2221]  0.786812425 -1.231786847 -0.261421651 -1.998495221  0.834731698
## [2226] -2.292000771  0.852701426  1.661339045  1.511591315  1.541540861
## [2231]  0.433407784 -1.387524486 -0.285381287 -0.471068442 -1.028129935
## [2236] -0.716654718 -0.195532650 -0.950261176 -2.196162224 -0.842442811
## [2241] -1.603161216  1.437310338  1.484409213  0.783159554  1.861200094
## [2246]  1.055286288 -1.676447511  1.227982044 -0.530375302  1.337879419
## [2251]  0.673262179 -1.566550136 -1.852236629 -1.198708892 -1.254926324
## [2256] -2.386302233 -1.423578620 -2.632253647 -2.702525377 -2.962531090
## [2261] -1.944234967 -1.877647161  1.259376168 -2.410349369  1.621909618
## [2266] -1.766667604 -2.232781887 -1.633492112 -2.040417194 -1.441127419
## [2271] -2.469538450  2.731705666  1.614510894  1.681098700  1.362957120
## [2276]  1.303768039 -1.606285334 -1.620339751 -2.674416780 -2.400356770
## [2281] -2.344139338 -2.301976204 -2.779824495 -1.929535627 -2.203595638
## [2286] -2.379275084 -1.543040752 -2.625226498 -1.592231035 -2.091160774
```

```
## [2291] -1.753856182 -2.140351057 -2.583063364 -2.034943342  1.194126248
## [2296]  0.966509640  0.445387602 -0.680715263 -0.495028079 -1.962555766
## [2301] -2.232101679  0.690973878  0.577165604  1.044378519  2.128551960
## [2306] -1.802044511  1.552440882  0.594764113 -1.891008973 -0.462343603
## [2311]  1.918765306  1.112851501  1.756536007 -1.885775805 -0.713537514
## [2316] -0.954264998 -2.284572363 -1.019404888 -1.418931484 -2.462139845
## [2321] -1.114382744 -1.521959186 -1.803046346 -1.648448467 -2.189541340
## [2326] -2.735889435 -2.099606514 -0.975013077 -2.846868992 -2.891260862
## [2331] -1.182175040 -2.180991411 -2.610112667 -2.217984676 -2.706295013
## [2336] -2.595315218  1.740287781 -2.624909878 -2.543524742 -1.159979105
## [2341] -1.278357387 -1.500316501 -2.055214643 -2.590090513 -2.210622787
## [2346] -2.597117662 -2.112242222 -1.163573027 -1.346279740 -2.013861895
## [2351] -2.105215073  1.794869781 -2.800905943 -2.660362244 -2.807933092
## [2356] -2.817274570 -2.795078516 -0.871432126 -2.107005119 -2.661903143
## [2361] -3.105821371 -1.115587234 -1.626093388 -3.002240419 -3.091024160
## [2366] -2.526845932 -1.191681743 -1.746828914 -1.781964898 -1.914640427
## [2371] -1.189857483 -0.644775808 -1.165897846 -0.800513446 -1.070059299
## [2376] -1.105998755 -1.064069390 -1.034119844 -0.878382266 -1.076049209
## [2381] -1.716969490 -1.519302487 -0.854422629 -2.447738409  0.319599509
## [2386] -0.614106596 -0.232082516 -0.509442449  5.828471184  3.811670303
## [2391]  3.094897985 -2.691497564 -1.907241821 -1.596498847 -1.034202218
## [2396] -1.396735549 -1.167377710 -2.280894518 -2.832071781 -2.728490829
## [2401] -1.751870275 -1.100794792 -1.461886048 -1.812510848 -1.001363873
## [2406] -1.158360124 -2.561546564 -1.082039118 -1.249756575 -0.345280379
## [2411] -0.507007897 -2.214131832 -1.423463941 -1.459403396 -0.530967534
## [2416] -0.333300561 -1.453413486 -0.189542741 -1.046099663 -0.399189562
## [2421] -2.591496229 -1.621130943  0.918590426 -1.465741754 -1.233844757
## [2426] -2.537586927 -1.531282306 -1.183867574 -1.363564849 -1.147928119
## [2431] -1.111988664 -1.213817120 -1.135948300 -1.567221761 -1.357574940
## [2436] -1.309655666 -0.518987715 -2.202152014 -1.483363032
```

```r
# See all distinct values in phonecallraw
unique(performance_labeled_p2$phonecallraw)
```

```
##   [1]  223  499  649  709  403  760  268   73  301  629  529  662  614  514  591
##  [16]  412  493  488  442  587  457  503  463  522  246  337  435  382  199  501
##  [31]  480  492  470  228  235  489  560  376  656  195   89  413  383  309  404
##  [46]  433  270  300  701  429  126  295  613  711  354  661  446  434  635  704
##  [61]  623  617  785  563  647  548  784  564  650  646  673  753  606  654  541
##  [76]  727  734  607  755  579   NA  546  634  643  651  585  348  624  517  506
##  [91]    6  358  465  498  574  565  170  638  616  497  159  612  421  214  116
## [106]  474  537    3  450  456  415  362  625  601  619  144  531  453  572  249
## [121]  158  247  273  519  386  423  417  357  381   82  521  545  201  329  365
## [136]  347   72  233  239  285  343  397  394  167  299  335  520    7  462  304
## [151]  331  400  390  536  472  427  388  389  487  145  511  684  702  356  204
## [166]  690  782  231  508  569  683  791  464  765  500  678  533  321  523  471
## [181]  598  416  513  524  366  798  482  671  551  528  419  481  483  641  561
## [196]  466  583  444  232  552  622  608  620  640  648  823  645  695  751  584
## [211]  380  459  831  805  780  777  688  256  933  828  826 1041  839  507  872
## [226]  799 1141  816  659  871  680  686  667  556  698  408  554  570  349  895
## [241]  544  633  525  420  590  627  728  697  293  748  717  689  891  691 1024
## [256]  768  923  712  676  679  577  776  985  312  800  924  555  325  109   94
## [271]  504  445  567  458  332  426  494  351  594  596  535  378  125  369  543
## [286]  553  266  440  518  292  377  205  825  739  597  340  112  763  582  414
```

```
## [301]  530  550  566   96  184  663  478  288  422  496  432  639  346  452  156
## [316]  398  359  451  475   92  155  485  502  630  438  527  473  491  317  773
## [331]  611  593  599  578  479  302   70  766  830  515  161    2  243  665  767
## [346]  858  637  708  808  722  516  540  588  425  538   98  363  265  374    1
## [361]  166  330  207  441  260  280  399  576  512  592  685  595  642  600  431
## [376]  681  743  636  747  119  752  863  729  573  660  868  715  694  829  822
## [391]  539  395  526  644  779  603  385  559  495  557  294   88  586  104  769
## [406]  448  562 1084  880  756  795  703  874  128  221  164  549  571  632  631
## [421]  618  575  286  418  364  469  192  183  430  460  558  437  505  424  401
## [436]  379  790  732  710  738  274  762  771  626  151  666  534  653  759  806
## [451]  833  484  733   71  664  510  350   60  333  318  352  353  291  241  306
## [466]  279  323  407  387  355  328  271  296  315  245  240  310  290  262  250
## [481]  344  411  393  282  371  373  220  368  610  367  674  202   44  361  190
## [496]  287   67  876  461  428  143  477  406  242  278  129  372  375  628  726
## [511]  668  731  370  532  696  568  225  672  775  509  314  580  725  277   12
## [526]   59  341  180  197   86  238   48  339  410    4  252  476  140  455  322
## [541]   63  308  402  384  103  111  326   19  193  289  146  391  447  244  345
## [556]  307   81  313  443  468  449  338  284  602  162  713  467  327  212  298
## [571]  615  700  655  621  714  609  547  253  589  230  707  342  658  173  409
## [586]  186  102  320  405   45  336  258   74  454  105  139  206  486  749  605
## [601]  257  334  846  720  938  928   38  581  778  761  490  817  677  744  730
## [616]  803  670  264   84  789  148  772  716  211  188  319  152   99  108  276
## [631]  275  392  227  234  259  360   15  236  176  149  154  316   47   16   21
## [646]  100   55  324  283   65  297  311  118  216  255  123  210  237  251  305
## [661]  122   77  217   75   79  396  147  269  860  750  877  254  171  436  542
## [676]  261  222  281   31  157  137  208  165  194   97  182  107  132  110   22
## [691]   90  136  114  120  179  263  226  203  213  741  267  692  792  834  810
## [706]  910  802  824  181   87  742  737  764  966  949  941   13  705   28  706
## [721]  801  652  218  168  439  604  187  757  177  841  807  786  657  774  215
## [736]  770  735  303  224  248  229  160  142  682  219  191  113   23  189  272
## [751]  196  138   64  106   18  124  175  687  788  115   51   57  153  669  172
## [766]  758  835  178  209   76  185  745  101  169  693  675  718  867  900  903
## [781]  200  141  121  117  797  850  886   85   93  198  848   91   62  174  783
## [796]  882  724  130   95  883  719  859  723   50   54   39   61  812  736   78
## [811]   36   30   68   66  134  135   56   35   40   43 1264  977  875  163   52
## [826]   29   24   33
```

```r
# See all distinct values in WFH_due_building_issues
unique(performance_labeled_p2$WFH_due_building_issues)
```

```
## [1] 0 1
```

Converted the variable `WFH_due_building_issues` into interpretable factor labels (`Remote` for 1 and `On-site` for 0).

```r
performance_labeled_p2$WFH_due_building_issues <- factor(dplyr::recode(performance_labeled_p2$WFH_due_bu
                                                          `1` = "Remote",
                                                          `0` = "On-site"))
```

Extracted the year and week components from the `year_week` variable and removed the original field.

```r
## Transform into weekly data

performance_labeled_p2 <- performance_labeled_p2 %>% mutate(year=as.numeric(substr(year_week, 1, 4)))

performance_labeled_p2 <- performance_labeled_p2 %>%
  mutate(week = as.numeric(substr(year_week, 5, 6)))
```

```r
performance_labeled_p2 <- performance_labeled_p2 %>% dplyr::select(-year_week)

performance_labeled_p2$date <- ISOweek::ISOweek2date(paste0(performance_labeled_p2$year, "-W",
                                                   sprintf("%02d", performance_labeled_p2$week),
```

Repositioned the columns and reassigned the dataset to `performance_clean`.

```r
performance_clean <- performance_labeled_p2 %>%
  dplyr::select(personid, date, year, week, perform1, phonecall, phonecallraw, WFH_due_building_issues,
         logphonecall, logcallpersec, logcalllength, logcall_dayworked, everything())

rm(performance_labeled_p2)
```

##The Summary Volunteer Dataset

The **`summary_volunteer_labeled_p2`** dataset contains demographic and background information about participants, including age, tenure, commute distance, gender, marital status, education, bedroom availability, and presence of children.
The following cleaning steps were performed:

The following cleaning steps were performed for the summary (demographic) dataset:

1. **Inspected the dataset** using `View()`, `skim()`, and `head()` to understand its structure and variable types.

2. Checked for missing values, duplicate rows, and reviewed distinct values of key variables such as `personid`, `age`, `tenure`, `commute`, `men`, `married`, `high_educ`, `bedroom`, and `children`.

3. **Renamed the variable `men` to `gender`** to improve clarity and consistency.

4. **Converted binary demographic indicators into interpretable factor labels** to provide clearer categorical information.

5. Cleaned and formatted all categorical variables by applying descriptive labels across the binary indicators.

6. **Reordered columns** so that key demographic variables (`personid`, `age`, `tenure`, `commute`, `gender`, `married`, `higher_edu_indicator`, `bedroom_indicator`, `children_indicator`) appear at the front of the dataset.

7. **Saved the cleaned dataset as `summary_clean`** for subsequent analysis.

```r
# Viewing and analysing the data
# View(summary_volunteer_labeled_p2)
skim(summary_volunteer_labeled_p2)
```

Table 6: Data summary

Name	summary_volunteer_labeled...
Number of rows	135
Number of columns	9
Column type frequency:	
numeric	9
Group variables	None

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
personid	0	1	32716.79	10835.70	4122	25913	37292	40464.0	45442	
age	0	1	23.84	3.35	18	22	23	25.5	35	
tenure	0	1	21.41	19.05	2	8	13	31.0	94	
children	0	1	0.15	0.36	0	0	0	0.0	1	
bedroom	0	1	0.98	0.15	0	1	1	1.0	1	
commute	0	1	105.48	66.90	10	50	90	167.5	300	
men	0	1	0.50	0.50	0	0	1	1.0	1	
married	0	1	0.21	0.41	0	0	0	0.0	1	
high_educ	0	1	0.41	0.49	0	0	0	1.0	1	

```r
head(summary_volunteer_labeled_p2)
```

```
## # A tibble: 6 x 9
##   personid   age tenure children   bedroom     commute   men married high_educ
##      <dbl> <dbl>  <dbl> <dbl+lbl>  <dbl+lbl>     <dbl> <dbl>   <dbl>     <dbl>
## 1     4122    30     94 0 [no]     0 [no]          180     0       0         0
## 2     6278    32     77 1 [yes]    1 [yes]         170     0       1         1
## 3     7720    25     70 0 [no]     1 [yes]         180     0       0         1
## 4     8834    22     66 0 [no]     0 [no]           60     0       0         0
## 5     8854    22     66 0 [no]     1 [yes]          60     0       0         0
## 6    10098    28     63 1 [yes]    1 [yes]         180     0       1         1
```

Checked for missing values, duplicate rows, and examined distinct values of key variables (`personid`, `age`, `tenure`, `commute`, `men`, `married`, `high_educ`, `bedroom`, `children`).

```r
# Check for missing values
colSums(is.na(summary_volunteer_labeled_p2))
```

```
##  personid       age    tenure  children   bedroom   commute       men   married
##         0         0         0         0         0         0         0         0
## high_educ
##         0
```

```r
# Check for duplicates
summary_volunteer_labeled_p2[duplicated(summary_volunteer_labeled_p2), ]
```

```
## # A tibble: 0 x 9
## # i 9 variables: personid <dbl>, age <dbl>, tenure <dbl>, children <dbl+lbl>,
## #   bedroom <dbl+lbl>, commute <dbl>, men <dbl>, married <dbl>, high_educ <dbl>
```

```
# Inspect distinct values
unique(summary_volunteer_labeled_p2$personid)
```

```
##   [1]  4122  6278  7720  8834  8854 10098 10356 12426 12974 13980 14048 14220
##  [13] 14522 14528 15444 16334 16422 16424 16514 16594 16596 17160 17906 19470
##  [25] 21654 22284 23136 23228 23772 24324 24608 25520 25638 25864 25962 26328
##  [37] 26634 26934 27704 28190 28224 28484 29172 29230 29808 30014 31136 31150
##  [49] 31292 31888 31936 32320 32804 33128 33278 33350 33354 34890 35006 35344
##  [61] 35822 36032 36288 36314 36494 36908 37276 37292 37294 37798 38038 38290
##  [73] 38552 38566 38580 38712 38842 38862 38878 38898 39096 39144 39164 39458
##  [85] 39466 39478 39634 39942 39990 40008 40034 40062 40162 40174 40192 40316
##  [97] 40322 40328 40336 40346 40456 40472 40490 41286 41320 41332 42096 42104
## [109] 42108 42152 42308 42592 42618 42624 42628 42632 42634 42682 43258 43264
## [121] 43288 43524 43534 43570 43926 44256 44266 44282 44408 44782 44784 44794
## [133] 44800 45254 45442
```

```
unique(summary_volunteer_labeled_p2$age)
```

```
##  [1] 30 32 25 22 28 27 29 34 21 23 24 26 20 35 19 18 31
```

```
unique(summary_volunteer_labeled_p2$tenure)
```

```
##  [1] 94.0 77.0 70.0 66.0 63.0 62.0 56.0 54.0 51.0 50.0 49.0 47.0 46.0 45.0 42.0
## [16] 37.0 36.0 35.0 34.0 32.0 31.0 30.0 28.0 27.0 26.0 25.0 24.0 23.0 22.0 21.0
## [31] 20.0 19.0 18.0 15.0 13.0 12.0 11.0 10.0  9.0  8.0  6.0  5.0  4.0  3.0  3.5
## [46]  2.5  2.0
```

```
unique(summary_volunteer_labeled_p2$commute)
```

```
##  [1] 180 170  60  20 120 240  40  65  90  70 160 210  80  45  35  30  32  50 140
## [20] 135  75 200  10 300 150  28 100 165 190 105  55
```

```
unique(summary_volunteer_labeled_p2$men)
```

```
## [1] 0 1
```

```
unique(summary_volunteer_labeled_p2$married)
```

```
## [1] 0 1
```

```
unique(summary_volunteer_labeled_p2$high_educ)
```

```
## [1] 0 1
```

```r
unique(summary_volunteer_labeled_p2$bedroom)
```

```
## <labelled<double>[2]>: number of bedrooms at home
## [1] 0 1
##
## Labels:
##  value label
##      0    no
##      1   yes
```

```r
unique(summary_volunteer_labeled_p2$children)
```

```
## <labelled<double>[2]>: number of children
## [1] 0 1
##
## Labels:
##  value label
##      0    no
##      1   yes
```

Renamed the variable `men` to `gender` for clarity and consistency.

```r
# Rename men to gender
summary_volunteer_labeled_p2 <- summary_volunteer_labeled_p2 %>%
  rename(gender = men)
```

Converted binary indicators into interpretable factor labels for `gender`, `marital_status`, `higher_edu_indicator`, `bedroom_indicator`, and `children_indicator`. Cleaned and formatted categorical variables by applying descriptive labels to all binary demographic indicators.

```r
# Clean and format variables
summary_clean <- summary_volunteer_labeled_p2 %>%
  mutate(
    gender = factor(gender, levels = c(0, 1),
                    labels = c("Female", "Male")),
    marital_status = factor(married, levels = c(0, 1),
                            labels = c("Not Married", "Married")),
    higher_edu_indicator = factor(high_educ, levels = c(0, 1),
                                  labels = c("No Degree", "Has Degree")),
    bedroom_indicator = factor(bedroom, levels = c(0, 1),
                               labels = c("No Bedroom", "Has Own Bedroom")),
    children_indicator = factor(children, levels = c(0, 1),
                                labels = c("No Children", "Has Child/Children"))
  )
```

Selected and reordered columns to place the key demographic variables at the front of the cleaned dataset.

```r
summary_clean <- summary_clean %>%
  dplyr::select(personid, age, tenure, commute,
         gender, married, higher_edu_indicator,
         bedroom_indicator, children_indicator)
```

Assigned the cleaned output as `summary_clean` for further analysis.

```r
# Remove original dataset
rm(summary_volunteer_labeled_p2)
```

The Wage Dataset

The `wage_new_labeled_p2` dataset contains monthly wage information, including base wage, bonus payments, gross wage, and the corresponding wage month.
The following cleaning steps were performed:

The following cleaning steps were performed for the wage dataset:

1. **Inspected the dataset** using `View()`, `skim()`, and `head()` to understand its structure and variable types.

2. **Converted the variable** `wage_month` from `YYYYMM` format into a proper date variable (`wage_month_date`) representing the first day of each month.

3. Identified inconsistencies in the reported gross wage and recalculated it as the sum of `basewage` and `bonustotal` to ensure accurate wage values.

4. Verified that all wage-related variables (`basewage`, `bonustotal`, `grosswage`) were correctly formatted as numeric values.

5. **Reordered columns** so that key wage variables (`personid`, `wage_month`, `wage_month_date`, `basewage`, `bonustotal`, `grosswage`) appear at the front of the dataset.

6. **Saved the cleaned dataset as `wage_clean`** for further analysis.

7. Removed the original dataset `wage_new_labeled_p2` from the environment to prevent conflicts during later merging.

Inspected the dataset using `View()`, `skim()`, and `head()` to understand structure and data types.

```r
# Viewing and analysing the data
# View(wage_new_labeled_p2)
skim(wage_new_labeled_p2)
```

Table 8: Data summary

Name	wage_new_labeled_p2
Number of rows	3007
Number of columns	5
Column type frequency:	
character	1
numeric	4
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
wage_month	0	1	6	6	0	26	0

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
basewage	0	1	1665.83	221.26	650.00	1500.00	1600.00	1800.00	2850	
grosswage	0	1	3133.63	1064.47	48.85	2455.24	2978.72	3727.00	14553	
personid	0	1	32285.38	10849.71	4122.00	25520.00	36908.00	40336.00	45442	
bonustotal	0	1	1502.65	927.90	0.00	914.50	1325.17	1964.74	12853	

```r
head(wage_new_labeled_p2)
```

```
## # A tibble: 6 x 5
##   basewage grosswage personid wage_month bonustotal
##      <dbl>     <dbl>    <dbl> <chr>           <dbl>
## 1     1650     3651.     4122 202201          2001.
## 2     1650     4776.     4122 202202          3126.
## 3     1650     4358      4122 202203          2708
## 4     1650     4801      4122 202204          3151
## 5     1650     4045.     4122 202205          2395.
## 6     1650     5498.     4122 202206          3848.
```

Converted the `wage_month` variable from a `YYYYMM` character format into a proper date variable (`wage_month_date`) representing the first day of each month.

```r
# Casting the data type from character to date for wage_month
wage_clean <- wage_new_labeled_p2 %>%
  mutate(
    wage_month_date = as.Date(paste0(wage_month, "01"), format = "%Y%m%d")
  )
```

Identified inconsistencies between `basewage`, `bonustotal`, and `grosswage`, and recalculated `grosswage` to ensure accuracy.

```r
# Recalculate gross wage because of inconsistencies
wage_clean <- wage_clean %>%
  mutate(
    grosswage = basewage + bonustotal
  )
```

Reorganized the dataset by placing key variables at the front (`personid`, `wage_month`, `wage_month_date`, `basewage`, `bonustotal`, `grosswage`) and assigned the cleaned output as `wage_clean` for further analysis.

```r
# Adjusting column positions
wage_clean <- wage_clean %>%
  dplyr::select(personid, wage_month, wage_month_date, basewage,
         bonustotal, grosswage, everything())
```

Removed the original dataset (`wage_new_labeled_p2`) from the environment to avoid conflicts during merging.

```
rm(wage_new_labeled_p2)
```

#Data Merging

Data Merging – Person-level dataset

The goal of this step is to construct a final person-level dataset by aggregating weekly or monthly information to the individual level and merging all sources using `personid`.
The following aggregation and merging steps were performed:

The following cleaning steps were performed for the summary volunteer dataset:

1. **Inspected the dataset** using `View()`, `skim()`, and `head()` to understand its structure and data types.

2. Checked for missing values, duplicate rows, and reviewed the distinct values of key variables such as `personid`, `age`, `tenure`, `commute`, `gender`, `married`, `high_educ`, `bedroom`, and `children`.

3. **Renamed the variable** `men` to `gender` for improved clarity and consistency.

4. **Converted binary indicators into interpretable factor labels** to ensure clearer categorical information.

5. **Cleaned and formatted all categorical demographic variables** by applying descriptive labels to the binary indicators.

6. **Reordered columns** so that key demographic variables (`personid`, `age`, `tenure`, `commute`, `gender`, `married`, `higher_edu_indicator`, `bedroom_indicator`, `children_indicator`) appear at the front of the dataset.

7. **Saved the cleaned dataset as `summary_clean`** for further analysis.

Aggregating `attitude` data to the person level

```
# Aggregate weekly attitude variables to person-level means
attitude_agg <- attitude_clean %>%
  group_by(personid) %>%
  summarise(
    exhaustion = mean(exhaustion, na.rm = TRUE),    # Average weekly exhaustion
    negative   = mean(negative,   na.rm = TRUE),    # Average weekly negative affect
    positive   = mean(positive,   na.rm = TRUE)     # Average weekly positive affect
  )

# Convert continuous averages to integer scale (rounded)
attitude_agg$exhaustion <- as.integer(round(attitude_agg$exhaustion))
attitude_agg$negative   <- as.integer(round(attitude_agg$negative))
attitude_agg$positive   <- as.integer(round(attitude_agg$positive))
```

Aggregating weekly `performance` data

```r
# Aggregate weekly performance into person-level metrics
performance_agg_person <- performance_clean %>%
  group_by(personid) %>%
  summarise(
    mean_overall_perf_z_score    = mean(perform1,     na.rm = TRUE),   # Avg z-score performance
    mean_phonecall_perf_z_score = mean(phonecall,    na.rm = TRUE),   # Avg phonecall z-score
    total_calls                  = sum(phonecallraw, na.rm = TRUE),   # Total call volume

    # Log-transformed performance metrics (averages)
    mean_log_phone_calls         = mean(logphonecall,     na.rm = TRUE),
    mean_log_calls_per_second    = mean(logcallpersec,    na.rm = TRUE),
    mean_log_average_call_lenght= mean(logcalllength,    na.rm = TRUE),
    mean_log_calls_per_day_worked = mean(logcall_dayworked, na.rm = TRUE),
    mean_log_days_worked         = mean(logdaysworked,    na.rm = TRUE),

    # Work format counts
    weeks_observed = n(),
    remote_weeks   = sum(WFH_due_building_issues == "Remote",  na.rm = TRUE),
    on_site_weeks  = sum(WFH_due_building_issues == "On-site", na.rm = TRUE),

    # Work format proportions
    pct_remote_weeks = remote_weeks / weeks_observed,
    pct_on_site_weeks = on_site_weeks / weeks_observed
  ) %>%
  ungroup()
```

Aggregating `wage` data

```r
wage_medians <- wage_clean %>%
  group_by(personid) %>%  # Group by person ID
  summarise(
    median_base_wage_cny         = median(basewage, na.rm = TRUE),        # Median base monthly wage
    median_gross_wage_cny        = median(grosswage, na.rm = TRUE),       # Median gross monthly wage
    median_bonus_total_cny       = median(bonustotal, na.rm = TRUE),      # Median total bonus
    months_observed              = n()                                    # Number of months observed
  ) %>%
  ungroup()  # Remove grouping
```

Preparing `summary` and `endperiod` data

```r
# Keep unique demographic entries per person
summary_agg <- summary_clean %>%
  dplyr::select(personid, everything()) %>%
  distinct(personid, .keep_all = TRUE)

# Keep unique end-period outcome entries
endperiod_agg <- endperiod_clean %>%
  dplyr::select(personid, everything()) %>%
  distinct(personid, .keep_all = TRUE)
```

Creating `final_all` person-level dataset

```r
# Sequentially merge: demographics → outcomes → performance → wage → attitudes
final_all <- summary_agg %>%
  left_join(endperiod_agg,           by = "personid") %>%
  left_join(performance_agg_person, by = "personid") %>%
  left_join(wage_medians,            by = "personid") %>%
  left_join(attitude_agg,            by = "personid") %>%
  distinct(personid, .keep_all = TRUE)    # Ensure unique persons
```

In addition to the `final_all` person-level dataset, a weekly panel dataset `final_panel_weekly` was constructed that combines outcomes, demographics, attitudes, performance, and wages at the week level.
The following steps were performed:

Data Merging – Weekly panel dataset

In addition to the person-level file, a weekly panel dataset was constructed that combines outcomes, demographics, attitudes, performance, and wages at the week level.
The following steps were performed:

1. Verified that `endperiod_clean` and `summary_clean` contained the same employees based on `personid` and **merged them into** `aa_sum_end_join`.

2. **Merged weekly attitude and performance data** by creating `att_perf_join` via a full join of `attitude_clean` and `performance_clean` on `personid`, `year`, and `week`, and resolved duplicate `date` fields using `coalesce()`.

3. **Prepared `wage_clean` for weekly merging** by constructing `test_wage_new_labeled_p2` with a proper monthly `date` variable and a common `month` key, and then **joined wages to** `att_perf_join` by `personid` and `month`, yielding `att_with_wage`.

4. Checked the integrity of the merged wage information in `att_with_wage`, confirming stable summary statistics and a low share of missing wage values.

5. **Created the final weekly panel dataset** `final_panel_weekly` by joining `att_with_wage` with `aa_sum_end_join` on `personid`, and removed intermediate objects before inspecting `final_all` and `final_panel_weekly` with `skim()` and `head()`.

Checked whether both datasets contained the same `personid` values and merged them into `aa_sum_end_join`, followed by an inspection with `skim()`.

```r
# Check if both datasets contain the same employees
sort(unique(endperiod_clean$personid)) == sort(unique(summary_clean$personid))
```

```
##   [1] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
##  [16] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
##  [31] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
##  [46] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
##  [61] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
##  [76] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
##  [91] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [106] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## [121] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
```

```r
# Merge them
aa_sum_end_join <- left_join(endperiod_clean,
                             summary_clean,
                             by = "personid")

skimr::skim(aa_sum_end_join)
```

Table 11: Data summary

Name	aa_sum_end_join
Number of rows	135
Number of columns	12
Column type frequency:	
factor	4
numeric	8
Group variables	None

Variable type: factor

skim_variable	n_missing	complete_rate	ordered	n_unique	top_counts
gender	0	1	FALSE	2	Mal: 68, Fem: 67
higher_edu_indicator	0	1	FALSE	2	No : 79, Has: 56
bedroom_indicator	0	1	FALSE	2	Has: 132, No : 3
children_indicator	0	1	FALSE	2	No : 115, Has: 20

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
personid	0	1	32716.79	10835.70	4122	25913.0	37292	40464.0	45442	
promote_switch	0	1	0.16	0.37	0	0.0	0	0.0	1	
quitjob	0	1	0.30	0.46	0	0.0	0	1.0	1	
costofcommute	0	1	7.40	7.22	0	2.5	6	10.0	55	
age	0	1	23.84	3.35	18	22.0	23	25.5	35	
tenure	0	1	21.41	19.05	2	8.0	13	31.0	94	
commute	0	1	105.48	66.90	10	50.0	90	167.5	300	
married	0	1	0.21	0.41	0	0.0	0	0.0	1	

Merged weekly attitude and performance data using a full join on `personid`, `year`, and `week`, resolved duplicate date fields, and inspected the result with `skim()`.

```r
# Full join because the time frames differ slightly
att_perf_join <- full_join(attitude_clean,
                           performance_clean,
                           by = c("personid", "year", "week"))

# Fix date variable (from attitude or performance)
att_perf_join <- att_perf_join %>%
```

```r
  mutate(date = coalesce(date.x, date.y)) %>%   # take non-NA value
  dplyr::select(-date.x, -date.y)

skimr::skim(att_perf_join)
```

Table 14: Data summary

Name	att_perf_join
Number of rows	10079
Number of columns	16
Column type frequency:	
Date	1
factor	1
numeric	14
Group variables	None

Variable type: Date

skim_variable	n_missing	complete_rate	min	max	median	n_unique
date	0	1	2022-01-03	2023-08-28	2022-10-17	87

Variable type: factor

skim_variable	n_missing	complete_rate	ordered	n_unique	top_counts
WFH_due_building_issues	209	0.98	FALSE	2	On-: 7932, Rem: 1938

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
personid	0	1.00	32518.87	10613.45	4122.00	25864.00	36908.00	40328.00	45442.00	
year	0	1.00	2022.35	0.48	2022.00	2022.00	2022.00	2023.00	2023.00	
week	0	1.00	23.91	14.49	1.00	12.00	23.00	34.00	53.00	
exhaustion	7700	0.24	8.61	7.79	0.00	2.00	7.00	12.00	36.00	
negative	7700	0.24	16.65	6.85	8.00	11.00	16.00	21.00	40.00	
positive	7700	0.24	24.21	6.67	8.00	20.00	24.00	29.00	40.00	
perform1	232	0.98	-0.02	0.99	-3.03	-0.61	0.05	0.61	4.16	
phonecall	343	0.97	-0.01	0.96	-3.11	-0.54	0.07	0.61	5.83	
phonecallraw	490	0.95	440.21	142.53	1.00	357.00	445.00	527.00	1264.00	
logphonecall	490	0.95	6.01	0.48	0.00	5.88	6.10	6.27	7.14	
logcallpersec	488	0.95	-5.17	0.16	-5.95	-5.26	-5.17	-5.08	-1.10	
logcalllength	488	0.95	11.17	0.52	2.48	11.05	11.27	11.44	12.12	
logcall_dayworked	488	0.95	9.47	0.46	2.48	9.33	9.55	9.73	10.36	
logdaysworked	209	0.98	1.69	0.28	0.00	1.61	1.79	1.79	1.95	

Converted `wage_month` into a proper monthly date, created `test_wage_new_labeled_p2` for merging, and inspected the output with `skim()`.

```r
# Convert wage month (YYYYMM) into a proper monthly date
test_wage_new_labeled_p2 <- wage_clean %>%
  mutate(
    year  = as.integer(substr(wage_month, 1, 4)),
    month = as.integer(substr(wage_month, 5, 6)),
    date  = as.Date(paste(year, month, 1, sep = "-"))   # first day of month
  ) %>%
  dplyr::select(-year, -month)

skimr::skim(test_wage_new_labeled_p2)
```

Table 18: Data summary

Name	test_wage_new_labeled_p2
Number of rows	3007
Number of columns	7
Column type frequency:	
character	1
Date	2
numeric	4
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
wage_month	0	1	6	6	0	26	0

Variable type: Date

skim_variable	n_missing	complete_rate	min	max	median	n_unique
wage_month_date	0	1	2022-01-01	2024-02-01	2022-12-01	26
date	0	1	2022-01-01	2024-02-01	2022-12-01	26

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
personid	0	1	32285.38	10849.71	4122.00	25520.00	36908.00	40336.00	45442	
basewage	0	1	1665.83	221.26	650.00	1500.00	1600.00	1800.00	2850	
bonustotal	0	1	1502.65	927.90	0.00	914.50	1325.17	1964.74	12853	
grosswage	0	1	3168.48	1020.03	1264.43	2472.15	2984.38	3733.81	14553	

Created monthly identifiers in both datasets, merged wage information into the weekly data using `personid` and `month`, and checked the result with `skim()`.

```r
# Create 'month' variable in both datasets
att_perf_join <- att_perf_join %>%
  mutate(date = as.Date(date),
         month = floor_date(date, unit = "month"))

test_wage_new_labeled_p2 <- test_wage_new_labeled_p2 %>%
  mutate(date = as.Date(date),
         month = floor_date(date, unit = "month"))

# Merge wage values for each person-month into weekly rows
att_with_wage <- att_perf_join %>%
  left_join(
    test_wage_new_labeled_p2 %>%
      dplyr::select(personid, month, basewage, grosswage, bonustotal),
    by = c("personid", "month")
  )

skimr::skim(att_with_wage)
```

Table 22: Data summary

Name	att_with_wage
Number of rows	10079
Number of columns	20
Column type frequency:	
Date	2
factor	1
numeric	17
Group variables	None

Variable type: Date

skim_variable	n_missing	complete_rate	min	max	median	n_unique
date	0	1	2022-01-03	2023-08-28	2022-10-17	87
month	0	1	2022-01-01	2023-08-01	2022-10-01	20

Variable type: factor

skim_variable	n_missing	complete_rate	ordered	n_unique	top_counts
WFH_due_building_issues	209	0.98	FALSE	2	On-: 7932, Rem: 1938

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
personid	0	1.00	32518.87	10613.45	4122.00	25864.00	36908.00	40328.00	45442.00	
year	0	1.00	2022.35	0.48	2022.00	2022.00	2022.00	2023.00	2023.00	

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
week	0	1.00	23.91	14.49	1.00	12.00	23.00	34.00	53.00	
exhaustion	7700	0.24	8.61	7.79	0.00	2.00	7.00	12.00	36.00	
negative	7700	0.24	16.65	6.85	8.00	11.00	16.00	21.00	40.00	
positive	7700	0.24	24.21	6.67	8.00	20.00	24.00	29.00	40.00	
perform1	232	0.98	-0.02	0.99	-3.03	-0.61	0.05	0.61	4.16	
phonecall	343	0.97	-0.01	0.96	-3.11	-0.54	0.07	0.61	5.83	
phonecallraw	490	0.95	440.21	142.53	1.00	357.00	445.00	527.00	1264.00	
logphonecall	490	0.95	6.01	0.48	0.00	5.88	6.10	6.27	7.14	
logcallpersec	488	0.95	-5.17	0.16	-5.95	-5.26	-5.17	-5.08	-1.10	
logcalllength	488	0.95	11.17	0.52	2.48	11.05	11.27	11.44	12.12	
logcall_dayworked	488	0.95	9.47	0.46	2.48	9.33	9.55	9.73	10.36	
logdaysworked	209	0.98	1.69	0.28	0.00	1.61	1.79	1.79	1.95	
basewage	12	1.00	1601.69	176.22	650.00	1500.00	1600.00	1700.00	2450.00	
grosswage	12	1.00	3095.24	988.18	1264.43	2453.00	2871.10	3539.66	14553.00	
bonustotal	12	1.00	1493.55	912.05	0.00	915.00	1284.43	1891.90	12853.00	

Merged weekly `performance`, `attitude`, and `wage` data with `summary` and `endperiod` data to create `final_panel_weekly`.

```r
# Combine (weekly performance+attitude+wage) with (demographics+endperiod)
final_panel_weekly <- full_join(att_with_wage,
                                aa_sum_end_join,
                                by = "personid")
```

Removed intermediate objects to clean the workspace and inspected the final datasets using `skim()` and `head()`.

```r
# Remove unnecessary intermediate datasets
rm(attitude_agg, attitude_clean, attitude_performance, attitude_performance_wage,
   endperiod_agg, endperiod_clean, performance_agg_person, performance_clean,
   summary, summary_agg, summary_clean, volunteer_endperiod, wage_clean,
   wage_medians, endperiod_outcomes, att_perf_join, att_with_wage,
   test_wage_new_labeled_p2, aa_sum_end_join)
```

```
## Warning in rm(attitude_agg, attitude_clean, attitude_performance,
## attitude_performance_wage, : object 'attitude_performance' not found
```

```
## Warning in rm(attitude_agg, attitude_clean, attitude_performance,
## attitude_performance_wage, : object 'attitude_performance_wage' not found
```

```
## Warning in rm(attitude_agg, attitude_clean, attitude_performance,
## attitude_performance_wage, : object 'summary' not found
```

```
## Warning in rm(attitude_agg, attitude_clean, attitude_performance,
## attitude_performance_wage, : object 'volunteer_endperiod' not found
```

```
## Warning in rm(attitude_agg, attitude_clean, attitude_performance,
## attitude_performance_wage, : object 'endperiod_outcomes' not found
```

```r
# Inspect merged datasets
skim(final_all)
```

Table 26: Data summary

Name	final_all
Number of rows	135
Number of columns	32
Column type frequency:	
factor	4
numeric	28
Group variables	None

Variable type: factor

skim_variable	n_missing	complete_rate	ordered	n_unique	top_counts
gender	0	1	FALSE	2	Mal: 68, Fem: 67
higher_edu_indicator	0	1	FALSE	2	No : 79, Has: 56
bedroom_indicator	0	1	FALSE	2	Has: 132, No : 3
children_indicator	0	1	FALSE	2	No : 115, Has: 20

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
personid	0	1.00	32716.79	10835.70	4122.00	25913.00	37292.00	40464.00	45442.00	
age	0	1.00	23.84	3.35	18.00	22.00	23.00	25.50	35.00	
tenure	0	1.00	21.41	19.05	2.00	8.00	13.00	31.00	94.00	
commute	0	1.00	105.48	66.90	10.00	50.00	90.00	167.50	300.00	
married	0	1.00	0.21	0.41	0.00	0.00	0.00	0.00	1.00	
promote_switch	0	1.00	0.16	0.37	0.00	0.00	0.00	0.00	1.00	
quitjob	0	1.00	0.30	0.46	0.00	0.00	0.00	1.00	1.00	
costofcommute	0	1.00	7.40	7.22	0.00	2.50	6.00	10.00	55.00	
mean_overall_perf_z_score	0	1.00	-0.06	0.54	-1.20	-0.40	-0.04	0.28	1.42	
mean_phonecall_perf_z_score	0	1.00	-0.04	0.49	-1.12	-0.34	-0.04	0.27	1.22	
total_calls	0	1.00	31268.23	9635.28	6088.00	23760.00	33311.00	37984.50	49621.00	
mean_log_phone_calls	0	1.00	6.00	0.20	5.31	5.89	6.01	6.13	6.59	
mean_log_calls_per_second	1	0.99	-5.17	0.12	-5.56	-5.24	-5.17	-5.10	-4.81	
mean_log_average_call_lenght	1	0.99	11.16	0.20	10.45	11.06	11.17	11.29	11.67	
mean_log_calls_per_day_worked	1	0.99	9.47	0.20	8.67	9.38	9.48	9.60	9.91	
mean_log_days_worked	0	1.00	1.68	0.10	1.34	1.62	1.67	1.76	1.85	
weeks_observed	0	1.00	73.11	14.07	27.00	62.50	81.00	85.00	86.00	
remote_weeks	0	1.00	14.36	16.37	0.00	0.00	1.00	33.00	39.00	
on_site_weeks	0	1.00	58.76	16.79	26.00	47.00	55.00	72.00	86.00	
pct_remote_weeks	0	1.00	0.18	0.21	0.00	0.00	0.01	0.41	0.58	
pct_on_site_weeks	0	1.00	0.82	0.21	0.42	0.59	0.99	1.00	1.00	
median_base_wage_cny	0	1.00	1635.56	130.06	1300.00	1550.00	1600.00	1700.00	2375.00	
median_gross_wage_cny	0	1.00	3023.55	688.64	1919.76	2518.40	2792.00	3428.90	4801.74	

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
median_bonus_total_cny	0	1.00	1400.48	590.61	517.76	972.00	1208.60	1759.67	3051.98	
months_observed	0	1.00	22.27	5.05	7.00	19.50	26.00	26.00	26.00	
exhaustion	74	0.45	8.59	6.53	0.00	3.00	9.00	12.00	29.00	
negative	74	0.45	16.64	5.39	8.00	12.00	17.00	20.00	34.00	
positive	74	0.45	24.25	5.14	13.00	21.00	24.00	27.00	37.00	

```
skim(final_panel_weekly)
```

Table 29: Data summary

Name	final_panel_weekly
Number of rows	10079
Number of columns	31
Column type frequency:	
Date	2
factor	5
numeric	24
Group variables	None

Variable type: Date

skim_variable	n_missing	complete_rate	min	max	median	n_unique
date	0	1	2022-01-03	2023-08-28	2022-10-17	87
month	0	1	2022-01-01	2023-08-01	2022-10-01	20

Variable type: factor

skim_variable	n_missing	complete_rate	ordered	n_unique	top_counts
WFH_due_building_issues	209	0.98	FALSE	2	On-: 7932, Rem: 1938
gender	0	1.00	FALSE	2	Mal: 5064, Fem: 5015
higher_edu_indicator	0	1.00	FALSE	2	No : 6051, Has: 4028
bedroom_indicator	0	1.00	FALSE	2	Has: 9815, No : 264
children_indicator	0	1.00	FALSE	2	No : 8658, Has: 1421

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
personid	0	1.00	32518.87	10613.45	4122.00	25864.00	36908.00	40328.00	45442.00	
year	0	1.00	2022.35	0.48	2022.00	2022.00	2022.00	2023.00	2023.00	
week	0	1.00	23.91	14.49	1.00	12.00	23.00	34.00	53.00	
exhaustion	7700	0.24	8.61	7.79	0.00	2.00	7.00	12.00	36.00	
negative	7700	0.24	16.65	6.85	8.00	11.00	16.00	21.00	40.00	
positive	7700	0.24	24.21	6.67	8.00	20.00	24.00	29.00	40.00	
perform1	232	0.98	-0.02	0.99	-3.03	-0.61	0.05	0.61	4.16	

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
phonecall	343	0.97	-0.01	0.96	-3.11	-0.54	0.07	0.61	5.83	
phonecallraw	490	0.95	440.21	142.53	1.00	357.00	445.00	527.00	1264.00	
logphonecall	490	0.95	6.01	0.48	0.00	5.88	6.10	6.27	7.14	
logcallpersec	488	0.95	-5.17	0.16	-5.95	-5.26	-5.17	-5.08	-1.10	
logcalllength	488	0.95	11.17	0.52	2.48	11.05	11.27	11.44	12.12	
logcall_dayworked	488	0.95	9.47	0.46	2.48	9.33	9.55	9.73	10.36	
logdaysworked	209	0.98	1.69	0.28	0.00	1.61	1.79	1.79	1.95	
basewage	12	1.00	1601.69	176.22	650.00	1500.00	1600.00	1700.00	2450.00	
grosswage	12	1.00	3095.24	988.18	1264.43	2453.00	2871.10	3539.66	14553.00	
bonustotal	12	1.00	1493.55	912.05	0.00	915.00	1284.43	1891.90	12853.00	
promote_switch	0	1.00	0.18	0.39	0.00	0.00	0.00	0.00	1.00	
quitjob	0	1.00	0.24	0.43	0.00	0.00	0.00	0.00	1.00	
costofcommute	0	1.00	7.28	7.24	0.00	2.00	6.00	10.00	55.00	
age	0	1.00	23.82	3.35	18.00	22.00	23.00	26.00	35.00	
tenure	0	1.00	21.74	18.78	2.00	8.00	15.00	31.00	94.00	
commute	0	1.00	103.78	65.85	10.00	50.00	80.00	165.00	300.00	
married	0	1.00	0.19	0.39	0.00	0.00	0.00	0.00	1.00	

```r
head(final_all)
```

```
## # A tibble: 6 x 32
##   personid   age tenure commute gender married higher_edu_indicator
##      <dbl> <dbl>  <dbl>   <dbl> <fct>    <dbl> <fct>
## 1     4122    30     94     180 Female       0 No Degree
## 2     6278    32     77     170 Female       1 Has Degree
## 3     7720    25     70     180 Female       0 Has Degree
## 4     8834    22     66      60 Female       0 No Degree
## 5     8854    22     66      60 Female       0 No Degree
## 6    10098    28     63     180 Female       1 Has Degree
## # i 25 more variables: bedroom_indicator <fct>, children_indicator <fct>,
## #   promote_switch <dbl>, quitjob <dbl>, costofcommute <dbl>,
## #   mean_overall_perf_z_score <dbl>, mean_phonecall_perf_z_score <dbl>,
## #   total_calls <dbl>, mean_log_phone_calls <dbl>,
## #   mean_log_calls_per_second <dbl>, mean_log_average_call_lenght <dbl>,
## #   mean_log_calls_per_day_worked <dbl>, mean_log_days_worked <dbl>,
## #   weeks_observed <int>, remote_weeks <int>, on_site_weeks <int>, ...
```

```r
head(final_panel_weekly)
```

```
## # A tibble: 6 x 31
##   personid  year  week exhaustion negative positive perform1 phonecall
##      <dbl> <dbl> <dbl>      <int>    <int>    <int>    <dbl>     <dbl>
## 1     4122  2022    49          9       20       20  -0.694    -0.729
## 2     4122  2022    50          8       21       25   1.14      1.37
## 3     4122  2022    51          8       20       24   0.0687    0.0139
## 4     4122  2022    52          6       17       22  -0.0442   -0.0542
## 5     4122  2022    53         12       19       19  -1.66     -1.64
## 6     4122  2023     2         12       18       19   0.594     0.909
## # i 23 more variables: phonecallraw <dbl>, WFH_due_building_issues <fct>,
## #   logphonecall <dbl>, logcallpersec <dbl>, logcalllength <dbl>,
```

```
## #   logcall_dayworked <dbl>, logdaysworked <dbl>, date <date>, month <date>,
## #   basewage <dbl>, grosswage <dbl>, bonustotal <dbl>, promote_switch <dbl>,
## #   quitjob <dbl>, costofcommute <dbl>, age <dbl>, tenure <dbl>, commute <dbl>,
## #   gender <fct>, married <dbl>, higher_edu_indicator <fct>,
## #   bedroom_indicator <fct>, children_indicator <fct>
```

Minimal Exploratory Data Analysis (EDA)

Below you find a **short descriptive summary** followed by **a complete R code chunk** containing all EDA steps in the exact sequence used during the analysis. This section provides a concise overview of the data cleaning, transformation, and exploratory steps conducted prior to modeling.

1. **Inspected the data structure** using `dim()`, `glimpse()`, `summary()`, and `skim()`, and checked missing values via `colSums(is.na())`.
2. **Created log-transformed variables** (`log_wage`, `log_bonus`, `log_tenure`) to address skewness and improve model suitability.
3. **Explored numeric distributions** with histograms and compared original vs. log-transformed variables.
4. **Computed and visualized correlations** among key numeric predictors using `ggpairs()`.
5. **Analyzed categorical variables** with frequency tables and bar plots for demographic and job-related groups.
6. **Examined promotion patterns** by plotting promotion rates across groups and comparing numeric predictors using boxplots.
7. **Investigated performance relationships** through scatterplots with trend lines and boxplots across categories.
8. **Explored attrition (quit) patterns** by visualizing quit rates and comparing numeric and categorical variables across quit status.

Inspected the data structure** using `dim()`, `glimpse()`, `summary()`, and `skim()`

Distribution Analysis

```r
# Quick overview of structure, summary stats, and missing values
dim(final_all)
```

```
## [1] 135  32
```

```r
glimpse(final_all)
```

```
## Rows: 135
## Columns: 32
## $ personid                    <dbl> 4122, 6278, 7720, 8834, 8854, 10098, 103~
## $ age                         <dbl> 30, 32, 25, 22, 22, 28, 27, 30, 22, 28, ~
## $ tenure                      <dbl> 94, 77, 70, 66, 66, 63, 62, 56, 54, 51, ~
## $ commute                     <dbl> 180, 170, 180, 60, 60, 180, 60, 60, 20, ~
## $ gender                      <fct> Female, Female, Female, Female, Female, ~
## $ married                     <dbl> 0, 1, 0, 0, 0, 1, 0, 1, 0, 0, 1, 1, 0, 1~
## $ higher_edu_indicator        <fct> No Degree, Has Degree, Has Degree, No De~
## $ bedroom_indicator           <fct> No Bedroom, Has Own Bedroom, Has Own Bed~
```

```
## $ children_indicator           <fct> No Children, Has Child/Children, No Chil~
## $ promote_switch               <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 1~
## $ quitjob                      <dbl> 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0~
## $ costofcommute                <dbl> 18.00000, 12.00000, 9.00000, 0.00000, 4.~
## $ mean_overall_perf_z_score    <dbl> 0.30980061, -0.07127851, -0.55909314, 0.~
## $ mean_phonecall_perf_z_score  <dbl> 0.3254365292, 0.0006961388, -0.614241400~
## $ total_calls                  <dbl> 43132, 20430, 20136, 45957, 49621, 22216~
## $ mean_log_phone_calls         <dbl> 6.136062, 5.901210, 5.780755, 6.287985, ~
## $ mean_log_calls_per_second    <dbl> -5.205012, -5.133074, -5.344394, -5.1700~
## $ mean_log_average_call_lenght <dbl> 11.34107, 11.01579, 11.09415, 11.45802, ~
## $ mean_log_calls_per_day_worked <dbl> 9.561425, 9.524700, 9.534999, 9.651024, ~
## $ mean_log_days_worked         <dbl> 1.779649, 1.424983, 1.505603, 1.756560, ~
## $ weeks_observed               <int> 86, 68, 69, 86, 82, 51, 86, 27, 86, 86, ~
## $ remote_weeks                 <int> 38, 0, 0, 0, 34, 0, 37, 0, 37, 0, 1, 0, ~
## $ on_site_weeks                <int> 48, 68, 69, 86, 48, 51, 49, 27, 49, 86, ~
## $ pct_remote_weeks             <dbl> 0.44186047, 0.00000000, 0.00000000, 0.00~
## $ pct_on_site_weeks            <dbl> 0.5581395, 1.0000000, 1.0000000, 1.00000~
## $ median_base_wage_cny         <dbl> 1900, 1800, 1850, 1900, 1850, 2375, 1800~
## $ median_gross_wage_cny        <dbl> 4152.450, 3110.000, 3121.695, 3849.655, ~
## $ median_bonus_total_cny       <dbl> 2277.510, 1389.000, 1413.315, 2089.880, ~
## $ months_observed              <int> 26, 20, 26, 26, 26, 12, 26, 20, 26, 26, ~
## $ exhaustion                   <int> 14, NA, NA, 4, NA, NA, 3, NA, 11, NA, NA~
## $ negative                     <int> 22, NA, NA, 12, NA, NA, 15, NA, 14, NA, ~
## $ positive                     <int> 20, NA, NA, 29, NA, NA, 25, NA, 15, NA, ~
```

```
summary(final_all)
```

```
##     personid          age            tenure          commute         gender
##  Min.   : 4122   Min.   :18.00   Min.   : 2.00   Min.   : 10.0   Female:67
##  1st Qu.:25913   1st Qu.:22.00   1st Qu.: 8.00   1st Qu.: 50.0   Male  :68
##  Median :37292   Median :23.00   Median :13.00   Median : 90.0
##  Mean   :32717   Mean   :23.84   Mean   :21.41   Mean   :105.5
##  3rd Qu.:40464   3rd Qu.:25.50   3rd Qu.:31.00   3rd Qu.:167.5
##  Max.   :45442   Max.   :35.00   Max.   :94.00   Max.   :300.0
##
##     married        higher_edu_indicator       bedroom_indicator
##  Min.   :0.0000   No Degree :79        No Bedroom     :  3
##  1st Qu.:0.0000   Has Degree:56        Has Own Bedroom:132
##  Median :0.0000
##  Mean   :0.2148
##  3rd Qu.:0.0000
##  Max.   :1.0000
##
##          children_indicator promote_switch     quitjob       costofcommute
##  No Children       :115      Min.   :0.000   Min.   :0.0000   Min.   : 0.000
##  Has Child/Children: 20      1st Qu.:0.000   1st Qu.:0.0000   1st Qu.: 2.500
##                              Median :0.000   Median :0.0000   Median : 6.000
##                              Mean   :0.163   Mean   :0.2963   Mean   : 7.401
##                              3rd Qu.:0.000   3rd Qu.:1.0000   3rd Qu.:10.000
##                              Max.   :1.000   Max.   :1.0000   Max.   :55.000
##
##  mean_overall_perf_z_score mean_phonecall_perf_z_score  total_calls
##  Min.   :-1.20014          Min.   :-1.12002            Min.   : 6088
##  1st Qu.:-0.40148          1st Qu.:-0.34469            1st Qu.:23760
```

```
##  Median :-0.04058          Median :-0.03728           Median :33311
##  Mean   :-0.06438          Mean   :-0.03998           Mean   :31268
##  3rd Qu.: 0.28251          3rd Qu.: 0.27193           3rd Qu.:37984
##  Max.   : 1.41558          Max.   : 1.22426           Max.   :49621
##
##  mean_log_phone_calls mean_log_calls_per_second mean_log_average_call_lenght
##  Min.   :5.311        Min.   :-5.563            Min.   :10.45
##  1st Qu.:5.890        1st Qu.:-5.243            1st Qu.:11.06
##  Median :6.014        Median :-5.171            Median :11.17
##  Mean   :5.997        Mean   :-5.172            Mean   :11.16
##  3rd Qu.:6.133        3rd Qu.:-5.104            3rd Qu.:11.29
##  Max.   :6.588        Max.   :-4.811            Max.   :11.67
##                       NA's   :1                 NA's   :1
##  mean_log_calls_per_day_worked mean_log_days_worked weeks_observed
##  Min.   :8.673                 Min.   :1.342        Min.   :27.00
##  1st Qu.:9.383                 1st Qu.:1.616        1st Qu.:62.50
##  Median :9.475                 Median :1.665        Median :81.00
##  Mean   :9.466                 Mean   :1.677        Mean   :73.11
##  3rd Qu.:9.603                 3rd Qu.:1.759        3rd Qu.:85.00
##  Max.   :9.909                 Max.   :1.853        Max.   :86.00
##  NA's   :1
##   remote_weeks   on_site_weeks   pct_remote_weeks pct_on_site_weeks
##  Min.   : 0.00   Min.   :26.00   Min.   :0.0000   Min.   :0.4194
##  1st Qu.: 0.00   1st Qu.:47.00   1st Qu.:0.0000   1st Qu.:0.5912
##  Median : 1.00   Median :55.00   Median :0.0119   Median :0.9881
##  Mean   :14.36   Mean   :58.76   Mean   :0.1837   Mean   :0.8163
##  3rd Qu.:33.00   3rd Qu.:72.00   3rd Qu.:0.4088   3rd Qu.:1.0000
##  Max.   :39.00   Max.   :86.00   Max.   :0.5806   Max.   :1.0000
##
##  median_base_wage_cny median_gross_wage_cny median_bonus_total_cny
##  Min.   :1300         Min.   :1920          Min.   : 517.8
##  1st Qu.:1550         1st Qu.:2518          1st Qu.: 972.0
##  Median :1600         Median :2792          Median :1208.6
##  Mean   :1636         Mean   :3024          Mean   :1400.5
##  3rd Qu.:1700         3rd Qu.:3429          3rd Qu.:1759.7
##  Max.   :2375         Max.   :4802          Max.   :3052.0
##
##  months_observed   exhaustion       negative        positive
##  Min.   : 7.00   Min.   : 0.00   Min.   : 8.00   Min.   :13.00
##  1st Qu.:19.50   1st Qu.: 3.00   1st Qu.:12.00   1st Qu.:21.00
##  Median :26.00   Median : 9.00   Median :17.00   Median :24.00
##  Mean   :22.27   Mean   : 8.59   Mean   :16.64   Mean   :24.25
##  3rd Qu.:26.00   3rd Qu.:12.00   3rd Qu.:20.00   3rd Qu.:27.00
##  Max.   :26.00   Max.   :29.00   Max.   :34.00   Max.   :37.00
##                  NA's   :74      NA's   :74      NA's   :74
```

```r
skim(final_all)
```

Table 33: Data summary

Name	final_all
Number of rows	135
Number of columns	32

Column type frequency:	
factor	4
numeric	28
Group variables	None

Variable type: factor

skim_variable	n_missing	complete_rate	ordered	n_unique	top_counts
gender	0	1	FALSE	2	Mal: 68, Fem: 67
higher_edu_indicator	0	1	FALSE	2	No : 79, Has: 56
bedroom_indicator	0	1	FALSE	2	Has: 132, No : 3
children_indicator	0	1	FALSE	2	No : 115, Has: 20

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
personid	0	1.00	32716.79	10835.70	4122.00	25913.00	37292.00	40464.00	45442.00	
age	0	1.00	23.84	3.35	18.00	22.00	23.00	25.50	35.00	
tenure	0	1.00	21.41	19.05	2.00	8.00	13.00	31.00	94.00	
commute	0	1.00	105.48	66.90	10.00	50.00	90.00	167.50	300.00	
married	0	1.00	0.21	0.41	0.00	0.00	0.00	0.00	1.00	
promote_switch	0	1.00	0.16	0.37	0.00	0.00	0.00	0.00	1.00	
quitjob	0	1.00	0.30	0.46	0.00	0.00	0.00	1.00	1.00	
costofcommute	0	1.00	7.40	7.22	0.00	2.50	6.00	10.00	55.00	
mean_overall_perf_z_score	0	1.00	-0.06	0.54	-1.20	-0.40	-0.04	0.28	1.42	
mean_phonecall_perf_z_score	0	1.00	-0.04	0.49	-1.12	-0.34	-0.04	0.27	1.22	
total_calls	0	1.00	31268.23	9635.28	6088.00	23760.00	33311.00	37984.50	49621.00	
mean_log_phone_calls	0	1.00	6.00	0.20	5.31	5.89	6.01	6.13	6.59	
mean_log_calls_per_second	1	0.99	-5.17	0.12	-5.56	-5.24	-5.17	-5.10	-4.81	
mean_log_average_call_lenght	1	0.99	11.16	0.20	10.45	11.06	11.17	11.29	11.67	
mean_log_calls_per_day_worked	1	0.99	9.47	0.20	8.67	9.38	9.48	9.60	9.91	
mean_log_days_worked	0	1.00	1.68	0.10	1.34	1.62	1.67	1.76	1.85	
weeks_observed	0	1.00	73.11	14.07	27.00	62.50	81.00	85.00	86.00	
remote_weeks	0	1.00	14.36	16.37	0.00	0.00	1.00	33.00	39.00	
on_site_weeks	0	1.00	58.76	16.79	26.00	47.00	55.00	72.00	86.00	
pct_remote_weeks	0	1.00	0.18	0.21	0.00	0.00	0.01	0.41	0.58	
pct_on_site_weeks	0	1.00	0.82	0.21	0.42	0.59	0.99	1.00	1.00	
median_base_wage_cny	0	1.00	1635.56	130.06	1300.00	1550.00	1600.00	1700.00	2375.00	
median_gross_wage_cny	0	1.00	3023.55	688.64	1919.76	2518.40	2792.00	3428.90	4801.74	
median_bonus_total_cny	0	1.00	1400.48	590.61	517.76	972.00	1208.60	1759.67	3051.98	
months_observed	0	1.00	22.27	5.05	7.00	19.50	26.00	26.00	26.00	
exhaustion	74	0.45	8.59	6.53	0.00	3.00	9.00	12.00	29.00	
negative	74	0.45	16.64	5.39	8.00	12.00	17.00	20.00	34.00	
positive	74	0.45	24.25	5.14	13.00	21.00	24.00	27.00	37.00	

```r
colSums(is.na(final_all))
```

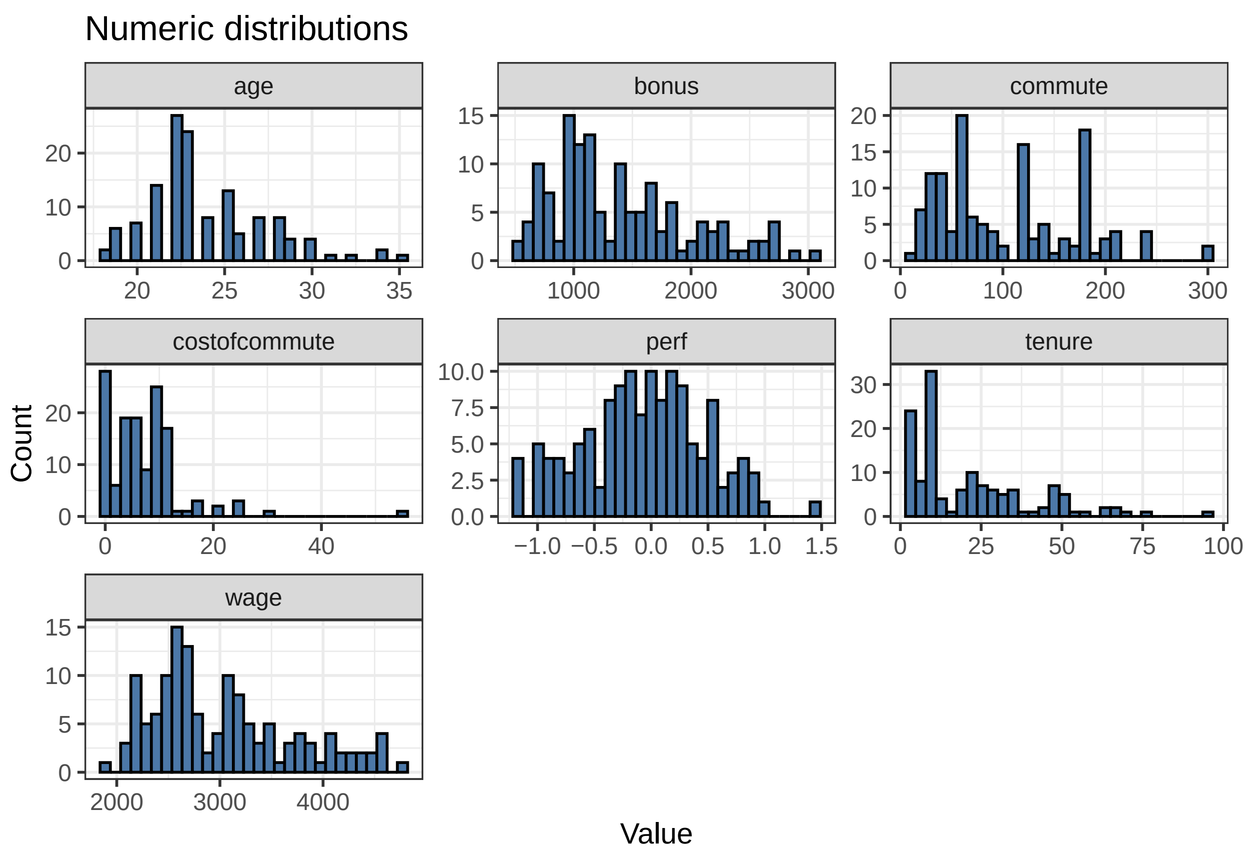
```
##                      personid                         age 
##                             0                           0 
##                        tenure                     commute 
##                             0                           0 
##                        gender                     married 
##                             0                           0 
##          higher_edu_indicator           bedroom_indicator 
##                             0                           0 
##            children_indicator              promote_switch 
##                             0                           0 
##                       quitjob                costofcommute 
##                             0                           0 
##      mean_overall_perf_z_score  mean_phonecall_perf_z_score 
##                             0                           0 
##                   total_calls         mean_log_phone_calls 
##                             0                           0 
##      mean_log_calls_per_second mean_log_average_call_lenght 
##                             1                           1 
## mean_log_calls_per_day_worked         mean_log_days_worked 
##                             1                           0 
##                weeks_observed                remote_weeks 
##                             0                           0 
##                 on_site_weeks             pct_remote_weeks 
##                             0                           0 
##             pct_on_site_weeks         median_base_wage_cny 
##                             0                           0 
##         median_gross_wage_cny       median_bonus_total_cny 
##                             0                           0 
##               months_observed                  exhaustion 
##                             0                          74 
##                      negative                    positive 
##                            74                          74
```

This section visualizes the distributions of key numeric predictors — including `perf`, `age`, `tenure_months`, `wage`, `bonus`, and `commute_time_mins` — using faceted histograms to identify skewness, outliers, and the overall data spread.

Numeric Distributions

```
# Histograms of numeric variables
final_all %>%
  transmute(
    perf   = mean_overall_perf_z_score,
    age,
    tenure,
    wage          = median_gross_wage_cny,
    bonus         = median_bonus_total_cny,
    commute,
    costofcommute
  ) %>%
  pivot_longer(
```

```r
    cols      = everything(),
    names_to  = "var",
    values_to = "value"
  ) %>%
  ggplot(aes(x = value)) +
  geom_histogram(bins = 30, fill = "#4C78A8", color = "black") +
  facet_wrap(~ var, scales = "free") +
  theme_bw() +
  labs(
    title = "Numeric distributions",
    x = "Value",
    y = "Count"
  )
```



The variables bonus, wage, and tenure exhibit pronounced positive skewness, with most observations concentrated in the lower range and a few extreme high values pulling the mean upward. Due to this strong skewness, these variables were log-transformed to reduce the influence of outliers, stabilize variance, and approximate a more symmetric distribution suitable for statistical modeling.

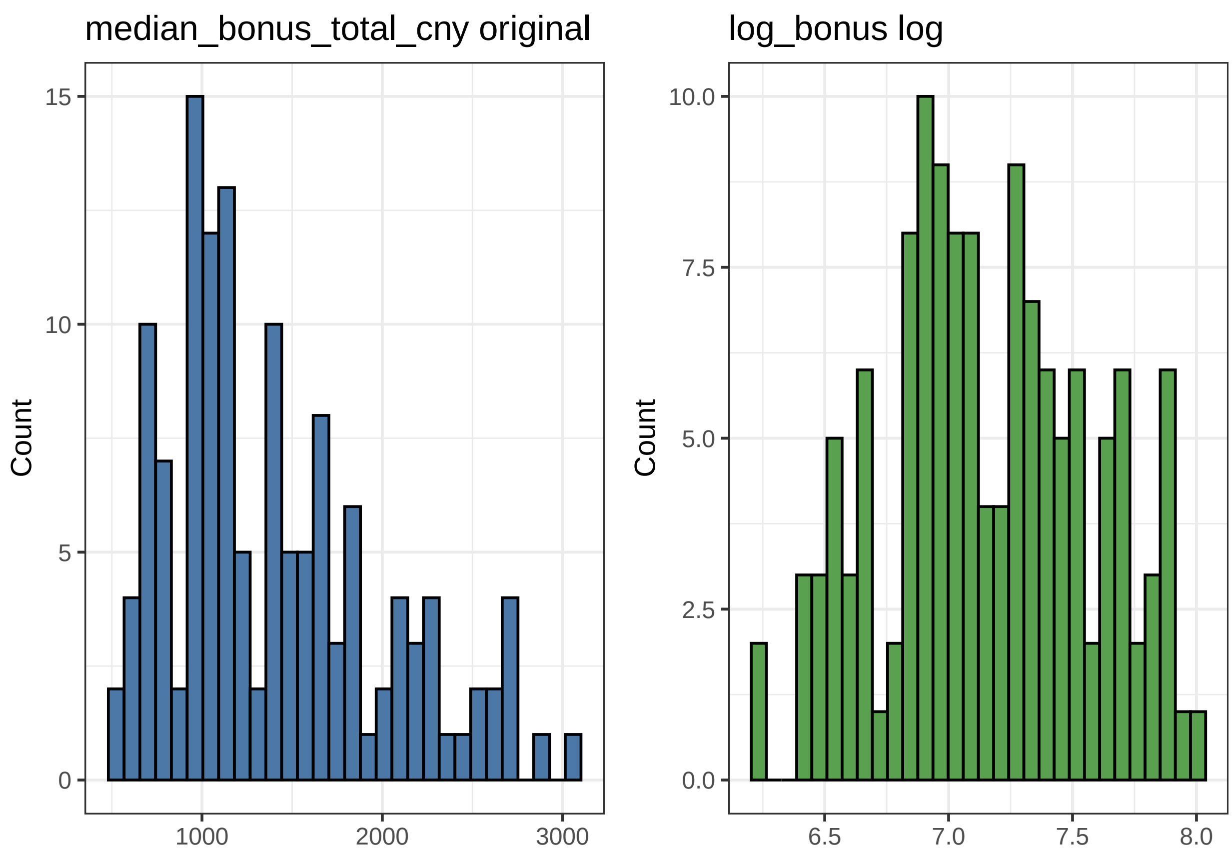
The remaining variables show weaker distortions: age reflects a predominantly young workforce with slight right-skewness, perf is roughly symmetric around the mean, and commute_time_mins displays a broad, multimodal pattern indicating heterogeneous commuting distances.

Log-Transformations

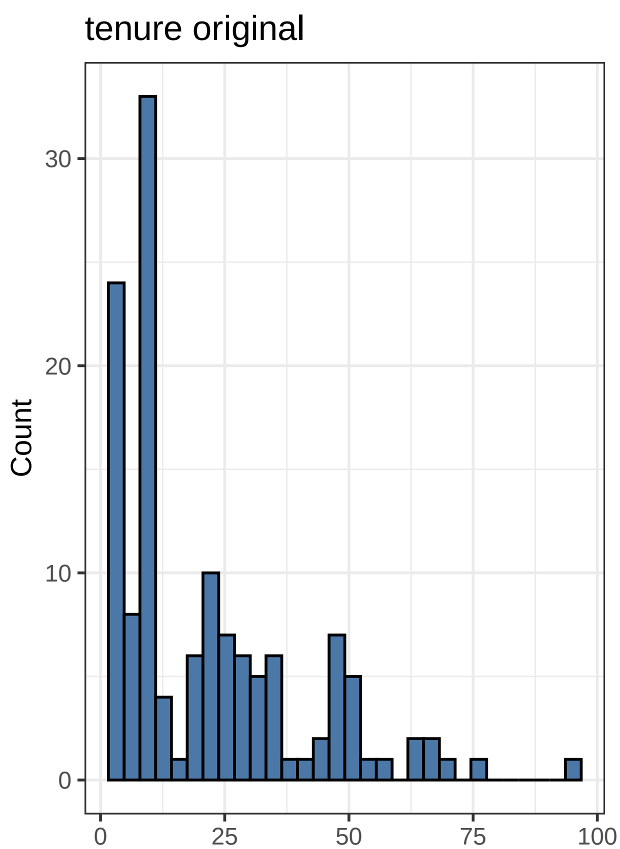
```r
# Create log-transformed versions of wage, bonus, and tenure
final_all <- final_all %>%
  mutate(
    # Lohn (brutto)
    log_wage = if_else(
      median_gross_wage_cny > 0,
      log(median_gross_wage_cny),
      NA_real_
    ),
    # Bonus (0 möglich, daher +1)
    log_bonus = if_else(
      median_bonus_total_cny >= 0,
      log(median_bonus_total_cny + 1),
      NA_real_
    ),
    # Tenure in Monaten/Jahren (wie in deinem Datensatz)
    log_tenure = if_else(
      tenure > 0,
      log(tenure),
      NA_real_
    )
  )
```

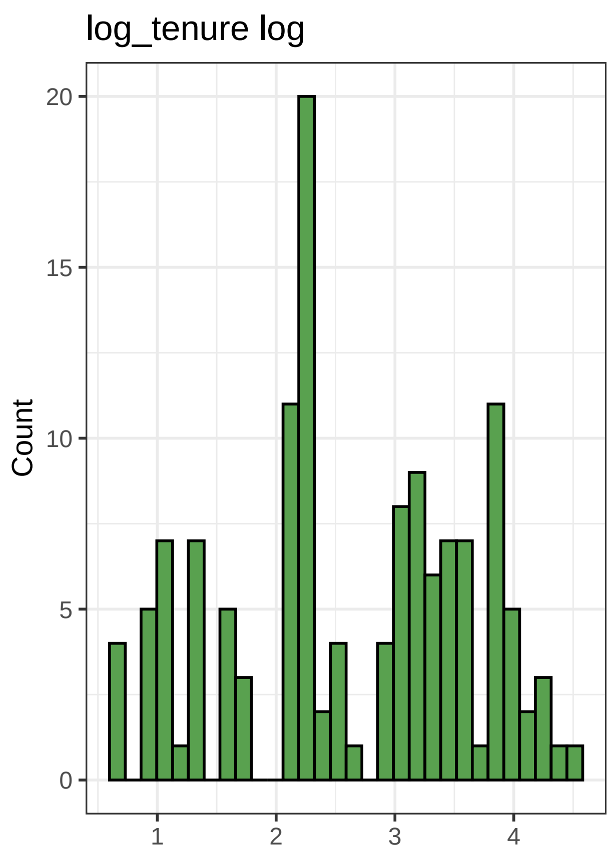
```r
# Function to plot original vs. log-transformed distributions
plot_log_compare <- function(df, var, logvar) {
  p1 <- ggplot(df, aes(x = .data[[var]])) +
    geom_histogram(bins = 30, fill = "#4C78A8", color = "black") +
    theme_bw() +
    labs(title = paste(var, "original"), x = NULL, y = "Count")

  p2 <- ggplot(df, aes(x = .data[[logvar]])) +
    geom_histogram(bins = 30, fill = "#59A14F", color = "black") +
    theme_bw() +
    labs(title = paste(logvar, "log"), x = NULL, y = "Count")

  gridExtra::grid.arrange(p1, p2, ncol = 2)
}

plot_log_compare(final_all, "median_gross_wage_cny", "log_wage")
```


```
plot_log_compare(final_all, "median_bonus_total_cny", "log_bonus")
```



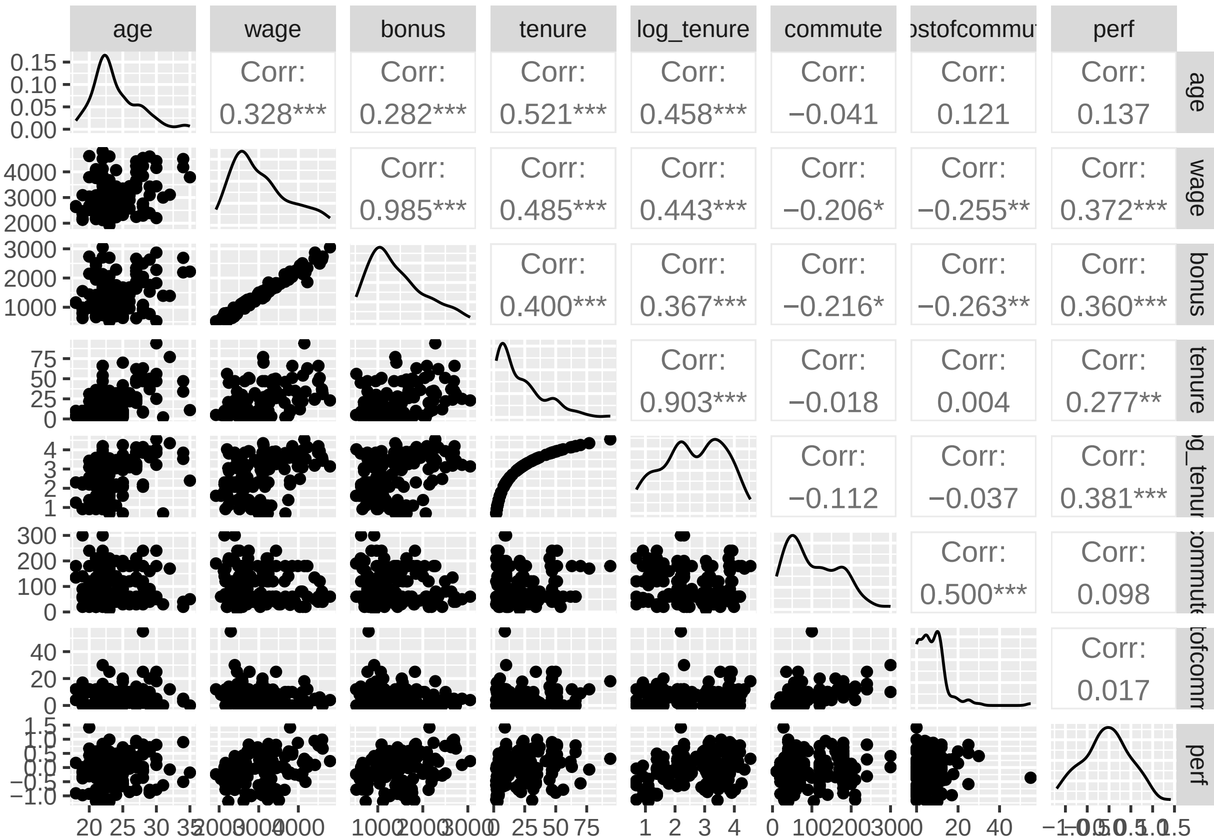

```
plot_log_compare(final_all, "tenure",        "log_tenure")
```





The visual comparison between the original and log-transformed distributions confirms that the logarithmic transformation substantially improves the statistical properties of `bonus`, `wage`, and `tenure`. In the original histograms, all three variables display heavy right tails, dense clustering at lower values, and a small number of large observations that distort the overall distribution. After applying the log transformation, these variables become considerably more symmetric, with reduced tail length and a more even spread of observations across the range. This transformation therefore mitigates the influence of extreme values, brings the distributions closer to normality, and enhances the suitability of these variables for linear modeling and inferential procedures that rely on homoscedasticity and approximate normality.

```
GGally::ggpairs(
  final_all %>%
    transmute(
      age,
      wage            = median_gross_wage_cny,
      bonus           = median_bonus_total_cny,
      tenure,
      log_tenure,
      commute,
      costofcommute,
      perf            = mean_overall_perf_z_score
    )
)
```



Displays frequency tables with percentages for key categorical variables in `final_all`, including `gender`, `marital_status`, `children_indicator`, and `higher_edu_indicator`.

Categorical Distributions

```
final_all %>% tabyl(gender)             %>% adorn_pct_formatting()
```

```
##  gender  n percent
##  Female 67   49.6%
##    Male 68   50.4%
```

```
final_all %>% tabyl(married)            %>% adorn_pct_formatting()
```

```
##  married   n percent
##        0 106   78.5%
##        1  29   21.5%
```

```
final_all %>% tabyl(children_indicator) %>% adorn_pct_formatting()
```

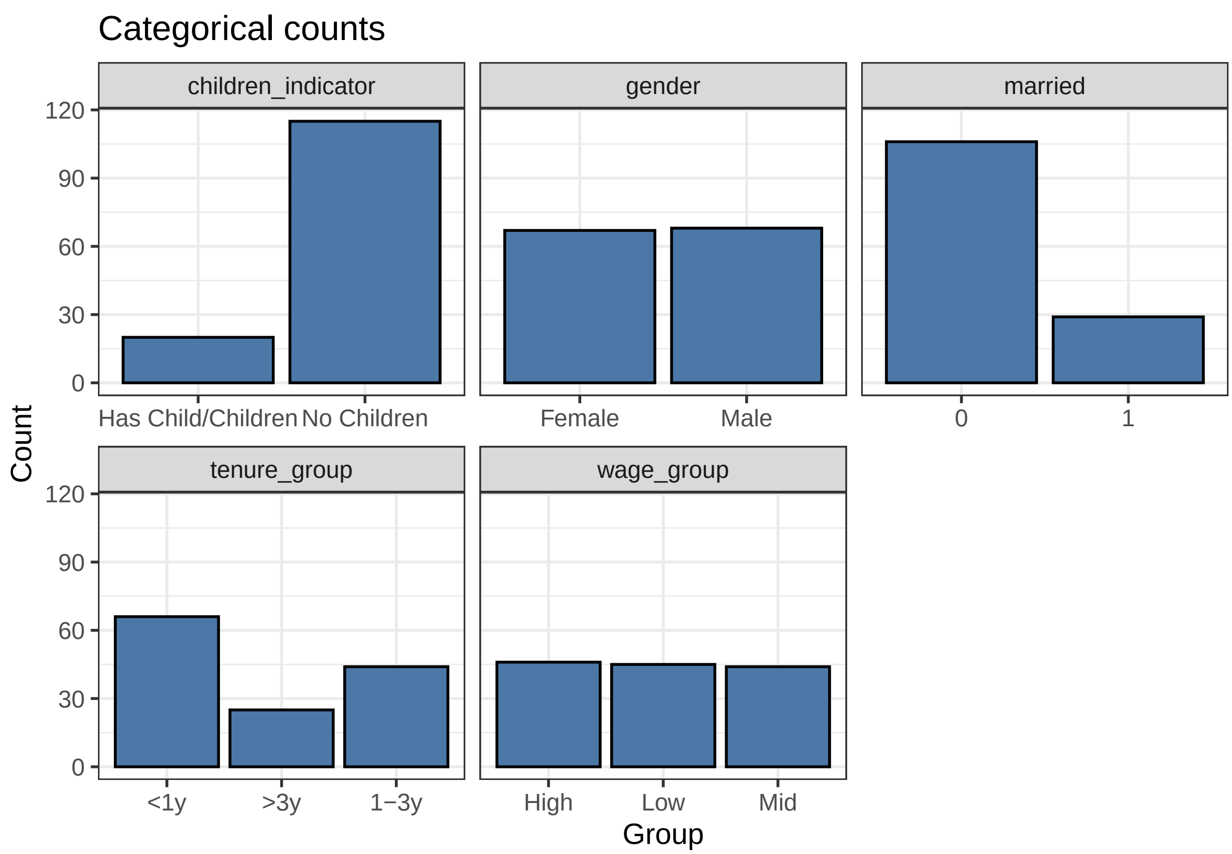
```
##  children_indicator   n percent
##         No Children 115   85.2%
##  Has Child/Children  20   14.8%
```

```r
final_all %>% tabyl(higher_edu_indicator) %>% adorn_pct_formatting()
```

```
##  higher_edu_indicator  n percent
##             No Degree 79   58.5%
##            Has Degree 56   41.5%
```

Creates temporary grouping variables (`tenure_group`, `wage_group`) within `final_all` and visualizes categorical counts across `gender`, `marital_status`, `children_indicator`, tenure groups, and wage groups using faceted bar plots.

```r
#Add temporary groups inside the pipe for plotting
final_all %>%
  mutate(
    tenure_group = cut(
      tenure,
      breaks = c(-Inf, 12, 36, Inf),
      labels = c("<1y", "1-3y", ">3y")
    ),
    wage_group = cut(
      median_gross_wage_cny,
      breaks = quantile(
        median_gross_wage_cny,
        probs = c(0, .33, .66, 1),
        na.rm = TRUE
      ),
      include.lowest = TRUE,
      labels = c("Low", "Mid", "High")
    )
  ) %>%
  dplyr::select(gender, married, children_indicator,
         tenure_group, wage_group) %>%
  mutate(across(everything(), as.character)) %>%   # ← diese Zeile neu
  pivot_longer(
    cols      = everything(),
    names_to  = "category",
    values_to = "group"
  ) %>%
  ggplot(aes(x = group)) +
  geom_bar(fill = "#4C78A8", color = "black") +
  facet_wrap(~ category, scales = "free_x") +
  theme_bw() +
  labs(
    title = "Categorical counts",
    x = "Group",
    y = "Count"
  )
```

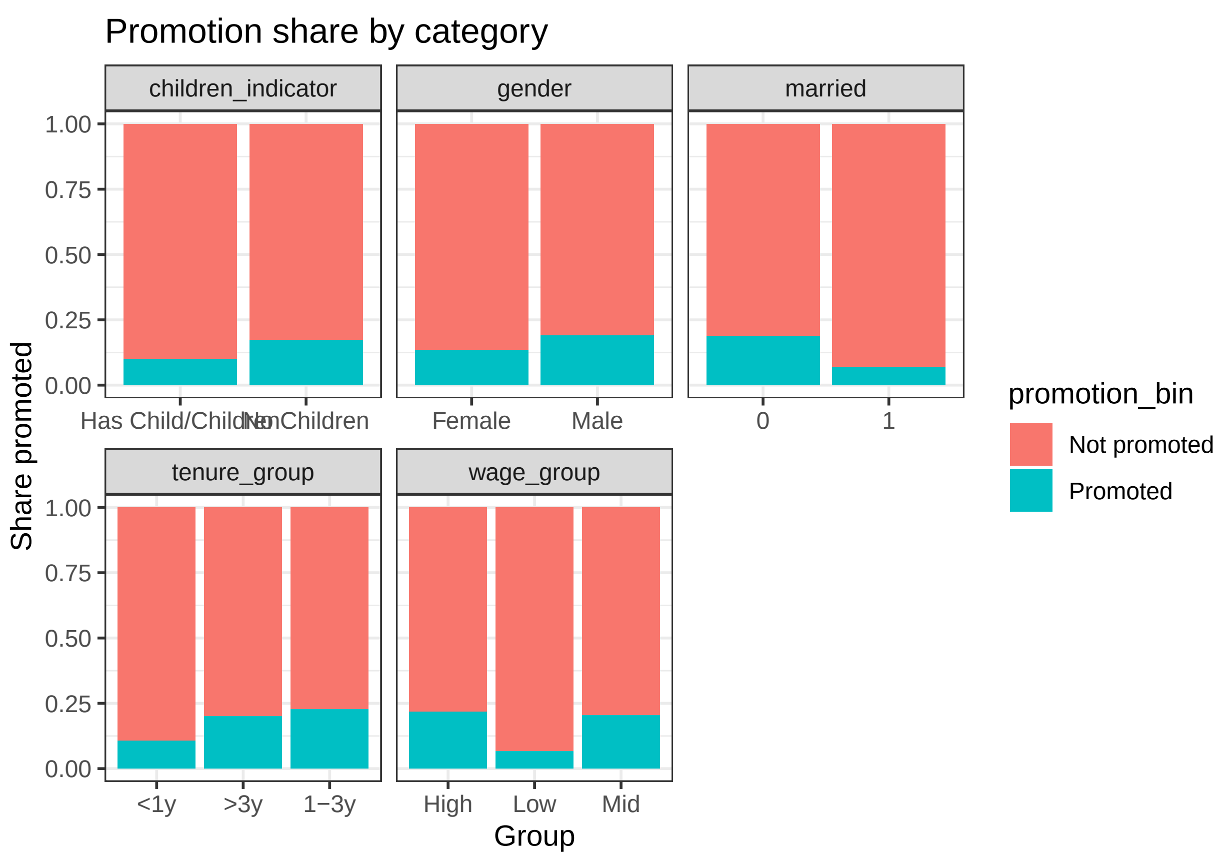


Now we create a binary `promotion` indicator and grouped predictors, and examine how `promotion` rates differ across demographic and job-related categories.

Exploratory Promotion Analysis

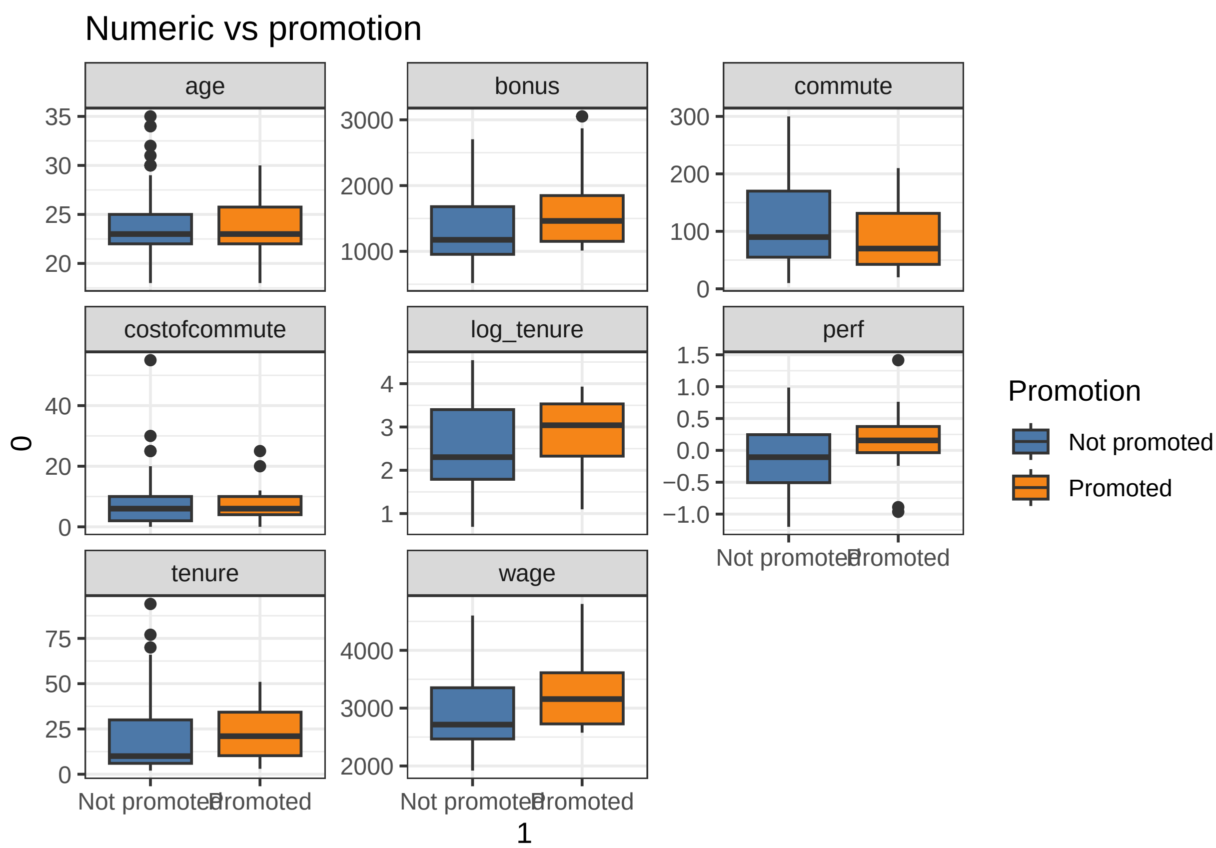
```
## Promotion by categories (wirklich nach Promotion unterschieden)
final_all %>%
  mutate(
    promotion_bin = if_else(
      promote_switch == 1, "Promoted", "Not promoted"
    ),
    tenure_group = cut(
      tenure,
      breaks = c(-Inf, 12, 36, Inf),
      labels = c("<1y", "1-3y", ">3y")
    ),
    wage_group = cut(
      median_gross_wage_cny,
      breaks = quantile(
        median_gross_wage_cny,
        probs = c(0, .33, .66, 1),
        na.rm = TRUE
      ),
      include.lowest = TRUE,
```

```r
    labels = c("Low", "Mid", "High")
  )
) %>%
dplyr::select(promotion_bin, gender, married,
       children_indicator, tenure_group, wage_group) %>%
mutate(across(-promotion_bin, as.character)) %>%
pivot_longer(
  cols      = -promotion_bin,
  names_to  = "category",
  values_to = "group"
) %>%
ggplot(aes(x = group, fill = promotion_bin)) +
geom_bar(position = "fill") +
facet_wrap(~ category, scales = "free_x") +
theme_bw() +
labs(
  title = "Promotion share by category",
  x = "Group",
  y = "Share promoted"
)
```



Compares numeric variables with promotion outcomes by creating `promotion_bin` and visualizing group differences using boxplots across key predictors.

```r
#Numeric vs promotion (boxplots)
final_all %>%
  mutate(
    promotion_bin = if_else(
      promote_switch == 1,
      "Promoted",
      "Not promoted"
    ),
    promotion_bin = factor(promotion_bin,
                           levels = c("Not promoted", "Promoted"))
  ) %>%
  transmute(
    promotion_bin,
    age,
    wage          = median_gross_wage_cny,
    bonus         = median_bonus_total_cny,
    tenure,
    log_tenure,
    commute,
    costofcommute,
    perf          = mean_overall_perf_z_score
  ) %>%
  pivot_longer(
    cols      = -promotion_bin,
    names_to  = "var",
    values_to = "value"
  ) %>%
  ggplot(aes(x = promotion_bin, y = value, fill = promotion_bin)) +
  geom_boxplot() +
  scale_fill_manual(
    values = c("Not promoted" = "#4C78A8",
               "Promoted"     = "#F58518"),
    name   = "Promotion"
  ) +
  facet_wrap(~ var, scales = "free_y") +
  theme_bw() +
  labs(
    title = "Numeric vs promotion",
    x = "1",
    y = "0"
  )
```

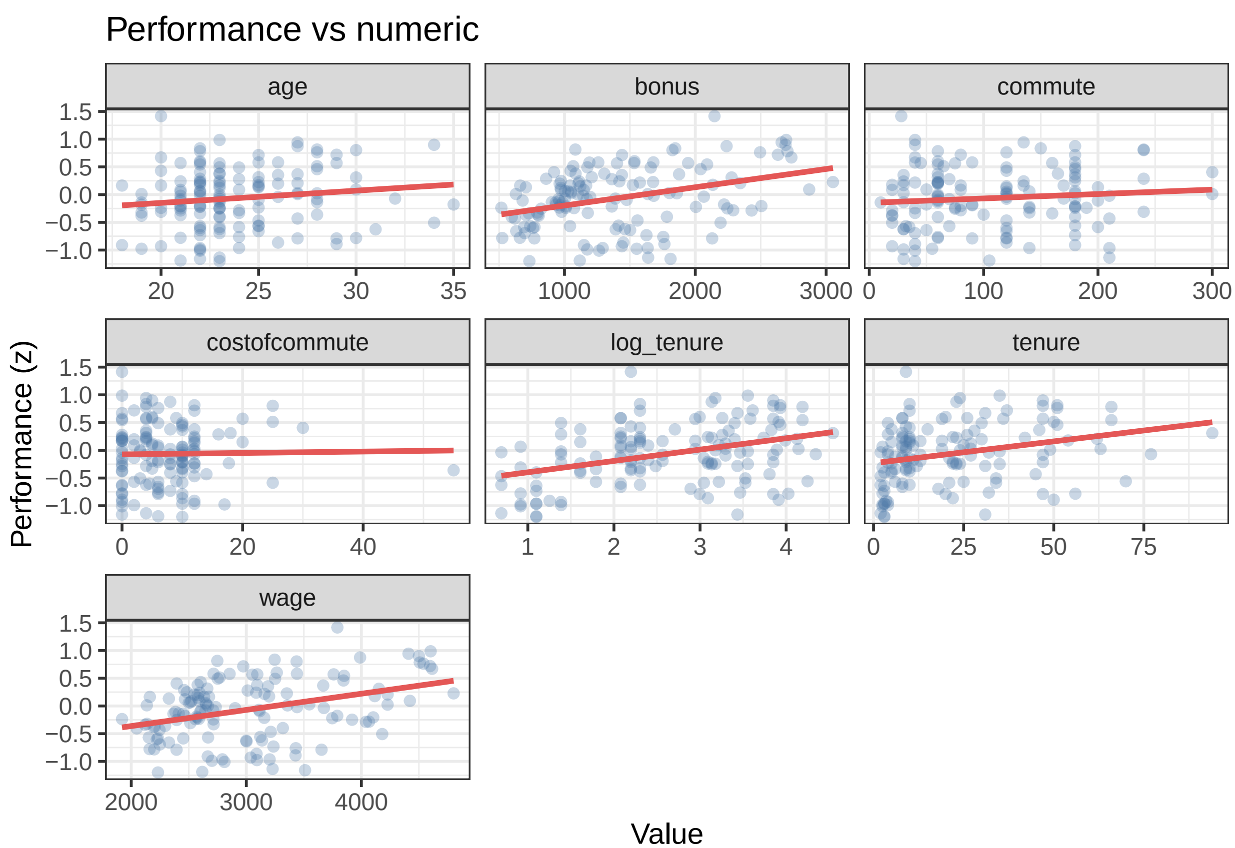


Exploratory Performance Analysis

```
#Numeric vs performance
final_all %>%
  transmute(
    perf          = mean_overall_perf_z_score,
    age,
    tenure,
    wage          = median_gross_wage_cny,
    bonus         = median_bonus_total_cny,
    commute,
    costofcommute,
    log_tenure
  ) %>%
  pivot_longer(
    cols      = -perf,
    names_to  = "var",
    values_to = "value"
  ) %>%
  ggplot(aes(x = value, y = perf)) +
  geom_point(alpha = 0.3, color = "#4C78A8") +
  geom_smooth(method = "lm", se = FALSE, color = "#E45756") +
  facet_wrap(~ var, scales = "free_x") +
  theme_bw() +
```

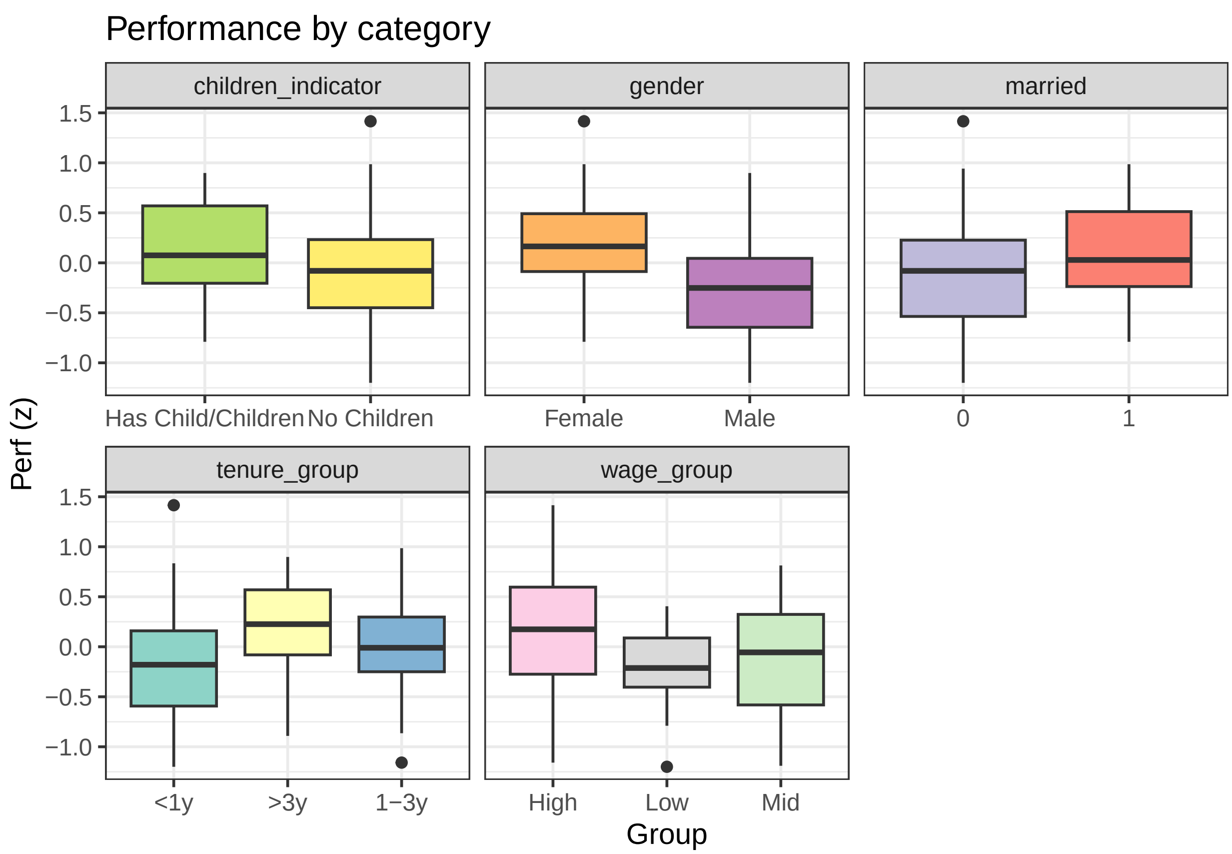
```
  labs(
    title = "Performance vs numeric",
    x = "Value",
    y = "Performance (z)"
  )
```

```
## `geom_smooth()` using formula = 'y ~ x'
```




```
#Performance by categories
final_all %>%
  mutate(
    tenure_group = cut(
      tenure,
      breaks = c(-Inf, 12, 36, Inf),
      labels = c("<1y", "1-3y", ">3y")
    ),
    wage_group = cut(
      median_gross_wage_cny,
      breaks = quantile(
        median_gross_wage_cny,
        probs = c(0, .33, .66, 1),
        na.rm = TRUE
      ),
      include.lowest = TRUE,
      labels = c("Low", "Mid", "High")
```

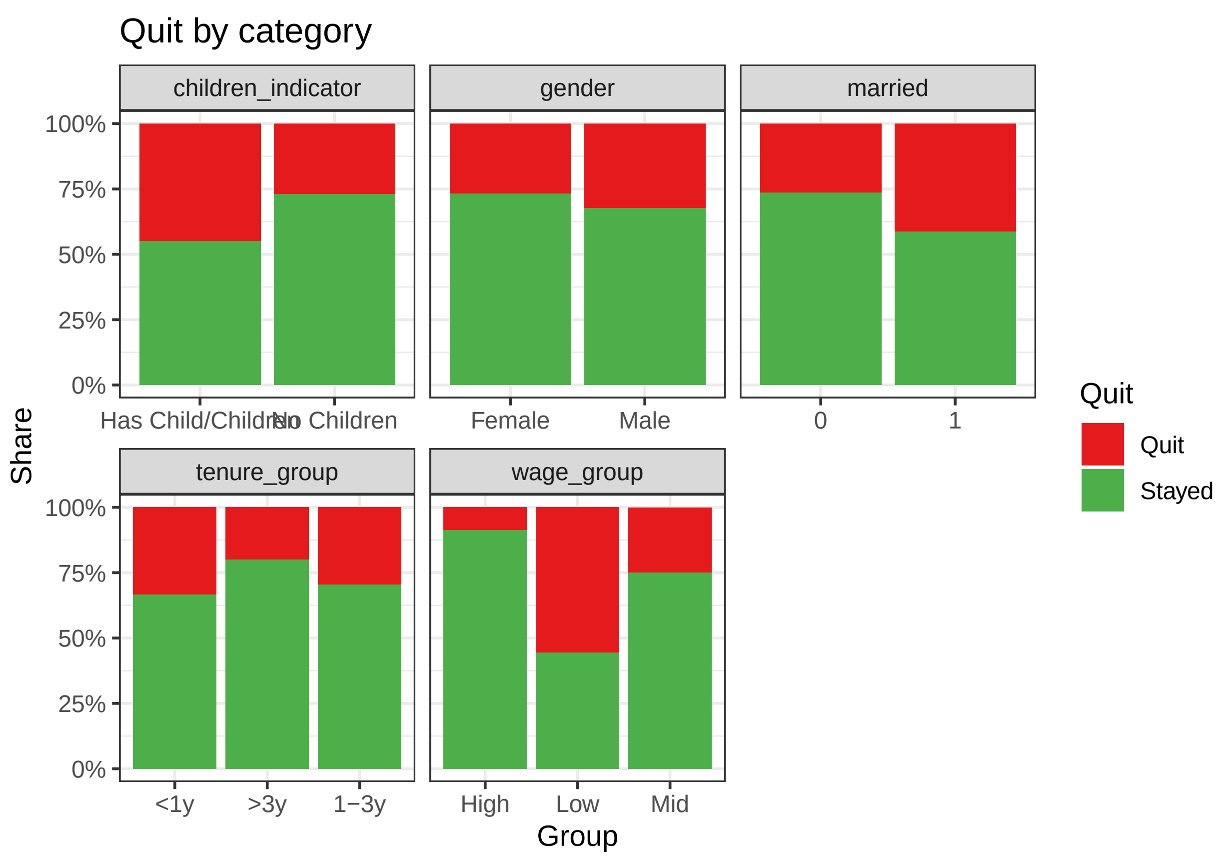
```
  )
) %>%
transmute(
  perf          = mean_overall_perf_z_score,
  gender,
  married,
  children_indicator,
  tenure_group,
  wage_group
) %>%
mutate(across(-perf, as.character)) %>%   # ← alle Gruppen-Variablen auf gleichen Typ
pivot_longer(
  cols      = -perf,
  names_to  = "category",
  values_to = "group"
) %>%
ggplot(aes(x = group, y = perf, fill = group)) +
geom_boxplot() +
scale_fill_brewer(palette = "Set3") +
facet_wrap(~ category, scales = "free_x") +
theme_bw() +
labs(
  title = "Performance by category",
  x = "Group",
  y = "Perf (z)"
) +
guides(fill = "none")
```



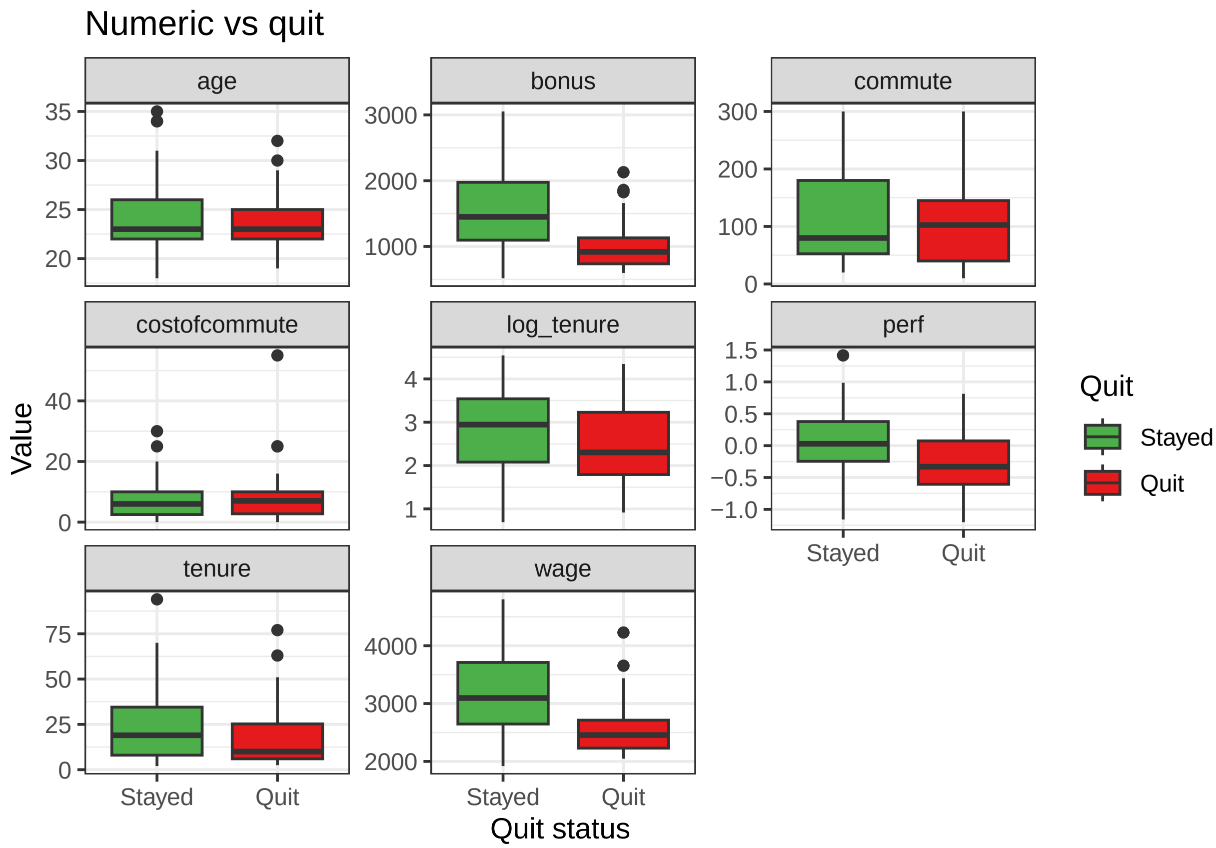
Exploratory Attrition Analysis

```
#Quit by categories
final_all %>%
  mutate(
    # quitjob ist 0/1 → 1 = Quit, 0 = Stayed (anpassbar falls anders)
    quit_bin = if_else(quitjob == 1, "Quit", "Stayed"),

    tenure_group = cut(
      tenure,
      breaks = c(-Inf, 12, 36, Inf),
      labels = c("<1y", "1-3y", ">3y")
    ),
    wage_group = cut(
      median_gross_wage_cny,
      breaks = quantile(
        median_gross_wage_cny,
        probs = c(0, .33, .66, 1),
        na.rm = TRUE
      ),
      include.lowest = TRUE,
      labels = c("Low", "Mid", "High")
    )
  ) %>%
```

```r
dplyr::select(quit_bin, gender, married,
       children_indicator, tenure_group, wage_group) %>%
mutate(across(-quit_bin, as.character)) %>%   # Typen angleichen für pivot_longer
pivot_longer(
  cols      = -quit_bin,
  names_to  = "category",
  values_to = "group"
) %>%
ggplot(aes(x = group, fill = quit_bin)) +
geom_bar(position = "fill") +
scale_y_continuous(labels = percent_format()) +
scale_fill_manual(
  values = c("Stayed" = "#4DAF4A",
             "Quit"   = "#E41A1C"),
  name   = "Quit"
) +
facet_wrap(~ category, scales = "free_x") +
theme_bw() +
labs(
  title = "Quit by category",
  x = "Group",
  y = "Share"
)
```



```r
#Numeric vs quit (boxplots)
final_all %>%
  mutate(
    # quitjob ist 0/1 → 1 = Quit, 0 = Stayed
    quit_bin = if_else(quitjob == 1, "Quit", "Stayed"),
    quit_bin = factor(quit_bin, levels = c("Stayed", "Quit"))
  ) %>%
  transmute(
    quit_bin,
    age,
    wage          = median_gross_wage_cny,
    bonus         = median_bonus_total_cny,
    tenure,                  # statt tenure_in_months
    log_tenure,
    commute,                 # statt commute_time_mins
    costofcommute,
    perf          = mean_overall_perf_z_score
  ) %>%
  pivot_longer(
    cols      = -quit_bin,
    names_to  = "var",
    values_to = "value"
  ) %>%
  ggplot(aes(x = quit_bin, y = value, fill = quit_bin)) +
  geom_boxplot() +
  scale_fill_manual(
    values = c("Stayed" = "#4DAF4A",
               "Quit"   = "#E41A1C"),
    name   = "Quit"
  ) +
  facet_wrap(~ var, scales = "free_y") +
  theme_bw() +
  labs(
    title = "Numeric vs quit",
    x = "Quit status",
    y = "Value"
  )
```




```r
rm(list = setdiff(ls(), c("final_all", "final_panel_weekly")))
```

Regression Analysis

After completing the exploratory data analysis and gaining an initial understanding of variable distributions, relationships, and group differences, the next step is to estimate statistical models that formally quantify these associations. Depending on the type of dependent variable, different regression methods are appropriate:

Choose the appropriate regression method:
– **Linear (OLS)** for continuous outcomes such as 'mean_overall_perf_z_score'
– **LPM**, **Logit**, or **Probit** for binary outcomes such as 'promote_switch' or 'quit_job'

The following section presents the regression specifications and the corresponding R code used in the analysis.

Below you find a **short descriptive summary** followed by the corresponding regression models and R code, presented in the exact sequence used during the analysis. This section provides a structured overview of the model-building process and outlines the key steps taken before selecting the preferred specifications.

Regression Analysis for Performance

1. **Specified outcome variables** for the regression analysis, distinguishing between continuous outcomes and binary outcomes such as 'promotion' or 'quit'.

2. **Grouped independent variables logically** into demographic, work arrangement, work intensity, salary/commute, and well-being categories.

3. **Checked multicollinearity** among numerical predictors using correlation matrices and VIF values.

4. **Estimated baseline models** (e.g., using only 'pct_remote_weeks') to establish initial effect directions.

5. **Extended models step-by-step** by adding demographic factors, wage variables, well-being indicators, and commute measures.

6. **Compared model fit and significance** using R^2, adjusted R^2, F-tests, and coefficient significance levels.

7. **Evaluated functional form choices** such as level vs. log transformations for variables including 'tenure' and 'bonus'.

8. **Assessed model diagnostics** through heteroscedasticity tests (BP test) and multicollinearity checks (VIF).

9. **Selected preferred specifications** based on explanatory power, theory consistency, and interpretability of effects.

Model Setup and Correlation Check

```r
# Checking collinearity among numerical independent variables (brief overview)
num_vars <- final_all |>
  dplyr::select(mean_overall_perf_z_score, age, tenure, commute, costofcommute,
                weeks_observed, remote_weeks, on_site_weeks,
                pct_remote_weeks, pct_on_site_weeks,
                total_calls, mean_log_phone_calls,
                median_gross_wage_cny, median_bonus_total_cny,mean_log_days_worked)

# Correlation Matrix
num_vars %>%
  correlate(use = "pairwise.complete.obs") %>%
  fashion()
```

```
## Correlation computed with
## * Method: 'pearson'
## * Missing treated using: 'pairwise.complete.obs'

##                         term mean_overall_perf_z_score  age tenure commute
## 1  mean_overall_perf_z_score                            .14    .28     .10
## 2                        age                       .14         .52    -.04
## 3                     tenure                       .28  .52           -.02
## 4                    commute                       .10 -.04   -.02
## 5              costofcommute                       .02  .12    .00     .50
## 6             weeks_observed                       .46 -.03    .10    -.13
## 7               remote_weeks                       .21  .16    .04    -.18
## 8              on_site_weeks                       .18 -.18    .04     .07
## 9           pct_remote_weeks                       .16  .16    .02    -.18
```

```
## 10         pct_on_site_weeks                      -.16 -.16   -.02      .18
## 11               total_calls                       .80  .02    .19     -.06
## 12      mean_log_phone_calls                       .86  .05    .21      .10
## 13     median_gross_wage_cny                       .37  .33    .49     -.21
## 14    median_bonus_total_cny                       .36  .28    .40     -.22
## 15      mean_log_days_worked                       .04 -.12   -.19     -.12
##    costofcommute weeks_observed remote_weeks on_site_weeks pct_remote_weeks
## 1            .02            .46          .21           .18              .16
## 2            .12           -.03          .16          -.18              .16
## 3            .00            .10          .04           .04              .02
## 4            .50           -.13         -.18           .07             -.18
## 5                          -.08          .02          -.09              .03
## 6           -.08                         .40           .45              .32
## 7            .02            .40                       -.64              .99
## 8           -.09            .45         -.64                           -.69
## 9            .03            .32          .99          -.69                 
## 10          -.03           -.32         -.99           .69            -1.00
## 11          -.07            .85          .35           .37              .28
## 12          -.05            .39          .10           .23              .05
## 13          -.25            .42          .25           .10              .22
## 14          -.26            .43          .25           .11              .22
## 15          -.18            .44          .31           .07              .29
##    pct_on_site_weeks total_calls mean_log_phone_calls median_gross_wage_cny
## 1               -.16         .80                  .86                   .37
## 2               -.16         .02                  .05                   .33
## 3               -.02         .19                  .21                   .49
## 4                .18        -.06                  .10                  -.21
## 5               -.03        -.07                 -.05                  -.25
## 6               -.32         .85                  .39                   .42
## 7               -.99         .35                  .10                   .25
## 8                .69         .37                  .23                   .10
## 9              -1.00         .28                  .05                   .22
## 10                          -.28                 -.05                  -.22
## 11              -.28                              .70                   .48
## 12              -.05         .70                                        .33
## 13              -.22         .48                  .33                      
## 14              -.22         .49                  .33                   .98
## 15              -.29         .42                  .06                   .39
##    median_bonus_total_cny mean_log_days_worked
## 1                     .36                  .04
## 2                     .28                 -.12
## 3                     .40                 -.19
## 4                    -.22                 -.12
## 5                    -.26                 -.18
## 6                     .43                  .44
## 7                     .25                  .31
## 8                     .11                  .07
## 9                     .22                  .29
## 10                   -.22                 -.29
## 11                    .49                  .42
## 12                    .33                  .06
## 13                    .98                  .39
## 14                                         .45
## 15                    .45                     
```

based on the correlations in our correlation table we start building or models first we do it by group

to iteratively add more variables and see how the model improves we first group our variables by different categories. After that the variables will be added step by step to see how the model improves. Of course it will be checked for multicollinearity.

Groups of Independent Variables:

- Demographics: age, gender, married, children, high_educ, months_observed, tenure, commute

- Work Arrangement: remote_weeks, pct_remote_weeks, on_site_weeks, pct_on_site_weeks

- Work Intensity: total_calls, mean_log_phone_calls, mean_log_calls_per_second, mean_log_average_call_lenght, mean_log_calls_per_day_worked, mean_log_days_worked

- Salary and Commute: promote_switch, quitjob, median_base_wage_cny, median_gross_wage_cny, median_bonus_total_cny, cost_of_commute_cny, commute_time_mins

- Well-being: exhaustion, negative, positive, bedroom_indicator

we will state beforehand that the well-being variables will be from no use for us **(except bedroom_indicator)** in this analysis as they reduce our sample size by half.

Baseline Model (Remote Work Only)

```
m0 <- lm(mean_overall_perf_z_score ~
           pct_remote_weeks,
         data = final_all)

#Work arrangement:
suppressWarnings(
  stargazer(m0,
           type = "text",
           title = "Regression Results Model 0",
           dep.var.labels = "Mean Overall Performance Z-Score",
           covariate.labels = c("Remote Work Percentage"),
           out = "regression_results_model_0.txt",
           no.space = TRUE)
)
```

```
##
## Regression Results Model 0
## =======================================================
##                              Dependent variable:
##                         -------------------------------
##                         Mean Overall Performance Z-Score
## -------------------------------------------------------
## Remote Work Percentage             0.421*
##                                   (0.225)
## Constant                          -0.142**
##                                   (0.062)
## -------------------------------------------------------
## Observations                        135
## R2                                 0.026
```

```
## Adjusted R2                         0.018
## Residual Std. Error            0.535 (df = 133)
## F Statistic                  3.512* (df = 1; 133)
## ==========================================================
## Note:                        *p<0.1; **p<0.05; ***p<0.01
```

```r
 # Breusch-Pagan test for heteroscedasticity
bptest(m0)
```

```
##
##  studentized Breusch-Pagan test
##
## data:  m0
## BP = 0.75419, df = 1, p-value = 0.3852
```

There is no heteroscedasticity present

We cannot check for multicollinearity with VIF here as there is only one independent variable.

With 10% CI the pct_remote_weeks is stat. significant. With an increase of 10 percentage points in remote work percentage, the mean overall performance z-score increases by 0.42 Very low R squared the model doesn't explain much of the variability of the mean overall performance z-score

So let's add a few demographic variables to see if we can improve the model

Adding Demographics and Job Characteristics

```r
#m0 + Demographic & Job Characteristics:
m1 <- lm(mean_overall_perf_z_score ~
           pct_remote_weeks +
           gender +
           log(tenure),
         data = final_all)

suppressWarnings(
  stargazer(m1,
            type = "text",
            title = "Regression Results Model 1",
            dep.var.labels = "Mean Overall Performance Z-Score",
            covariate.labels = c("remote work percentage",
                                 "gender (male=1)",
                                 "log(tenure)"),
            out = "regression_results_model_1.txt",
            no.space = TRUE)
)
```

```
##
## Regression Results Model 1
## ==========================================================
##                                  Dependent variable:
##                            --------------------------------
##                            Mean Overall Performance Z-Score
```

```
## ---------------------------------------------------------
## remote work percentage             0.474**
##                                    (0.195)
## gender (male=1)                   -0.362***
##                                    (0.083)
## log(tenure)                        0.158***
##                                    (0.041)
## Constant                          -0.385***
##                                    (0.136)
## ---------------------------------------------------------
## Observations                         135
## R2                                  0.277
## Adjusted R2                         0.261
## Residual Std. Error             0.464 (df = 131)
## F Statistic                 16.752*** (df = 3; 131)
## =========================================================
## Note:                        *p<0.1; **p<0.05; ***p<0.01
```

Assumption-check:

```r
 # Breusch-Pagan test for heteroscedasticity
bptest(m1)
```

```
##
##  studentized Breusch-Pagan test
##
## data:  m1
## BP = 6.398, df = 3, p-value = 0.09377
```

There is no heteroscedasticity present

```r
# Variance Inflation Factor for multicollinearity
vif(m1)
```

```
## pct_remote_weeks           gender      log(tenure)
##         1.002815         1.075554         1.072640
```

There is no multicollinearity present.

By adding the variables gender and log(tenure) the remote work percentage becomes statistically significant at a 5% level. An increase of 10 percentage points in remote work percentage is associated with an increase of 0.474 in the mean overall performance z-score, keeping everything else constant. We also conclude that by adding gender to the regression, being a man decreases the mean overall performance z-score by 0.362 compared to being a woman, with a confidence of 99%, ceteris paribus. Finally, we see that an increase in tenure of 1% would increase by 0.00158 the mean overall performance z-score, ceteris paribus. The R2 and adjusted R2 also increases considerably from model 0 to model 1, indicating a better fit of the model. Model 1 justifies around 26.1% of the variability of the mean overall performance z-score. F statistic is also stat. significant at 1% level, indicating that at least one of the independent variables is stat. significant in explaining the variability of the dependent variable.

```r
#m0 + Demographic + (tenure without logs)
m1_1 <- lm(mean_overall_perf_z_score ~
```

```r
          pct_remote_weeks +
          gender +
          tenure,
        data= final_all)

suppressWarnings(
  stargazer(m1_1,
            type = "text",
            title = "Regression Results Model 1 (Tenure without log)",
            dep.var.labels = "Mean Overall Performance Z-Score",
            covariate.labels = c("remote work percentage",
                                 "gender (male=1)",
                                 "tenure"),
            out = "regression_results_model_1_without_log.txt",
            no.space = TRUE)
)
```

```
##
## Regression Results Model 1 (Tenure without log)
## =======================================================
##                              Dependent variable:
##                        --------------------------------
##                        Mean Overall Performance Z-Score
## -------------------------------------------------------
## remote work percentage             0.463**
##                                    (0.202)
## gender (male=1)                   -0.394***
##                                    (0.086)
## tenure                             0.005**
##                                    (0.002)
## Constant                            -0.060
##                                    (0.090)
## -------------------------------------------------------
## Observations                         135
## R2                                  0.226
## Adjusted R2                         0.209
## Residual Std. Error            0.480 (df = 131)
## F Statistic                12.776*** (df = 3; 131)
## =======================================================
## Note:                       *p<0.1; **p<0.05; ***p<0.01
```

Assumption-check:

```r
# Breusch-Pagan test for heteroscedasticity
bptest(m1_1)
```

```
##
##  studentized Breusch-Pagan test
##
## data:  m1_1
## BP = 5.9013, df = 3, p-value = 0.1165
```

There is no heteroscedasticity present

```r
# Variance Inflation Factor for multicollinearity
vif(m1_1)
```

```
## pct_remote_weeks           gender           tenure
##         1.003905         1.073801         1.071207
```

There is no multicollinearity present.

We did this regressions without logs on the independent variable tenure because level-log models are extremely rare in the literature as well as the beta1 was higher for the regression for the model with tenure in levels. However, when we replace log(tenure) with tenure in levels, the coefficient becomes numerically larger (0.005 vs 0.0016), but this comparison is misleading because the units differ. In the level–log model, 0.0016 is the effect of a 1% increase in tenure, whereas 0.005 is the effect of a 1-unit increase in tenure. The model with log(tenure) has a higher adjusted R^2 and lower residual standard error, and it captures diminishing returns to tenure, which is theoretically reasonable. Therefore, we prefer the specification with log(tenure).

```r
#m1 + Wage and well being commute:


m2 <- lm(mean_overall_perf_z_score ~
           pct_remote_weeks +
           gender +
           log(tenure) +
           bedroom_indicator +
           promote_switch,
         data = final_all)

suppressWarnings(
  stargazer(m2,
            type = "text",
            title = "Regression Results Model 2",
            dep.var.labels = "Mean Overall Performance Z-Score",
            covariate.labels = c("remote work percentage",
                                 "gender (male=1)",
                                 "log(tenure)",
                                 "bedroom (has own=1)",
                                 "promotion status (promoted=1)"),
            out = "regression_results_model_2.txt",
            no.space = TRUE)
)
```

```
##
## Regression Results Model 2
## ================================================================
##                                      Dependent variable:
##                                ---------------------------------
##                                Mean Overall Performance Z-Score
## ----------------------------------------------------------------
## remote work percentage                     0.495**
##                                            (0.193)
## gender (male=1)                           -0.382***
##                                            (0.082)
## log(tenure)                                0.154***
```

```
##                                              (0.042)
## bedroom (has own=1)                           0.332
##                                              (0.275)
## promotion status (promoted=1)                0.226**
##                                              (0.109)
## Constant                                     -0.729**
##                                              (0.323)
## ----------------------------------------------------------------
## Observations                                   135
## R2                                            0.311
## Adjusted R2                                   0.284
## Residual Std. Error                      0.457 (df = 129)
## F Statistic                          11.654*** (df = 5; 129)
## ================================================================
## Note:                                 *p<0.1; **p<0.05; ***p<0.01
```

Assumption-check:

```r
 # Breusch-Pagan test for heteroscedasticity
bptest(m2)
```

```
##
##  studentized Breusch-Pagan test
##
## data:  m2
## BP = 7.6693, df = 5, p-value = 0.1754
```

There is no heteroscedasticity present.

```r
# Variance Inflation Factor for multicollinearity
vif(m2)
```

```
##  pct_remote_weeks            gender       log(tenure) bedroom_indicator
##          1.006445          1.091508          1.162332          1.063217
##    promote_switch
##          1.046492
```

There is no multicollinearity present.

The adj. R2 of the model increased from 0.261 to 0.284, indicating a better fit of the model, due to promotion status being stat. significant and being added to the model. F statistic is also stat. significant at 1% level, indicating that at least one of the independent variables is stat. significant in explaining the variability of the dependent variable.

Adding Wage, Commute, and Choosing Preferred Specification

```r
#m2 + Well being + Wage and commute:

m3_1 <- lm(mean_overall_perf_z_score ~
             pct_remote_weeks +
             gender +
```

```r
             log_tenure +
             bedroom_indicator +
             promote_switch +
             commute +
             log(median_gross_wage_cny),
           data = final_all)

summary(m3_1)
```

```
##
## Call:
## lm(formula = mean_overall_perf_z_score ~ pct_remote_weeks + gender +
##     log_tenure + bedroom_indicator + promote_switch + commute +
##     log(median_gross_wage_cny), data = final_all)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.04784 -0.25847  0.02245  0.26450  1.02552
##
## Coefficients:
##                                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)                     -6.0314840  1.6416599  -3.674 0.000351 ***
## pct_remote_weeks                 0.4127115  0.1925680   2.143 0.034004 *
## genderMale                      -0.3752290  0.0798992  -4.696 6.77e-06 ***
## log_tenure                       0.1085336  0.0446083   2.433 0.016365 *
## bedroom_indicatorHas Own Bedroom  0.4176988  0.2647864   1.577 0.117170
## promote_switch                   0.1820333  0.1056556   1.723 0.087342 .
## commute                          0.0012901  0.0005909   2.183 0.030854 *
## log(median_gross_wage_cny)       0.6534883  0.2046973   3.192 0.001778 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4374 on 127 degrees of freedom
## Multiple R-squared:  0.3775, Adjusted R-squared:  0.3432
## F-statistic:    11 on 7 and 127 DF,  p-value: 8.178e-11
```

```r
suppressWarnings(
  stargazer(m3_1,
            type = "text",
            title = "Regression Results Model 3",
            dep.var.labels = "Mean Overall Performance Z-Score",
            covariate.labels = c("remote work percentage",
                                 "gender (male=1)",
                                 "log(tenure)",
                                 "bedroom (has own=1)",
                                 "promotion status (promoted=1)",
                                 "commute time (mins)",
                                 "log median gross wage (CNY)"),
            out = "regression_results_model_3.txt",
            no.space = TRUE)
)
```

```
##
```

```
## Regression Results Model 3
## ================================================================
##                                      Dependent variable:
##                               --------------------------------
##                               Mean Overall Performance Z-Score
## ----------------------------------------------------------------
## remote work percentage                    0.413**
##                                           (0.193)
## gender (male=1)                          -0.375***
##                                           (0.080)
## log(tenure)                               0.109**
##                                           (0.045)
## bedroom (has own=1)                        0.418
##                                           (0.265)
## promotion status (promoted=1)              0.182*
##                                           (0.106)
## commute time (mins)                       0.001**
##                                           (0.001)
## log median gross wage (CNY)               0.653***
##                                           (0.205)
## Constant                                 -6.031***
##                                           (1.642)
## ----------------------------------------------------------------
## Observations                                135
## R2                                         0.378
## Adjusted R2                                0.343
## Residual Std. Error                   0.437 (df = 127)
## F Statistic                       11.003*** (df = 7; 127)
## ================================================================
## Note:                             *p<0.1; **p<0.05; ***p<0.01
```

Assumption-check:

```
# Breusch-Pagan test for heteroscedasticity
bptest(m3_1)
```

```
##
##  studentized Breusch-Pagan test
##
## data:  m3_1
## BP = 8.6135, df = 7, p-value = 0.2816
```

There is no heteroscedasticity present

```
# Variance Inflation Factor for multicollinearity
vif(m3_1)
```

```
##          pct_remote_weeks                     gender
##                  1.097155                   1.126087
##                log_tenure           bedroom_indicator
##                  1.408966                   1.074955
##            promote_switch                    commute
##                  1.074459                   1.094362
```

```
## log(median_gross_wage_cny)
##                   1.394667
```

There is no multicollinearity present.

Regression with median gross wage logged instead of median bonus total wage logged, because of the higher correlation with performance score but we will see that bonus total wage gives a better fit of the model

```r
#m2 + Well being +  Wage and commute:
m3 <- lm(mean_overall_perf_z_score ~
               pct_remote_weeks +
               gender +
               log(tenure) +
               bedroom_indicator +
               promote_switch +
               commute +
               median_bonus_total_cny,
             data = final_all)

summary(m3)
```

```
##
## Call:
## lm(formula = mean_overall_perf_z_score ~ pct_remote_weeks + gender +
##     log(tenure) + bedroom_indicator + promote_switch + commute +
##     median_bonus_total_cny, data = final_all)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -1.0478 -0.2509  0.0303  0.2762  1.0112
##
## Coefficients:
##                                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)                         -1.200e+00  3.319e-01  -3.616 0.000431 ***
## pct_remote_weeks                     4.115e-01  1.904e-01   2.161 0.032575 *
## genderMale                          -3.727e-01  7.924e-02  -4.703 6.58e-06 ***
## log(tenure)                          1.164e-01  4.295e-02   2.710 0.007659 **
## bedroom_indicatorHas Own Bedroom     4.249e-01  2.628e-01   1.617 0.108372
## promote_switch                       1.800e-01  1.048e-01   1.719 0.088131 .
## commute                              1.352e-03  5.880e-04   2.298 0.023170 *
## median_bonus_total_cny               2.536e-04  7.244e-05   3.500 0.000642 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4342 on 127 degrees of freedom
## Multiple R-squared:  0.3867, Adjusted R-squared:  0.3529
## F-statistic: 11.44 on 7 and 127 DF,  p-value: 3.363e-11
```

```r
suppressWarnings(
  stargazer(m3,
            type = "text",
            title = "Regression Results Model 3",
            dep.var.labels = "Mean Overall Performance Z-Score",
```

```r
            covariate.labels = c("remote work percentage",
                                 "gender (male=1)",
                                 "log(tenure)",
                                 "bedroom (has own=1)",
                                 "promotion status (promoted=1)",
                                 "commute time (mins)",
                                 "median bonus total (CNY)"),
            out = "regression_results_model_3.txt",
            no.space = TRUE)
)
```

```
##
## Regression Results Model 3
## ===============================================================
##                                     Dependent variable:
##                                ---------------------------------
##                                Mean Overall Performance Z-Score
## ---------------------------------------------------------------
## remote work percentage                     0.411**
##                                            (0.190)
## gender (male=1)                           -0.373***
##                                            (0.079)
## log(tenure)                                0.116***
##                                            (0.043)
## bedroom (has own=1)                         0.425
##                                            (0.263)
## promotion status (promoted=1)               0.180*
##                                            (0.105)
## commute time (mins)                        0.001**
##                                            (0.001)
## median bonus total (CNY)                  0.0003***
##                                            (0.0001)
## Constant                                  -1.200***
##                                            (0.332)
## ---------------------------------------------------------------
## Observations                                 135
## R2                                          0.387
## Adjusted R2                                 0.353
## Residual Std. Error                    0.434 (df = 127)
## F Statistic                        11.440*** (df = 7; 127)
## ===============================================================
## Note:                               *p<0.1; **p<0.05; ***p<0.01
```

```r
# bp-test for model3
bptest(m3)
```

```
##
##  studentized Breusch-Pagan test
##
## data:  m3
## BP = 8.9877, df = 7, p-value = 0.2535
```

There is no heteroscedasticity present

```r
# vif for model3
vif(m3)
```

```
##       pct_remote_weeks                gender           log(tenure)
##               1.088885              1.124158              1.325743
##      bedroom_indicator        promote_switch               commute
##               1.074821              1.072122              1.100011
## median_bonus_total_cny
##               1.301186
```

There is no multicolinearity present

```r
#m3 but with log of median bonus total

m3_2 <- lm(mean_overall_perf_z_score ~
               pct_remote_weeks +
             gender +
             log(tenure) +
             bedroom_indicator +
             promote_switch +
             commute +
             log(median_bonus_total_cny),
           data = final_all)
summary(m3_2)
```

```
##
## Call:
## lm(formula = mean_overall_perf_z_score ~ pct_remote_weeks + gender +
##     log(tenure) + bedroom_indicator + promote_switch + commute +
##     log(median_bonus_total_cny), data = final_all)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.06792 -0.25844  0.02354  0.25677  1.01911
##
## Coefficients:
##                                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)                    -3.4547323  0.7853807  -4.399 2.28e-05 ***
## pct_remote_weeks                0.4130739  0.1898238   2.176 0.031399 *
## genderMale                     -0.3776625  0.0791752  -4.770 4.97e-06 ***
## log(tenure)                     0.1205582  0.0424340   2.841 0.005239 **
## bedroom_indicatorHas Own Bedroom  0.4354327  0.2625981   1.658 0.099751 .
## promote_switch                  0.1727385  0.1048452   1.648 0.101916
## commute                         0.0013470  0.0005866   2.296 0.023296 *
## log(median_bonus_total_cny)     0.3621301  0.1014060   3.571 0.000503 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4334 on 127 degrees of freedom
## Multiple R-squared:  0.3889, Adjusted R-squared:  0.3552
## F-statistic: 11.55 on 7 and 127 DF,  p-value: 2.714e-11
```

```r
suppressWarnings(
  stargazer(m3_2,
            type = "text",
            title = "Regression Results Model 3",
            dep.var.labels = "Mean Overall Performance Z-Score",
            covariate.labels = c("remote work percentage",
                                 "gender (male=1)",
                                 "log(tenure)",
                                 "bedroom (has own=1)",
                                 "promotion status (promoted=1)",
                                 "commute time (mins)",
                                 "log median bonus total (CNY)"))
)
```

```
##
## Regression Results Model 3
## ==============================================================
##                                    Dependent variable:
##                              ---------------------------------
##                              Mean Overall Performance Z-Score
## --------------------------------------------------------------
## remote work percentage                   0.413**
##                                          (0.190)
##
## gender (male=1)                         -0.378***
##                                          (0.079)
##
## log(tenure)                              0.121***
##                                          (0.042)
##
## bedroom (has own=1)                       0.435*
##                                          (0.263)
##
## promotion status (promoted=1)             0.173
##                                          (0.105)
##
## commute time (mins)                      0.001**
##                                          (0.001)
##
## log median bonus total (CNY)             0.362***
##                                          (0.101)
##
## Constant                                -3.455***
##                                          (0.785)
##
## --------------------------------------------------------------
## Observations                               135
## R2                                        0.389
## Adjusted R2                               0.355
## Residual Std. Error                  0.433 (df = 127)
## F Statistic                      11.547*** (df = 7; 127)
## ==============================================================
## Note:                              *p<0.1; **p<0.05; ***p<0.01
```

By logging the skewed model of median bonus total wage we get a better fit of the model, because the bonus was right skewed. R2 increases from 0.387 to 0.389 and adj R2 from 0.353 to 0.355 The F statistic shows stat significance at 1% level, indicating that at least one of the independent variables is stat. significant in explaining the variability of the dependent variable. Bedroom becomes stat. insignificant at 10% level but promotion status loses significance in explaining the performance. With an increase of 1% in bonus total the performance increases by 0.00362. Before without the log, with an increase of 1 CNY the performance increased by 0.0003. By logging the bonus also has a bigger impact on performance.

As this is the best model we have so far, we will now do the interpretations for the coefficients and check the assumptions of linear regression for this model.

An increase of 1 percentage point in remote work increases the performance score by 0.413 with a confidence of 95%. Being male decreases the performance score by 0.378, with a significance of 99%. When tenure increases by 1 month performance increases by 0.00121 with a confidence interval of 99%. The employees that live in a house with one bedroom have a performance score that is 0.435 higher than those who do not have their own bedroom, with a confidence of 90%. Commute time is stat. significant at a 5% level, however the coefficient is very small, with an increase of 1 minute in commute time the performance score increases by 0.001. When the median bonus increases by 1 % the performance increases by 0.00362.

```r
#BP test

bptest(m3_2)
```

```
##
##  studentized Breusch-Pagan test
##
## data:  m3_2
## BP = 10.356, df = 7, p-value = 0.1693
```

large p-value, we accept the null hypotheses so there is homoskedasticity and no heteroscedasticity present

```r
#VIF
vif(m3_2)
```

```
##           pct_remote_weeks                     gender
##                   1.086008                   1.126413
##                log(tenure)          bedroom_indicator
##                   1.298760                   1.076995
##             promote_switch                    commute
##                   1.077790                   1.098669
## log(median_bonus_total_cny)
##                   1.276829
```

all values close to 1 so no multicollinearity present

Regression Analysis for Promotion

1. **Created promotion and demographic indicators** using `mutate()` to generate clean binary variables for `promotion`, `gender`, `married`, `higher_edu_indicator`, and `children_indicator`.

2. **Computed descriptive statistics** for the promotion sample using `summarise()` to obtain `n_obs`, `promo_rate`, `avg_age`, and `avg_perf`.

3. **Constructed a correlation matrix** for relevant predictors (`promotion`, `gender`, `mean_overall_perf_z_score`, `age`, `tenure_in_months`, `higher_edu_indicator`, `married`) using `cor()`.

4. **Visualized promotion patterns** via graphs such as promotion rates by `gender`, performance distributions by `promotion`, and promotion differences by `married` status using `ggplot()`.

5. **Estimated sequential Probit models (M1–M5)** to assess omitted variable bias when adding `performance`, `married`, `age`, `tenure_in_months`, and `higher_edu_indicator`.

6. **Estimated full models using Logit and Probit** with the specification `promotion ~ gender + performance + age + tenure + higher_edu_indicator + married`.

7. **Compared model fit** across `OLS`, `Logit`, and `Probit` using `logLik()` and `AIC()` to identify the preferred functional form.

8. **Checked multicollinearity** by computing variance inflation factors using `vif()` for Logit and Probit models.

9. **Computed marginal effects and average partial effects (APE)** from the preferred Probit model using `margins()` to interpret effects in probability terms.

10. **Calculated McFadden's pseudo-R^2** for the Probit model using `pR2()` as a goodness-of-fit metric for binary outcome models.

All key predictors and the promotion outcome are converted into binary indicators to enable consistent regression analysis.

```
final_all <- final_all %>%
  mutate(
    promotion = case_when(
      promote_switch %in% c(1, "1") ~ 1L,
      promote_switch %in% c(0, "0") ~ 0L,
      TRUE ~ NA_integer_
    )
  )

# Check: gibt es wirklich 0 UND 1?
table(final_all$promotion, useNA = "ifany")
```

```
##
##   0   1
## 113  22
```

This code converts `promote_switch` into a clean binary promotion variable (`promotion`), ensuring that both numeric (`0`/`1`) and character (`"0"`/`"1"`) values are handled correctly. The `table()` check confirms that both categories (`0` and `1`) are present, which is essential because `Logit` and `Probit` models require variation in the dependent variable to be estimable.

Descriptive Statistics and Correlation Matrix

```r
#Deskriptive statistic


desc <- final_all %>%
  summarise(
    n_obs      = n(),
    promo_rate = mean(promotion, na.rm = TRUE),
    avg_age    = mean(age, na.rm = TRUE),
    avg_perf   = mean(mean_overall_perf_z_score, na.rm = TRUE)
  )

desc
```

```
## # A tibble: 1 x 4
##   n_obs promo_rate avg_age avg_perf
##   <int>      <dbl>   <dbl>    <dbl>
## 1   135      0.163    23.8  -0.0644
```

The descriptive summary provides a first overview of the dataset. We observe a total of 135 employees (`n_obs = 135`). The overall promotion rate is relatively low at around 16% (`promo_rate   0.163`), indicating that promotions are selective events in this sample. The average age of employees is about 23.8 years (`avg_age`), suggesting a relatively young workforce. The mean performance score (`avg_perf`) is close to zero, which is expected because the variable is standardized (z-score). This descriptive overview confirms that the dependent variable `promotion` has sufficient variation for subsequent `Logit` and `Probit` models, and it provides initial context for interpreting the regression results.

```r
# Correlation matrix (numeric variables only)

# Select variables to include in the correlation matrix
vars <- c(
  "promotion",
  "mean_overall_perf_z_score",
  "age",
  "tenure",
  "married",
  "children_indicator",
  "higher_edu_indicator"
)

# Convert all variables to numeric (important for 0/1 indicators)
corr_mat <- final_all %>%
  dplyr::select(all_of(vars)) %>%
  mutate(across(everything(), as.numeric)) %>%
  cor(use = "pairwise.complete.obs")

# Display a clean, regular correlation matrix in the knitted output
knitr::kable(
  corr_mat,
  caption = "Correlation Matrix",
  digits = 3
)
```

Table 36: Correlation Matrix

	promotion	mean_overall_perf_z_score	age	tenure	married	children_indicator	higher_edu_indicator
promotion	1.000	0.173	-0.028	0.074	-0.133	-0.071	-0.087
mean_overall_perf_z_score	0.173	1.000	0.137	0.277	0.177	0.172	0.013
age	-0.028	0.137	1.000	0.521	0.506	0.551	0.314
tenure	0.074	0.277	0.521	1.000	0.352	0.361	0.183
married	-0.133	0.177	0.506	0.352	1.000	0.797	0.255
children_indicator	-0.071	0.172	0.551	0.361	0.797	1.000	0.157
higher_edu_indicator	-0.087	0.013	0.314	0.183	0.255	0.157	1.000

The correlation matrix shows that `promotion` is only weakly correlated with all other variables, indicating no strong bivariate drivers of promotion. Performance has a small positive correlation with promotion (0.17), consistent with expectations. Age and tenure correlate strongly (0.52), and both are also moderately related to marital and children status. The very high correlation between `married` and `children_indicator` (0.80) indicates substantial overlap, which is why only `married` is included in the regression models to avoid multicollinearity. Higher education shows only weak relationships with all other variables.

Probit Models M1–M5 to Assess Omitted Variable Bias

```r
# Probit-Modele M1-M5


mod1 <- glm(
  promotion ~ gender,
  data   = final_all,
  family = binomial(link = "probit")
)

mod2 <- glm(
  promotion ~ gender + mean_overall_perf_z_score,
  data   = final_all,
  family = binomial(link = "probit")
)

mod3 <- glm(
  promotion ~ gender + mean_overall_perf_z_score + married,
  data   = final_all,
  family = binomial(link = "probit")
)

mod4 <- glm(
  promotion ~ gender + mean_overall_perf_z_score + married + tenure,
  data   = final_all,
  family = binomial(link = "probit")
)

mod5 <- glm(
  promotion ~ gender + mean_overall_perf_z_score + married +
    tenure + higher_edu_indicator,
```

```r
  data   = final_all,
  family = binomial(link = "probit")
)


suppressWarnings(
  stargazer(
    mod1, mod2, mod3, mod4, mod5,
    type           = "text",
    no.space       = TRUE,
    digits         = 3,
    column.labels  = c("M1","M2","M3","M4","M5"),
    dep.var.labels = "Promotion",
    covariate.labels = c(
      "Male",
      "Perf (z-score)",
      "Married",
      "Tenure",
      "Higher Edu"
    ),
    omit.stat = "ser"
  )
)
```

```
##
## ===================================================================
##                                 Dependent variable:
##                    ------------------------------------------------
##                                      Promotion
##                       M1        M2        M3        M4        M5
##                       (1)       (2)       (3)       (4)       (5)
## -------------------------------------------------------------------
## Male                 0.233    0.538*    0.566*    0.633**   0.631**
##                     (0.260)   (0.294)   (0.305)   (0.313)   (0.312)
## Perf (z-score)                0.707**  0.849***  0.793***  0.790***
##                               (0.278)   (0.297)   (0.301)   (0.302)
## Married                                 -0.812*  -0.988**  -0.944**
##                                         (0.419)   (0.448)   (0.454)
## Tenure                                             0.011     0.011
##                                                   (0.008)   (0.008)
## Higher Edu                                                  -0.190
##                                                             (0.293)
## Constant           -1.106*** -1.273*** -1.159*** -1.417*** -1.353***
##                     (0.193)   (0.212)   (0.224)   (0.296)   (0.306)
## -------------------------------------------------------------------
## Observations          135       135       135       135       135
## Log Likelihood      -59.613   -56.208   -53.991   -53.045   -52.829
## Akaike Inf. Crit.   123.225   118.417   115.981   116.091   117.658
## ===================================================================
## Note:                                   *p<0.1; **p<0.05; ***p<0.01
```

```r
cat("\nModel specs:\n",
    "M1 = Gender only\n",
```

```
    "M2 = M1 + Performance\n",
    "M3 = M2 + Married\n",
    "M4 = M3 + Age\n",
    "M5 = M4 + Tenure + Higher Edu\n")
```

```
##
## Model specs:
##  M1 = Gender only
##  M2 = M1 + Performance
##  M3 = M2 + Married
##  M4 = M3 + Age
##  M5 = M4 + Tenure + Higher Edu
```

The stepwise Probit models (M1–M5) illustrate how omitted variable bias (OVB) affects the estimated gender effect. In M1, `Male` is positive but not significant, but once performance is added in M2, the coefficient becomes significant and increases in magnitude. This indicates that the simple bivariate model suffers from OVB because performance is correlated with both gender and promotion. After controlling for this, the underlying gender effect becomes visible.

Performance is consistently positive and highly significant across all models, confirming it as the strongest driver of promotion. When family-status variables are introduced, an important specification decision arises: `married` and `children_indicator` correlate very strongly (0.80). To avoid multicollinearity, only one of them should be included in the regression. Since `married` is the variable that becomes statistically significant when added (M3), it is selected as the preferred control, while `children_indicator` is omitted from the main models.

In M3–M5, `Married` shows a negative and significant association with promotion, suggesting lower promotion probabilities for married employees. Meanwhile, tenure, and higher education do not become significant once performance and demographic factors are controlled for.

Overall, the sequence M1–M5 demonstrates clear evidence of OVB in the gender coefficient, highlights performance as the dominant predictor, and justifies the choice of `married` (instead of `children_indicator`) due to both statistical significance and the need to avoid multicollinearity.

Model Comparison

```r
#OLS vs Logit vs Probit (Comparison)

ols_full <- lm(
  promotion ~ gender + mean_overall_perf_z_score +
    age + tenure + higher_edu_indicator + married,
  data = final_all
)

logit_full <- glm(
  promotion ~ gender + mean_overall_perf_z_score +
    age + tenure + higher_edu_indicator + married,
  data = final_all,
  family = binomial("logit")
)

probit_full <- glm(
```

```r
  promotion ~ gender + mean_overall_perf_z_score +
    age + tenure + higher_edu_indicator + married,
  data = final_all,
  family = binomial("probit")
)

suppressWarnings(
  stargazer(
    ols_full, logit_full, probit_full,
    type           = "text",
    no.space       = TRUE,
    digits         = 3,
    dep.var.labels = "Promotion",
    covariate.labels = c(
      "Male",
      "Performance (Z)",
      "Age",
      "Tenure",
      "Higher Edu",
      "Married"
    ),
    omit.stat = "ser"
  )
)
```

```
##
## ==========================================================
##                              Dependent variable:
##                    ---------------------------------------
##                                   Promotion
##                         OLS          logistic  probit
##                         (1)            (2)       (3)
## ----------------------------------------------------------
## Male                  0.142**        1.195**   0.677**
##                       (0.071)        (0.583)   (0.324)
## Performance (Z)       0.169**        1.436***  0.803***
##                       (0.065)        (0.553)   (0.306)
## Age                   -0.004          -0.047    -0.030
##                       (0.013)        (0.105)   (0.059)
## Tenure                 0.003          0.021     0.013
##                       (0.002)        (0.015)   (0.009)
## Higher Edu            -0.045          -0.337    -0.162
##                       (0.067)        (0.542)   (0.300)
## Married               -0.150*        -1.558*   -0.870*
##                       (0.090)        (0.910)   (0.476)
## Constant               0.199          -1.308    -0.749
##                       (0.266)        (2.220)   (1.244)
## ----------------------------------------------------------
## Observations            135            135       135
## R2                     0.097
## Adjusted R2            0.054
## Log Likelihood                       -52.881   -52.701
## Akaike Inf. Crit.                    119.762   119.402
```

```
## F Statistic       2.281** (df = 6; 128)
## ==========================================================
## Note:                        *p<0.1; **p<0.05; ***p<0.01
```

We estimate OLS, `logit`, and `probit` models to ensure that our findings are not driven by a specific estimation method. Since promotion is a binary outcome, `logit` and `probit` are the theoretically appropriate nonlinear models, while OLS provides a simple baseline. The consistency of the results across all three approaches strengthens the credibility of our conclusions: male employees and higher performers are more likely to be promoted, whereas married employees face lower promotion odds. The stability of these effects across model types shows that the observed relationships are robust and not sensitive to model choice.

Diagnostics

```r
#Log-Likelihood & AIC comparison


logLik(logit_full)
```

```
## 'log Lik.' -52.88086 (df=7)
```

```r
logLik(probit_full)
```

```
## 'log Lik.' -52.70076 (df=7)
```

```r
AIC(logit_full, probit_full)
```

```
##             df      AIC
## logit_full   7 119.7617
## probit_full  7 119.4015
```

To compare the overall model fit between the `logit` and `probit` specifications, we examine their log-likelihood values and AIC scores. Both models produce very similar log-likelihoods, indicating nearly identical explanatory power. The `probit` model has a slightly lower AIC, suggesting a marginally better fit, although the difference is too small to have practical relevance. Overall, this comparison confirms that both nonlinear models perform equally well, and our substantive conclusions do not depend on whether we use `logit` or `probit`.

```r
#VIF Check (Multikollinearität)

vif(logit_full)
```

```
##                   gender mean_overall_perf_z_score                       age
##                 1.358939                  1.338824                  1.712404
##                   tenure       higher_edu_indicator                   married
##                 1.534909                  1.082132                  1.272267
```

Variance Inflation Factors (VIFs) are used to assess multicollinearity among the predictors in the full model. All VIF values are well below the common thresholds of 5 or 10, indicating that multicollinearity is not a concern. This confirms that the included variables—especially `married` and `children_indicator`, which are highly correlated in the raw data—do not create instability in the final model specification, as only `married` is included. Overall, the predictors are sufficiently independent for reliable coefficient estimation.

Now we check for the marginal effects:

```r
probitmfx(probit_full, data = final_all, atmean = FALSE)
```

```
## Call:
## probitmfx(formula = probit_full, data = final_all, atmean = FALSE)
##
## Marginal Effects:
##                                     dF/dx  Std. Err.       z    P>|z|
## genderMale                      0.1443070  0.0664766  2.1708 0.029947 *
## mean_overall_perf_z_score       0.1729997  0.0628049  2.7546 0.005877 **
## age                            -0.0063714  0.0126304 -0.5045 0.613945
## tenure                          0.0028595  0.0018741  1.5259 0.127046
## higher_edu_indicatorHas Degree -0.0344023  0.0627802 -0.5480 0.583706
## married                        -0.1449074  0.0582619 -2.4872 0.012876 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## dF/dx is for discrete change for the following variables:
##
## [1] "genderMale"                     "higher_edu_indicatorHas Degree"
## [3] "married"
```

```r
probitmfx(probit_full, data = final_all, atmean = TRUE)
```

```
## Call:
## probitmfx(formula = probit_full, data = final_all, atmean = TRUE)
##
## Marginal Effects:
##                                     dF/dx  Std. Err.       z    P>|z|
## genderMale                      0.1421106  0.0668196  2.1268 0.033438 *
## mean_overall_perf_z_score       0.1682889  0.0616241  2.7309 0.006316 **
## age                            -0.0061979  0.0122808 -0.5047 0.613780
## tenure                          0.0027817  0.0018494  1.5041 0.132552
## higher_edu_indicatorHas Degree -0.0333884  0.0609293 -0.5480 0.583702
## married                        -0.1369349  0.0535467 -2.5573 0.010549 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## dF/dx is for discrete change for the following variables:
##
## [1] "genderMale"                     "higher_edu_indicatorHas Degree"
## [3] "married"
```

There is also another function to check the marginal effects:

```r
#Marginal Effects (Probit)

me_full <- margins(probit_full)
summary(me_full)
```

```
##                          factor     AME     SE       z      p   lower  upper
##                             age -0.0064 0.0126 -0.5044 0.6139 -0.0311 0.0184
##                      genderMale  0.1443 0.0665  2.1708 0.0299  0.0140 0.2746
##  higher_edu_indicatorHas Degree -0.0344 0.0628 -0.5480 0.5837 -0.1574 0.0886
##                         married -0.1872 0.1006 -1.8613 0.0627 -0.3844 0.0099
##       mean_overall_perf_z_score  0.1730 0.0628  2.7546 0.0059  0.0499 0.2961
##                          tenure  0.0029 0.0019  1.5259 0.1270 -0.0008 0.0065
```

In total the marginal effects show that `genderMale` increases the probability of promotion by about 14 percentage points, and performance raises it by roughly 17 points—both statistically significant. `Married` reduces promotion chances by about 19 points and is marginally significant. Age, tenure, and higher education have small, insignificant effects. These results confirm the main findings from the Probit model.

```r
#McFadden Pseudo-R²

pR2(probit_full)
```

```
## fitting null model for pseudo-r2
```

```
##         llh     llhNull          G2    McFadden        r2ML        r2CU
## -52.7007599 -60.0143376  14.6271554   0.1218638   0.1026859   0.1743468
```

The McFadden Pseudo-R^2 of the `probit` model is about 0.12, which indicates a modest but meaningful improvement over the null model. Values in this range are typical for discrete-choice models and suggest that the included predictors provide reasonable explanatory power. This aligns with earlier results showing that performance, gender, and marital status drive most of the predictive strength in the model.

Key Findings Summary from Promotion Analysis

Overall, the analysis identifies three main determinants of promotion: performance, gender, and marital status. First, individual performance is the strongest and most consistent predictor across all models, with higher-performing employees having substantially greater promotion probabilities. Second, once relevant controls are added, male employees exhibit significantly higher promotion chances, revealing omitted variable bias in the simple gender-only model. Third, marital status is negatively associated with promotion, even after controlling for performance and demographics.

Other factors such as age, tenure, and higher education show no meaningful effects. Strong correlations between `married` and `children_indicator` justify including only one of them in the models to avoid multicollinearity. The OLS, `logit`, and `probit` models yield consistent results, and model fit metrics (AIC, log-likelihood, Pseudo-R^2) confirm that the conclusions are robust and not sensitive to estimation method. Marginal effects reinforce these findings, showing sizable effects for gender, performance, and marital status, while all other predictors remain small and statistically insignificant.

Overall, the evidence suggests that promotion decisions in this dataset are driven primarily by productivity and demographic characteristics related to gender and marital status.

Regression Analysis for Attrition

1. **Grouped data by `quitjob` status** to find significant differences between employees who quit versus those who stayed, using `group_by()` and `skim()`.

2. **Identified potential predictors** for quitting, based on mean differences between groups. These include `pct_on_site_weeks`, `mean_overall_perf_z_score`, `children`, `median_gross_wage_cny`, `costofcommute`.

3. **Checked multicollinearity** among numeric predictors using correlation matrices.

4. **Estimated baseline Logit and Probit models** for the binary outcome `quitjob`. Both showed similar explanatory power; Logit was chosen for easier interpretation.

5. **Created an analysis table** for practical interpretation.

6. **Conducted graphical analysis** to visualize each variable's relationship with `quitjob`.

7. **Explained the independent variables** in the model to understand why they are key drivers of quitting.

Descriptive Patterns and Variable Selection

```r
# Finding the relevant variables.

final_all %>%
  group_by(quitjob) %>%
  skim()
```

Table 37: Data summary

Name	Piped data
Number of rows	135
Number of columns	36
Column type frequency:	
factor	4
numeric	31
Group variables	quitjob

Variable type: factor

skim_variable	quitjob	n_missing	complete_rate	ordered	n_unique	top_counts
gender	0	0	1	FALSE	2	Fem: 49, Mal: 46
gender	1	0	1	FALSE	2	Mal: 22, Fem: 18
higher_edu_indicator	0	0	1	FALSE	2	No : 57, Has: 38
higher_edu_indicator	1	0	1	FALSE	2	No : 22, Has: 18
bedroom_indicator	0	0	1	FALSE	2	Has: 92, No : 3
bedroom_indicator	1	0	1	FALSE	1	Has: 40, No : 0
children_indicator	0	0	1	FALSE	2	No : 84, Has: 11
children_indicator	1	0	1	FALSE	2	No : 31, Has: 9

Variable type: numeric

skim_variable	quitjob	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
personid	0	0	1.00	31984.36	11160.87	4122.00	24190.00	36314.00	40396.00	45442.00	
personid	1	0	1.00	34456.30	9938.47	6278.00	29663.50	38852.00	41323.00	44794.00	
age	0	0	1.00	23.93	3.46	18.00	22.00	23.00	26.00	35.00	
age	1	0	1.00	23.65	3.08	19.00	22.00	23.00	25.00	32.00	
tenure	0	0	1.00	22.61	19.59	2.00	8.00	19.00	34.50	94.00	
tenure	1	0	1.00	18.59	17.61	2.50	6.00	10.00	25.25	77.00	
commute	0	0	1.00	104.35	64.46	20.00	52.50	80.00	180.00	300.00	
commute	1	0	1.00	108.17	73.14	10.00	40.00	102.50	145.00	300.00	
married	0	0	1.00	0.18	0.39	0.00	0.00	0.00	0.00	1.00	
married	1	0	1.00	0.30	0.46	0.00	0.00	0.00	1.00	1.00	
promote_switch	0	0	1.00	0.23	0.42	0.00	0.00	0.00	0.00	1.00	
promote_switch	1	0	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
costofcommute	0	0	1.00	6.87	5.95	0.00	2.50	6.00	10.00	30.00	
costofcommute	1	0	1.00	8.66	9.57	0.00	2.75	7.00	10.00	55.00	
mean_overall_perf_z_score	0	0	1.00	0.02	0.53	-1.16	-0.25	0.03	0.38	1.42	
mean_overall_perf_z_score	1	0	1.00	-0.28	0.50	-1.20	-0.61	-0.33	0.07	0.81	
mean_phonecall_perf_z_score	0	0	1.00	0.02	0.46	-1.12	-0.23	0.05	0.32	1.08	
mean_phonecall_perf_z_score	1	0	1.00	-0.18	0.54	-1.08	-0.57	-0.24	0.16	1.22	
total_calls	0	0	1.00	34393.18	8578.34	8483.00	27893.00	35971.00	40552.00	49621.00	
total_calls	1	0	1.00	23846.47	7831.75	6088.00	20094.00	23130.00	28002.75	41178.00	
mean_log_phone_calls	0	0	1.00	6.02	0.19	5.31	5.95	6.06	6.15	6.47	
mean_log_phone_calls	1	0	1.00	5.94	0.23	5.33	5.77	5.92	6.07	6.59	
mean_log_calls_per_second	0	0	1.00	-5.18	0.11	-5.56	-5.25	-5.18	-5.11	-4.99	
mean_log_calls_per_second	1	1	0.98	-5.15	0.13	-5.44	-5.24	-5.15	-5.09	-4.81	
mean_log_average_call_lenght	0	0	1.00	11.20	0.19	10.45	11.11	11.22	11.32	11.67	
mean_log_average_call_lenght	1	1	0.98	11.07	0.19	10.54	10.98	11.07	11.23	11.38	
mean_log_calls_per_day_worked	0	0	1.00	9.49	0.20	8.67	9.39	9.49	9.61	9.91	
mean_log_calls_per_day_worked	1	1	0.98	9.41	0.19	8.91	9.33	9.44	9.55	9.70	
mean_log_days_worked	0	0	1.00	1.70	0.10	1.39	1.64	1.70	1.77	1.85	
mean_log_days_worked	1	0	1.00	1.63	0.10	1.34	1.60	1.62	1.67	1.78	
weeks_observed	0	0	1.00	78.62	10.72	27.00	72.00	84.00	86.00	86.00	
weeks_observed	1	0	1.00	60.02	12.39	31.00	51.75	59.50	67.25	86.00	
remote_weeks	0	0	1.00	18.18	17.05	0.00	0.00	25.00	35.50	39.00	
remote_weeks	1	0	1.00	5.28	9.98	0.00	0.00	0.00	6.00	39.00	
on_site_weeks	0	0	1.00	60.44	18.30	26.00	47.00	57.00	81.50	86.00	
on_site_weeks	1	0	1.00	54.75	11.74	31.00	47.00	51.50	61.50	84.00	
pct_remote_weeks	0	0	1.00	0.23	0.21	0.00	0.00	0.30	0.44	0.58	
pct_remote_weeks	1	0	1.00	0.08	0.13	0.00	0.00	0.00	0.11	0.45	
pct_on_site_weeks	0	0	1.00	0.77	0.21	0.42	0.56	0.70	1.00	1.00	
pct_on_site_weeks	1	0	1.00	0.92	0.13	0.55	0.89	1.00	1.00	1.00	
median_base_wage_cny	0	0	1.00	1652.11	117.18	1300.00	1550.00	1650.00	1750.00	1900.00	
median_base_wage_cny	1	0	1.00	1596.25	150.91	1400.00	1500.00	1575.00	1631.25	2375.00	
median_gross_wage_cny	0	0	1.00	3210.21	682.06	1919.76	2646.28	3095.48	3710.67	4801.74	
median_gross_wage_cny	1	0	1.00	2580.22	470.84	2047.50	2229.62	2455.95	2712.75	4228.00	
median_bonus_total_cny	0	0	1.00	1562.07	592.09	517.76	1095.99	1449.84	1974.90	3051.98	
median_bonus_total_cny	1	0	1.00	1016.70	372.66	597.50	737.04	918.25	1131.23	2128.84	

skim_variable	quitjob	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
months_observed	0	0	1.00	25.25	1.60	20.00	26.00	26.00	26.00	26.00	
months_observed	1	0	1.00	15.20	2.95	7.00	13.00	15.00	16.25	20.00	
exhaustion	0	34	0.64	8.59	6.53	0.00	3.00	9.00	12.00	29.00	
exhaustion	1	40	0.00	NaN	NA	NA	NA	NA	NA	NA	
negative	0	34	0.64	16.64	5.39	8.00	12.00	17.00	20.00	34.00	
negative	1	40	0.00	NaN	NA	NA	NA	NA	NA	NA	
positive	0	34	0.64	24.25	5.14	13.00	21.00	24.00	27.00	37.00	
positive	1	40	0.00	NaN	NA	NA	NA	NA	NA	NA	
log_wage	0	0	1.00	8.05	0.21	7.56	7.88	8.04	8.22	8.48	
log_wage	1	0	1.00	7.84	0.17	7.62	7.71	7.81	7.91	8.35	
log_bonus	0	0	1.00	7.28	0.39	6.25	7.00	7.28	7.59	8.02	
log_bonus	1	0	1.00	6.87	0.33	6.39	6.60	6.82	7.03	7.66	
log_tenure	0	0	1.00	2.67	1.04	0.69	2.08	2.94	3.54	4.54	
log_tenure	1	0	1.00	2.52	0.93	0.92	1.79	2.30	3.23	4.34	
promotion	0	0	1.00	0.23	0.42	0.00	0.00	0.00	0.00	1.00	
promotion	1	0	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Looking at those who quit vs those who didn't, we see differences that might be interesting in: `pct_on_site_weeks`, `mean_overall_perf_z_score`, `children`, `median_gross_wage_cny`, `costofcommute`.

```
# Plotting the correlations between the numeric variables

mini_cor_matrix <- final_all %>%
  dplyr::select(quitjob, pct_on_site_weeks, children_indicator, median_gross_wage_cny, costofcommute) %>%
  mutate(across(everything(), as.numeric)) %>%
  correlate(diagonal = 1) %>%
  rearrange() %>% shave()
```

```
## Correlation computed with
## * Method: 'pearson'
## * Missing treated using: 'pairwise.complete.obs'
```

```
mini_cor_matrix
```

```
## # A tibble: 5 x 6
##   term                quitjob pct_on_site_weeks costofcommute children_indicator
##   <chr>                 <dbl>             <dbl>         <dbl>              <dbl>
## 1 quitjob               1                NA            NA                 NA
## 2 pct_on_site_weeks     0.339             1            NA                 NA
## 3 costofcommute         0.114            -0.0262        1                 NA
## 4 children_indicator    0.140             0.0500        0.209              1
## 5 median_gross_wage_~  -0.419            -0.223        -0.255              0.197
## # i 1 more variable: median_gross_wage_cny <dbl>
```

Significant values between `quitjob` and the independent variables, especially `pct_on_site_weeks` and `median_gross_wage_cny`, especially since `quitjob` is binary. Low correlation between the independent variables, so no multicollinearity issues.

Attrition Model Estimation (Logit & Probit)

```r
# Initial Logit and Probit Models

mini_attrition <- quitjob ~ pct_on_site_weeks + mean_overall_perf_z_score + children_indicator + median_

logit_mini_attrition <- glm(mini_attrition,
                  data = final_all,
                  family = binomial(link = "logit"))

probit_mini_attrition <- glm(mini_attrition,
                  data = final_all,
                  family = binomial(link = "probit"))

stargazer(final_all, logit_mini_attrition, probit_mini_attrition,
          type = "text",
          title = "Regression Results: Mini Attrition Model",
          no.space = TRUE, header = FALSE, font.size = 'scriptsize')
```

```
##
## Regression Results: Mini Attrition Model
## =================================
## Statistic N Mean St. Dev. Min Max
## =================================
##
## Regression Results: Mini Attrition Model
## ================================================================
##                                          Dependent variable:
##                                     ---------------------------
##                                               quitjob
##                                         logistic       probit
##                                           (1)           (2)
## ----------------------------------------------------------------
## pct_on_site_weeks                       3.786***      2.177***
##                                         (1.421)       (0.767)
## mean_overall_perf_z_score               -1.049*       -0.567*
##                                         (0.542)       (0.302)
## children_indicatorHas Child/Children    2.677***      1.516***
##                                         (0.870)       (0.475)
## median_gross_wage_cny                  -0.003***     -0.001***
##                                         (0.001)      (0.0003)
## costofcommute                           -0.007        -0.005
##                                         (0.036)       (0.020)
## Constant                                 2.491         1.364
##                                         (2.204)       (1.209)
## ----------------------------------------------------------------
## Observations                              135           135
## Log Likelihood                          -54.251       -54.585
## Akaike Inf. Crit.                       120.501       121.170
## ================================================================
## Note:                                *p<0.1; **p<0.05; ***p<0.01
```

`costofcommute` is not significant in both models, so we can drop it. The other variables are significant in both models.

```r
# Final Models without costofcommute

mini_attrition <- quitjob ~ pct_on_site_weeks + mean_overall_perf_z_score + children_indicator + median_

logit_mini_attrition <- glm(mini_attrition,
                  data = final_all,
                  family = binomial(link = "logit"))

probit_mini_attrition <- glm(mini_attrition,
                   data = final_all,
                   family = binomial(link = "probit"))

stargazer(final_all, logit_mini_attrition, probit_mini_attrition,
          type = "text",
          title = "Regression Results: Mini Attrition Model",
          no.space = TRUE, header = FALSE, font.size = 'scriptsize')
```

```
##
## Regression Results: Mini Attrition Model
## =================================
## Statistic N Mean St. Dev. Min Max
## =================================
##
## Regression Results: Mini Attrition Model
## =================================================================
##                                          Dependent variable:
##                                     -----------------------------
##                                               quitjob
##                                          logistic      probit
##                                            (1)           (2)
## -----------------------------------------------------------------
## pct_on_site_weeks                         3.834***      2.204***
##                                          (1.406)       (0.760)
## mean_overall_perf_z_score                -1.066**      -0.576*
##                                          (0.537)       (0.300)
## children_indicatorHas Child/Children      2.622***      1.477***
##                                          (0.826)       (0.450)
## median_gross_wage_cny                    -0.002***     -0.001***
##                                          (0.001)      (0.0003)
## Constant                                  2.294         1.243
##                                          (1.983)       (1.090)
## -----------------------------------------------------------------
## Observations                               135           135
## Log Likelihood                           -54.272       -54.613
## Akaike Inf. Crit.                        118.544       119.225
## =================================================================
## Note:                                 *p<0.1; **p<0.05; ***p<0.01
```

```r
pR2(logit_mini_attrition)
```

```
## fitting null model for pseudo-r2
```

```
##         llh     llhNull          G2    McFadden        r2ML        r2CU
## -54.2720157 -82.0386122  55.5331930   0.3384577   0.3372497   0.4794533
```

```r
pR2(probit_mini_attrition)
```

```
## fitting null model for pseudo-r2
```

```
##         llh     llhNull          G2    McFadden        r2ML        r2CU
## -54.6127435 -82.0386122  54.8517374   0.3343044   0.3338958   0.4746852
```

Similar values, pick either. We will use LOGIT since intepretation is more linear.. All of the variables within the model have a high statistical significance. Joining them in a table for easy interpretation.

```r
# Marginal Effects for Logit Model

marg_summary_mini <- summary(margins(logit_mini_attrition))

# coefficient table
coef_tbl_mini <- broom::tidy(logit_mini_attrition) %>%
  mutate(
    odds_ratio = exp(estimate),
    lower_OR = exp(estimate - 1.96 * std.error),
    upper_OR = exp(estimate + 1.96 * std.error)
  )

# marginal effects table
marg_tbl_mini <- marg_summary_mini %>%
  rename(
    term = factor,
    AME = AME,
    AME_se = SE,
    AME_p = p,
    AME_lower = lower,
    AME_upper = upper
  )

# join both tables
logit_attrition_table_mini <- coef_tbl_mini %>%
  full_join(marg_tbl_mini, by = "term") %>%
  dplyr::select(term, estimate, std.error, p.value,
         odds_ratio, lower_OR, upper_OR,
         AME, AME_lower, AME_upper)

knitr::kable(logit_attrition_table_mini)
```

term	estimate	std.error	p.value	odds_ratio	lower_OR	upper_OR	AME	AME_lower	AME_upper
(Intercept)	2.2941424	1.9833681	0.2473990	9.9159280	0.2032621	483.7381957	NA	NA	NA
pct_on_site_weeks	3.8344321	1.4059793	0.0063868	46.2671432	2.9408914	727.8910600	0.4995854	0.1771306	0.8220402
mean_overall_perf_z_score	-1.0657751	0.5372069	0.0472648	0.3444608	0.1201877	0.9872326	-0.1388591	-0.2679113	-0.0098069

term	estimate	std.error	p.value	odds_ratio	lower_OR	upper_OR	AME	AME_lower	AME_upper
children_indicatorHas Child/Children	2.6219705	0.8255256	0.0014926	13.7628162	2.7290139	69.4078970	0.3578774	0.1768680	0.5388868
median_gross_wage_cny	-0.0024851	0.0005909	0.0000260	0.9975179	0.9963633	0.9986739	-0.0003238	-0.0004310	-0.0002166

Model Interpretation and Conclusions.

`pct_on_site_weeks`
Going from full remote to full on-site work (0% to 100% on-site weeks) increases the probability of quitting by 50%.
The odds of quitting are 46.3× higher for employees who work on site.

`mean_overall_perf_z_score`
The odds of quitting drop by 65.6% for each 1-standard-deviation increase in performance ($1 - 0.344 = 0.656$).
On average, a one–SD increase in performance reduces the probability of quitting by 13.9 percentage points.

`children`
The odds of quitting are 13.8× higher for employees with children.
Having children increases the probability of quitting by 35.8 percentage points, on average.
This effect is large, statistically significant, and precisely estimated.

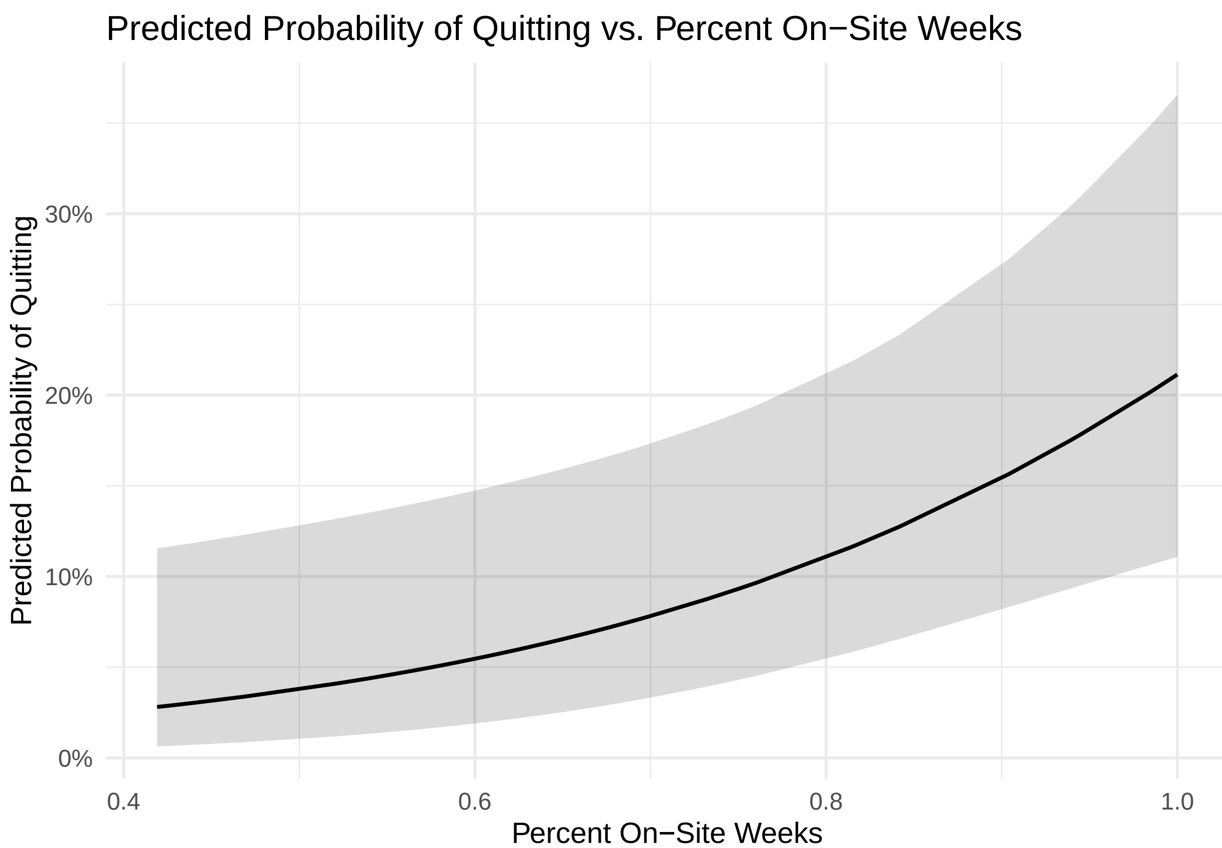
`median_gross_wage_cny`
Each 1-unit increase in wage (1 CNY) reduces the odds of quitting by about 0.02%.
In probability terms, each additional 1 CNY reduces quitting probability by 0.000324 (0.03 percentage points).
While the effect is statistically significant, it is very small in magnitude.

Practical interpretation:
A 100 CNY increase in wage reduces quitting probability by 3.24 percentage points.
A 1000 CNY increase in wage reduces quitting probability by 32.4 percentage points.

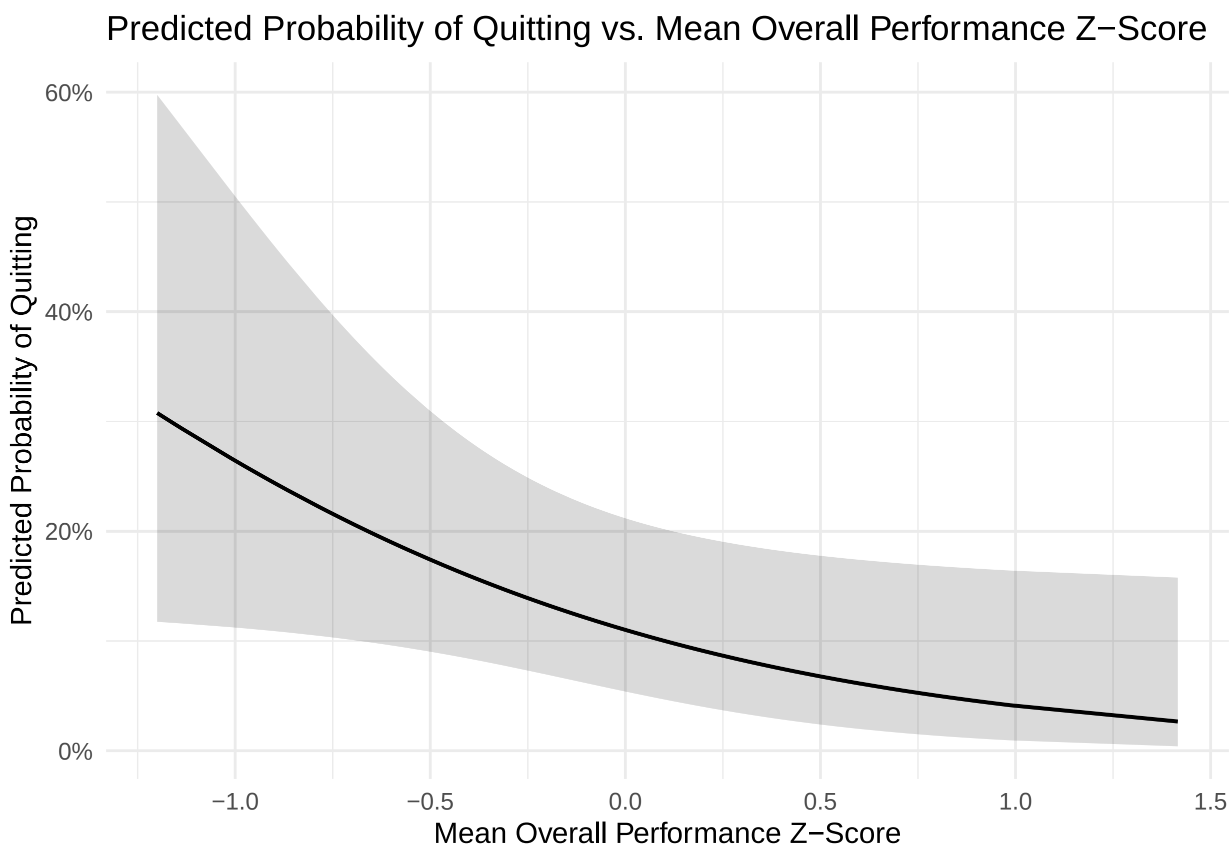
To summarize:
The main driver of quitting is whether employees work on site versus remotely.
Performance is also a strong predictor of quitting, although improving performance is more challenging than offering remote work options.
Having children is an important predictor, likely reflecting increased need for flexibility.
Wage has a statistically significant but very small effect, meaning wage increases may not be an efficient strategy to prevent quitting except when justified by other factors.

Visualizing Predicted Effects & Mechanisms

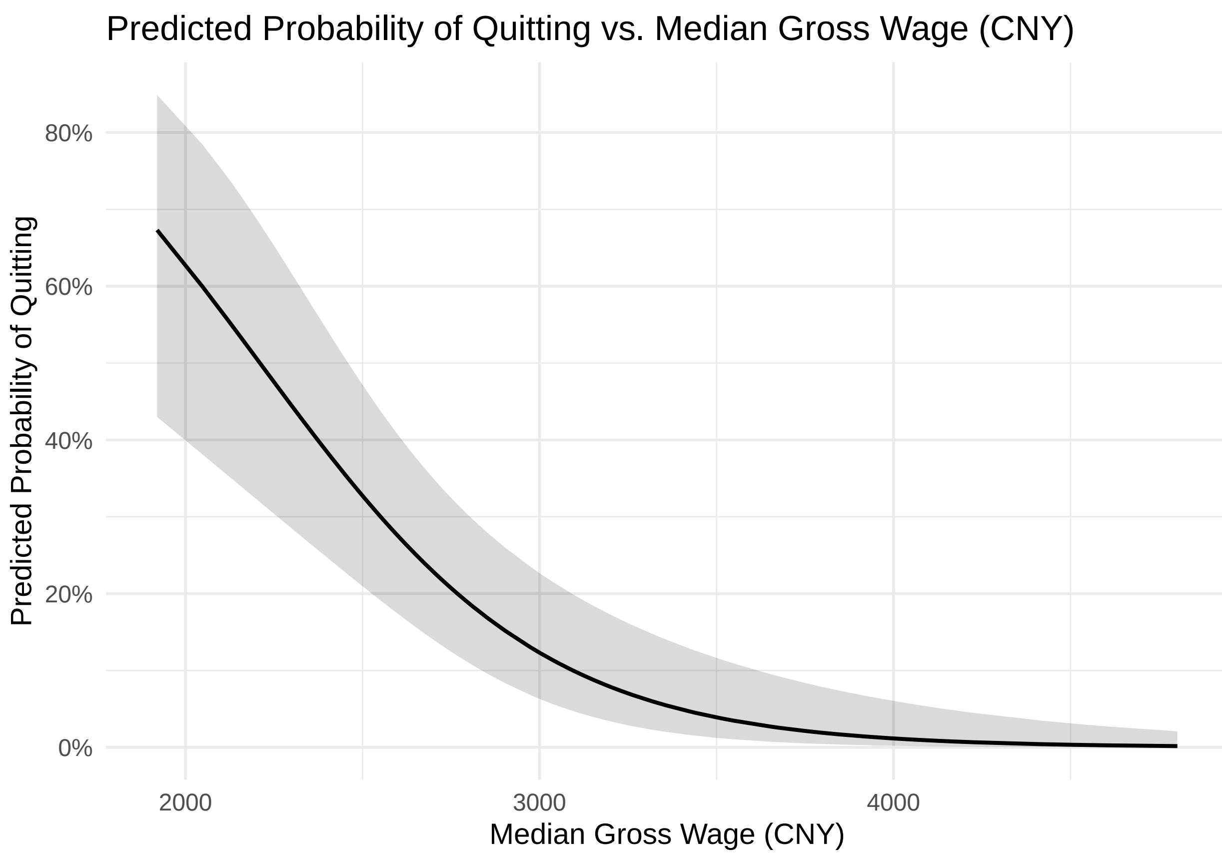
```r
# On site impact

logit_mini_attrition %>%
  ggeffects::ggpredict(terms = "pct_on_site_weeks [all]") %>%
  plot() +
  labs(
    title = "Predicted Probability of Quitting vs. Percent On-Site Weeks",
    x = "Percent On-Site Weeks",
    y = "Predicted Probability of Quitting"
  ) +
  theme_minimal()
```




```
# Performance impact

logit_mini_attrition %>%
  ggeffects::ggpredict(terms = "mean_overall_perf_z_score [all]") %>%
  plot() +
  labs(
    title = "Predicted Probability of Quitting vs. Mean Overall Performance Z-Score",
    x = "Mean Overall Performance Z-Score",
    y = "Predicted Probability of Quitting"
  ) +
  theme_minimal()
```




```
# Wage impact

logit_mini_attrition %>%
  ggeffects::ggpredict(terms = "median_gross_wage_cny [all]") %>%
  plot() +
  labs(
    title = "Predicted Probability of Quitting vs. Median Gross Wage (CNY)",
    x = "Median Gross Wage (CNY)",
    y = "Predicted Probability of Quitting"
  ) +
  theme_minimal()
```



This again reinforces the idea of WFH being the strongest factor, aswell as highlighting how the other variables also impact quitting probability.

Having children is not visualized since its a binary variable.

Explaining the independent variables.

WFH:

The variables that might explain Attrition and WFH : Exhaustion and Negative. Performance attributes dont influence quitting.

```
final_panel_weekly %>%
  group_by(WFH_due_building_issues) %>%
  skim()
```

Table 41: Data summary

Name	Piped data
Number of rows	10079
Number of columns	31
Column type frequency:	
Date	2
factor	4
numeric	24

Group variables	WFH_due_building_issues

Variable type: Date

skim_variable	WFH_due_building_issues	n_missing	complete_rate	min	max	median	n_unique
date	On-site	0	1	2022-01-03	2023-08-14	2022-08-22	85
date	Remote	0	1	2022-11-28	2023-08-14	2023-03-27	38
date	NA	0	1	2022-12-05	2023-08-28	2023-08-21	33
month	On-site	0	1	2022-01-01	2023-08-01	2022-08-01	20
month	Remote	0	1	2022-11-01	2023-08-01	2023-03-01	10
month	NA	0	1	2022-12-01	2023-08-01	2023-08-01	9

Variable type: factor

skim_variable	WFH_due_building_issues	n_missing	complete_rate	ordered	n_unique	top_counts
gender	On-site	0	1	FALSE	2	Fem: 4030, Mal: 3902
gender	Remote	0	1	FALSE	2	Mal: 1027, Fem: 911
gender	NA	0	1	FALSE	2	Mal: 135, Fem: 74
higher_edu_indicator	On-site	0	1	FALSE	2	No : 4779, Has: 3153
higher_edu_indicator	Remote	0	1	FALSE	2	No : 1142, Has: 796
higher_edu_indicator	NA	0	1	FALSE	2	No : 130, Has: 79
bedroom_indicator	On-site	0	1	FALSE	2	Has: 7741, No : 191
bedroom_indicator	Remote	0	1	FALSE	2	Has: 1871, No : 67
bedroom_indicator	NA	0	1	FALSE	2	Has: 203, No : 6
children_indicator	On-site	0	1	FALSE	2	No : 6778, Has: 1154
children_indicator	Remote	0	1	FALSE	2	No : 1683, Has: 255
children_indicator	NA	0	1	FALSE	2	No : 197, Has: 12

Variable type: numeric

skim_variable	WFH_due_building_issues	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
personid	On-site	0	1.00	32577.69	10564.39	4122.00	26328.00	36908.00	40322.00	45442.00	

skim_variable	WFH_due_building_issues	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
personid	Remote	0	1.00	32150.19	10859.48	4122.00	24324.00	36908.00	40472.00	44784.00	
personid	NA	0	1.00	33705.25	10066.62	4122.00	27704.00	36032.00	42152.00	45442.00	
year	On-site	0	1.00	2022.22	0.41	2022.00	2022.00	2022.00	2022.00	2023.00	
year	Remote	0	1.00	2022.85	0.36	2022.00	2023.00	2023.00	2023.00	2023.00	
year	NA	0	1.00	2022.96	0.19	2022.00	2023.00	2023.00	2023.00	2023.00	
week	On-site	0	1.00	24.47	14.30	1.00	12.00	24.00	36.00	53.00	
week	Remote	0	1.00	21.20	15.22	1.00	9.00	18.00	29.00	53.00	
week	NA	0	1.00	27.75	11.39	2.00	18.00	34.00	35.00	53.00	
exhaustion	On-site	6906	0.13	10.68	8.84	0.00	4.00	10.00	14.00	36.00	
exhaustion	Remote	794	0.59	6.66	5.99	0.00	0.00	6.00	11.00	36.00	
exhaustion	NA	0	1.00	9.13	8.36	0.00	2.00	7.00	13.00	36.00	
negative	On-site	6906	0.13	18.16	7.09	8.00	12.00	18.00	23.00	40.00	
negative	Remote	794	0.59	15.26	6.23	8.00	10.00	15.00	19.00	40.00	
negative	NA	0	1.00	16.90	7.29	8.00	11.00	16.00	21.00	40.00	
positive	On-site	6906	0.13	22.58	6.33	8.00	18.25	24.00	27.00	40.00	
positive	Remote	794	0.59	25.61	6.63	8.00	22.00	26.00	30.00	40.00	
positive	NA	0	1.00	24.61	6.73	8.00	21.00	24.00	29.00	40.00	
perform1	On-site	22	1.00	-0.06	1.00	-3.03	-0.65	0.02	0.59	4.16	
perform1	Remote	1	1.00	0.15	0.91	-2.99	-0.44	0.13	0.73	3.37	
perform1	NA	209	0.00	NaN	NA	NA	NA	NA	NA	NA	
phonecall	On-site	133	0.98	-0.04	0.99	-3.11	-0.57	0.05	0.59	5.83	
phonecall	Remote	1	1.00	0.10	0.85	-3.10	-0.43	0.12	0.65	3.37	
phonecall	NA	209	0.00	NaN	NA	NA	NA	NA	NA	NA	
phonecallraw	On-site	277	0.97	438.56	143.56	1.00	355.00	444.00	526.00	1264.00	
phonecallraw	Remote	4	1.00	446.77	138.20	2.00	361.00	449.00	529.75	1024.00	
phonecallraw	NA	209	0.00	NaN	NA	NA	NA	NA	NA	NA	
logphonecall	On-site	277	0.97	6.00	0.49	0.00	5.87	6.10	6.27	7.14	
logphonecall	Remote	4	1.00	6.04	0.43	0.69	5.89	6.11	6.27	6.93	
logphonecall	NA	209	0.00	NaN	NA	NA	NA	NA	NA	NA	
logcallpersec	On-site	273	0.97	-5.18	0.15	-5.95	-5.27	-5.18	-5.09	-3.18	
logcallpersec	Remote	6	1.00	-5.13	0.19	-5.65	-5.22	-5.13	-5.05	-1.10	
logcallpersec	NA	209	0.00	NaN	NA	NA	NA	NA	NA	NA	
logcalllength	On-site	273	0.97	11.18	0.53	3.18	11.06	11.28	11.45	12.12	
logcalllength	Remote	6	1.00	11.16	0.48	2.48	11.03	11.24	11.42	12.00	
logcalllength	NA	209	0.00	NaN	NA	NA	NA	NA	NA	NA	
logcall_dayworked	On-site	273	0.97	9.49	0.46	2.48	9.35	9.57	9.74	10.36	
logcall_dayworked	Remote	6	1.00	9.43	0.43	2.48	9.27	9.47	9.67	10.21	
logcall_dayworked	NA	209	0.00	NaN	NA	NA	NA	NA	NA	NA	
logdaysworked	On-site	0	1.00	1.67	0.30	0.00	1.61	1.79	1.79	1.95	
logdaysworked	Remote	0	1.00	1.74	0.20	0.00	1.61	1.79	1.79	1.95	
logdaysworked	NA	209	0.00	NaN	NA	NA	NA	NA	NA	NA	
basewage	On-site	12	1.00	1573.43	171.53	650.00	1500.00	1550.00	1650.00	2450.00	
basewage	Remote	0	1.00	1696.39	146.62	1300.00	1600.00	1700.00	1750.00	2300.00	
basewage	NA	0	1.00	1794.50	176.38	1500.00	1650.00	1800.00	1900.00	2150.00	
grosswage	On-site	12	1.00	3016.97	932.15	1264.43	2409.28	2804.00	3432.97	14553.00	
grosswage	Remote	0	1.00	3343.48	1103.61	1630.00	2616.00	3102.79	3852.00	11953.59	

skim_variable	WFH_due_building_issues	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
grosswage	NA	0	1.00	3759.56	1257.84	1740.00	3056.00	3445.00	4332.00	14553.00	
bonustotal	On-site	12	1.00	1443.54	860.02	0.00	894.00	1226.00	1822.10	12853.00	
bonustotal	Remote	0	1.00	1647.09	1045.57	5.00	982.81	1410.04	2114.67	10303.59	
bonustotal	NA	0	1.00	1965.06	1173.84	40.00	1324.00	1690.90	2444.00	12853.00	
promote_switch	On-site	0	1.00	0.19	0.39	0.00	0.00	0.00	0.00	1.00	
promote_switch	Remote	0	1.00	0.16	0.37	0.00	0.00	0.00	0.00	1.00	
promote_switch	NA	0	1.00	0.24	0.43	0.00	0.00	0.00	0.00	1.00	
quitjob	On-site	0	1.00	0.28	0.45	0.00	0.00	0.00	1.00	1.00	
quitjob	Remote	0	1.00	0.11	0.31	0.00	0.00	0.00	0.00	1.00	
quitjob	NA	0	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
costofcommute	On-site	0	1.00	7.23	6.76	0.00	3.00	6.00	10.00	55.00	
costofcommute	Remote	0	1.00	7.55	9.03	0.00	0.00	5.00	10.00	55.00	
costofcommute	NA	0	1.00	6.58	5.78	0.00	0.00	5.00	10.00	30.00	
age	On-site	0	1.00	23.67	3.28	18.00	22.00	23.00	25.00	35.00	
age	Remote	0	1.00	24.45	3.59	19.00	22.00	23.00	26.00	35.00	
age	NA	0	1.00	23.82	3.43	18.00	22.00	23.00	26.00	34.00	
tenure	On-site	0	1.00	21.65	18.58	2.00	8.00	15.00	31.00	94.00	
tenure	Remote	0	1.00	22.34	19.71	2.00	8.00	15.00	34.00	94.00	
tenure	NA	0	1.00	19.92	17.35	2.00	5.00	19.00	28.00	94.00	
commute	On-site	0	1.00	106.79	66.12	10.00	55.00	90.00	170.00	300.00	
commute	Remote	0	1.00	91.80	63.49	20.00	40.00	60.00	135.00	300.00	
commute	NA	0	1.00	100.45	64.47	20.00	40.00	80.00	140.00	300.00	
married	On-site	0	1.00	0.20	0.40	0.00	0.00	0.00	0.00	1.00	
married	Remote	0	1.00	0.18	0.39	0.00	0.00	0.00	0.00	1.00	
married	NA	0	1.00	0.09	0.29	0.00	0.00	0.00	0.00	1.00	

```r
exhaustion.WFH.model <- lm(exhaustion ~ WFH_due_building_issues,
                           data = final_panel_weekly)

stargazer(exhaustion.WFH.model,
          type = "text",
          title = "Regression Results: Exhaustion and WFH",
          no.space = TRUE, header = FALSE, font.size = 'scriptsize')
```

```
##
## Regression Results: Exhaustion and WFH
## =========================================================
##                                  Dependent variable:
##                              ---------------------------
##                                      exhaustion
## ---------------------------------------------------------
## WFH_due_building_issuesRemote         -4.019***
##                                        (0.321)
## Constant                              10.681***
##                                        (0.233)
## ---------------------------------------------------------
## Observations                            2,170
## R2                                      0.067
## Adjusted R2                             0.067
## Residual Std. Error               7.475 (df = 2168)
## F Statistic                   156.352*** (df = 1; 2168)
```

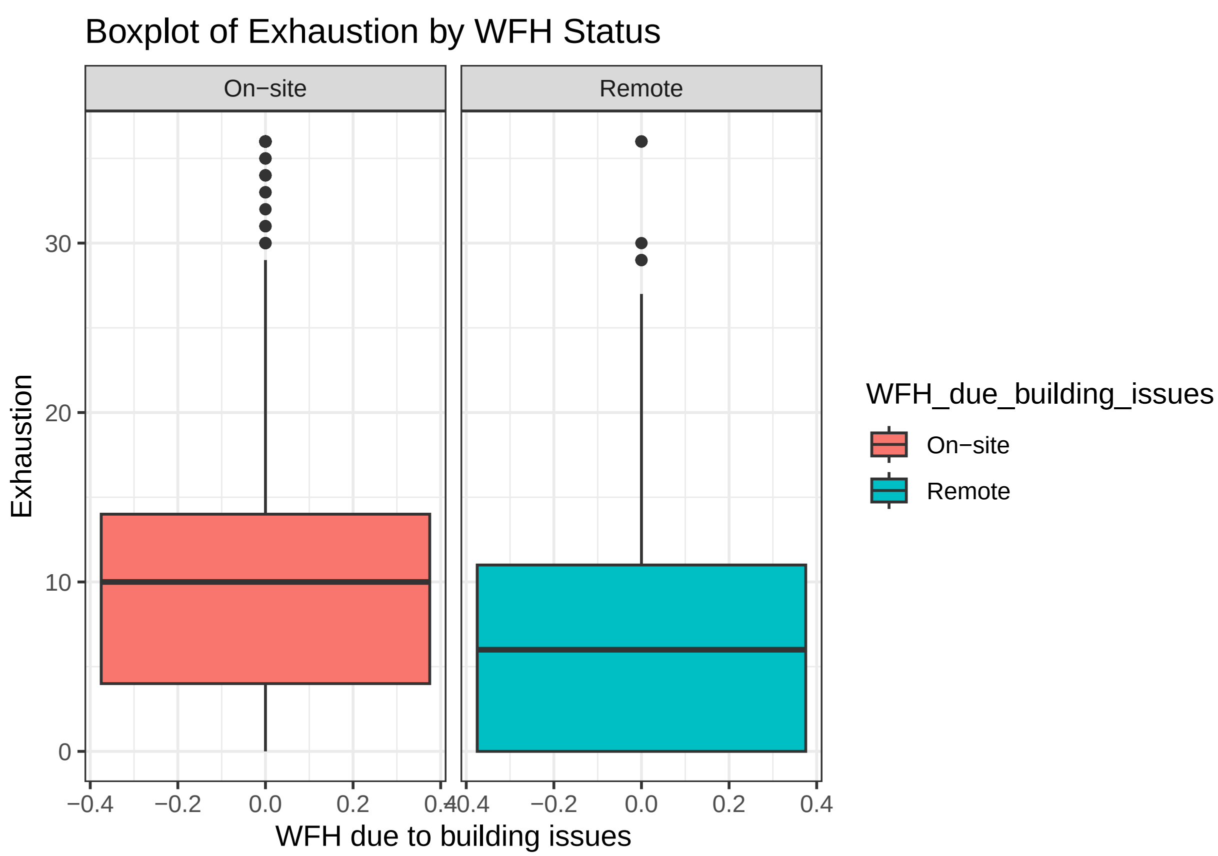
```
## ============================================================
## Note:                          *p<0.1; **p<0.05; ***p<0.01
```

```r
mean(final_panel_weekly$exhaustion, na.rm = TRUE)
```

```
## [1] 8.612863
```

Very relevant results.

```r
plot.attrition.df <- final_panel_weekly %>%
  filter(!is.na(WFH_due_building_issues),
         !is.na(exhaustion))


ggplot(plot.attrition.df, aes( y = exhaustion, fill = WFH_due_building_issues)) +
  geom_boxplot() +
  facet_wrap(~ WFH_due_building_issues) +
  labs(
    x = "WFH due to building issues",
    y = "Exhaustion"
  ) +
  ggtitle("Boxplot of Exhaustion by WFH Status") + theme_bw()
```



WFH is related to Exhaustion. Give more WFH days to fix exhaustion.

Children:

Factors to influence attrition: Exhaustion.

```
children.exhaustion.model <- lm(exhaustion ~ children_indicator,
                                data = final_panel_weekly)

stargazer(children.exhaustion.model,
          type = "text",
          title = "Regression Results: Exhaustion and Children",
          no.space = TRUE, header = FALSE, font.size = 'scriptsize')
```

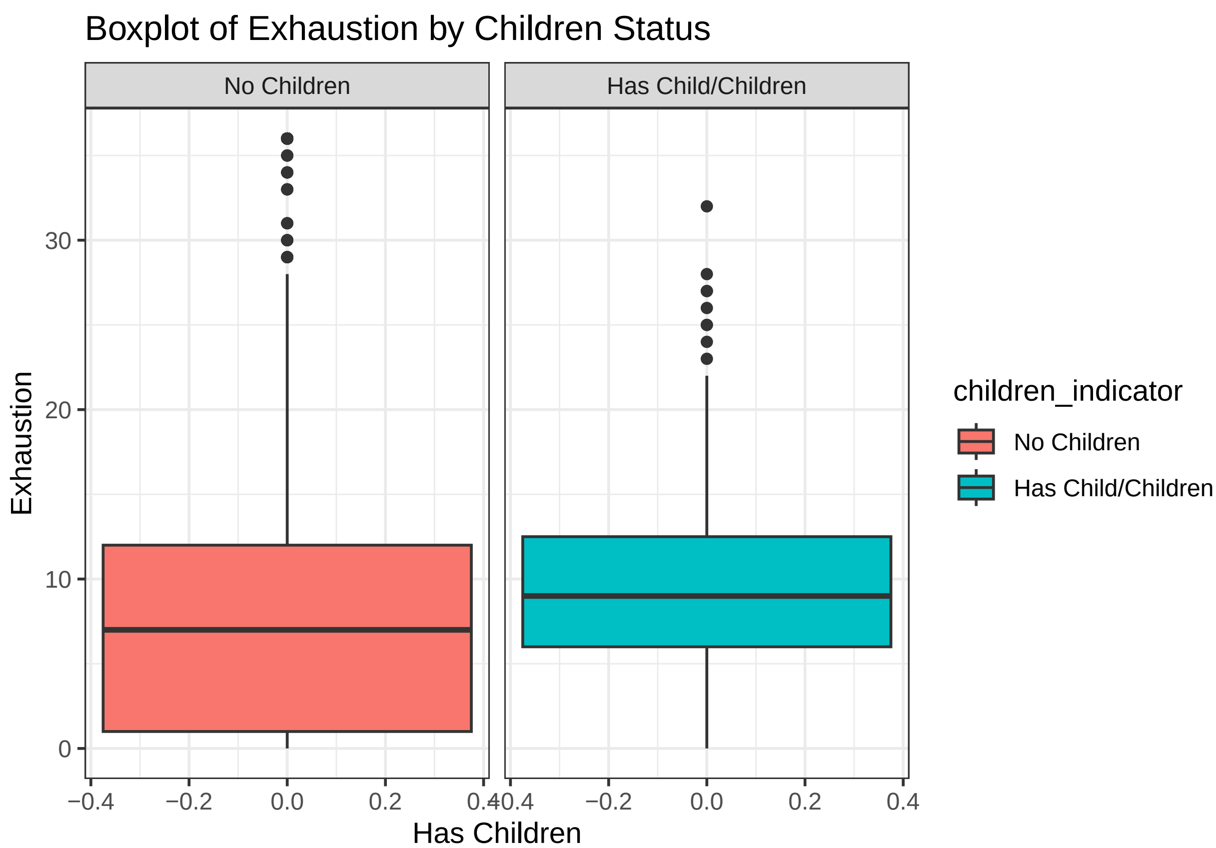
```
##
## Regression Results: Exhaustion and Children
## ================================================================
##                                          Dependent variable:
##                                      ---------------------------
##                                              exhaustion
## ----------------------------------------------------------------
## children_indicatorHas Child/Children          1.517***
##                                               (0.582)
## Constant                                      8.489***
##                                               (0.167)
## ----------------------------------------------------------------
## Observations                                   2,379
## R2                                             0.003
## Adjusted R2                                    0.002
## Residual Std. Error                      7.785 (df = 2377)
## F Statistic                           6.794*** (df = 1; 2377)
## ================================================================
## Note:                                *p<0.1; **p<0.05; ***p<0.01
```

```
mean(final_panel_weekly$exhaustion, na.rm = TRUE)
```

```
## [1] 8.612863
```

Relevant to mention having kids increases exhaustion.

```
plot.children.df <- final_panel_weekly %>%
  filter(!is.na(children_indicator),
         !is.na(exhaustion))

ggplot(plot.children.df, aes( y = exhaustion, fill = children_indicator)) +
  geom_boxplot() +
  facet_wrap(~ children_indicator) +
  labs(
    x = "Has Children",
    y = "Exhaustion"
  ) +
  ggtitle("Boxplot of Exhaustion by Children Status") + theme_bw()
```



To fix this, we might give work from home options to employees with children have a daycare present?

Although there is no direct data to relate quitting and exhaustion, since the ones who quit are from two groups (children == YES and WFH == NO) and these groups have significant higher exhaustion levels, we can assume that exhaustion is a key driver in quitting. To reduce quitting, we need to reduce exhaustion.

```
final_panel_weekly %>%
  group_by(quitjob, WFH_due_building_issues) %>%
  summarise(n())
```

```
## `summarise()` has grouped output by 'quitjob'. You can override using the
## `.groups` argument.
```

```
## # A tibble: 5 x 3
## # Groups:   quitjob [2]
##   quitjob WFH_due_building_issues `n()`
##     <dbl> <fct>                   <int>
## 1       0 On-site                  5742
## 2       0 Remote                   1727
## 3       0 <NA>                      209
## 4       1 On-site                  2190
## 5       1 Remote                    211
```

```
final_panel_weekly %>%
  filter(!is.na(quitjob),
         !is.na(WFH_due_building_issues)) %>%
```

```r
  tabyl(quitjob, WFH_due_building_issues) %>%
  adorn_totals(c('row', 'col')) %>%
  adorn_percentages("row") %>%
  adorn_pct_formatting(digits = 1) %>%
  adorn_ns('rear')
```

```
##  quitjob       On-site        Remote          Total
##        0 76.9% (5,742) 23.1% (1,727) 100.0% (7,469)
##        1 91.2% (2,190)  8.8%   (211) 100.0% (2,401)
##    Total 80.4% (7,932) 19.6% (1,938) 100.0% (9,870)
```

```r
final_all %>%
  filter(!is.na(quitjob),
         !is.na(children_indicator)) %>%
  tabyl(quitjob, children_indicator) %>%
  adorn_totals(c('row', 'col')) %>%
  adorn_percentages("row") %>%
  adorn_pct_formatting(digits = 1) %>%
  adorn_ns('rear')
```

```
##  quitjob No Children Has Child/Children        Total
##        0 88.4%  (84)         11.6% (11) 100.0%  (95)
##        1 77.5%  (31)         22.5%  (9) 100.0%  (40)
##    Total 85.2% (115)         14.8% (20) 100.0% (135)
```

WFH is truly the key driver for quitting.

Simple Difference in Difference analysis for WFH_due_building_issues without controls

Looking at the Difference-in-Differences for `WFH_due_building_issues` to understand the impact this event had on the performance of employees who were forced to work from home due to building issues. The execution follows the steps learned in Lab 7.

1. **Defined the treatment event and window** around the onset of building issues, focusing on the period from the start of disruptions onward.
2. **Specified the treatment and control groups:** employees affected by `WFH_due_building_issues` (forced to work remotely) versus comparable on-site workers who remained unaffected.
3. **Selected performance outcomes as the primary dependent variables** to quantify changes in productivity before and after the building-issues shock.
4. **Constructed the core DiD design** using an interaction of `Post` (after building issues) $\times$ `Treated` (`WFH_due_building_issues`), with the pre-period capturing the baseline when all relevant employees were on-site.
5. **Estimated baseline DiD models** with unit and time fixed effects to control for time-invariant individual differences and common temporal shocks.
6. Because there was only one group before the event, empirical pre-trend tests are not feasible. Instead, identification relies on the exogenous and unanticipated nature of the building-issues shock and the plausibly random assignment into forced WFH. There were no indications of other systematic reasons for group assignment.

First we create the DiD panel data to ensure that there are no `NA` values for `performance`.

```
# Creating the DiD panel data

panel_DiD <- final_panel_weekly %>%
  filter(date >= as.Date("2022-01-01"),
         date <= as.Date("2023-08-14")) %>%
  mutate(
    post = ifelse(date >= as.Date("2022-12-12"), 1, 0)
  )
```

Next we create the treatment variable based on whether the person ever had `WFH_due_building_issues` during the period.

```
#define group that gets treated (treat)
#treat = 1, if person has to switch to home office because of building issues
#otherwise = 0

panel_DiD <- panel_DiD %>%
  group_by(personid) %>%
  mutate(
    treat = ifelse(any(WFH_due_building_issues == "Remote"), 1, 0)
  ) %>%
  ungroup()

# Check if we have both groups in the periods

table(panel_DiD$treat, panel_DiD$post)
```

```
##
##         0    1
##    0 2316 1204
##    1 3068 2198
```

we then create a missing variable to identify individuals with missing performance in any period or not enough periods (in this case less than 2)

```
missing_by_person <- panel_DiD %>%
  group_by(personid) %>%
  summarise(
    n_periods = n_distinct(post),
    any_na    = any(is.na(perform1)),
    missing   = ifelse(n_periods < 2 | any_na, 1, 0),
    .groups   = "drop"
  )

panel_DiD <- panel_DiD %>%
  left_join(missing_by_person, by = "personid")

# Balance-Overview
table(panel_DiD$missing)
```

```
##
```

```
##    0    1
## 7220 2737
```

```r
table(panel_DiD$treat, panel_DiD$missing)
```

```
##
##        0    1
##   0 3392  128
##   1 3828 1438
```

Now we create the balanced panel by filtering out individuals with missing `performance` in any period or not enough periods.

```r
panel_balanced <- panel_DiD %>%
  filter(missing == 0)

# check
table(panel_balanced$treat, panel_balanced$post)
```

```
##
##        0    1
##   0 2239 1153
##   1 2293 1535
```

Now we can calculate the means for each group and period to see the differences.

```r
#Calculating DiD_means

did_means <- panel_balanced %>%
  group_by(treat, post) %>%
  summarise(
    mean_perf = mean(perform1, na.rm = TRUE),
    n         = n(),
    .groups   = "drop"
  )

did_means
```

```
## # A tibble: 4 x 4
##   treat  post mean_perf     n
##   <dbl> <dbl>     <dbl> <int>
## 1     0     0  -0.00184  2239
## 2     0     1  -0.157    1153
## 3     1     0  -0.00173  2293
## 4     1     1   0.171    1535
```

Now we can calculate the DiD estimate manually

```r
treat_pre  <- did_means$mean_perf[did_means$treat == 1 & did_means$post == 0]
treat_post <- did_means$mean_perf[did_means$treat == 1 & did_means$post == 1]
ctrl_pre   <- did_means$mean_perf[did_means$treat == 0 & did_means$post == 0]
```

```r
ctrl_post  <- did_means$mean_perf[did_means$treat == 0 & did_means$post == 1]

DiD_manual <- (treat_post - treat_pre) - (ctrl_post - ctrl_pre)
print(DiD_manual)
```

```
## [1] 0.3270175
```

and plot it afterwards

```r
did_means_plot <- did_means %>%
  mutate(
    group_label = ifelse(treat == 1,
                         "WFH due to building issues",
                         "Remain working on-site")
  )

ggplot(did_means_plot,
       aes(x = post, y = mean_perf,
           color = group_label, group = group_label)) +
  geom_line(size = 1) +
  geom_point(size = 3) +
  scale_x_continuous(breaks = c(0, 1),
                     labels = c("Pre", "Post")) +
  labs(
    title = "Difference-in-Differences: Performance by Work Location",
    x = "Period",
    y = "Average performance (perform1)",
    color = "Group"
  ) +
  theme_minimal()
```

```
## Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.
## i Please use `linewidth` instead.
## This warning is displayed once every 8 hours.
## Call `lifecycle::last_lifecycle_warnings()` to see where this warning was
## generated.
```

Finally, we run the regression to look at our results

```
did_reg0 <- lm(
  perform1 ~ treat * post,
  data = panel_balanced
)

stargazer(did_reg0,
          type = "text",
          title = "DiD Regression without Controls",
          dep.var.labels = "Performance (perform1)",
          covariate.labels = c("Treatment (treat)",
                               "Post Period (post)",
                               "Treatment x Post Interaction"),
          star.cutoffs = c(0.05, 0.01, 0.001),
          notes = "Standard errors")
```

```
##
## DiD Regression without Controls
## ===========================================================
##                                   Dependent variable:
##                              -----------------------------
##                                 Performance (perform1)
## -----------------------------------------------------------
## Treatment (treat)                        0.0001
##                                         (0.030)
```

```
##
## Post Period (post)                      -0.155***
##                                          (0.037)
##
## Treatment x Post Interaction            0.327***
##                                          (0.050)
##
## Constant                                 -0.002
##                                          (0.021)
##
## ------------------------------------------------------------
## Observations                              7,220
## R2                                        0.010
## Adjusted R2                               0.009
## Residual Std. Error                 1.011 (df = 7216)
## F Statistic                    23.557*** (df = 3; 7216)
## ============================================================
## Note:                        *p<0.05; **p<0.01; ***p<0.001
##                                             Standard errors
```

Interpretation of DiD Results without Controls

The DiD results without controls suggest a clear positive performance effect of forced WFH due to building issues. The treatment-group baseline difference in the pre-period is essentially zero and not significant (**Treatment = 0.0001**, **SE = 0.030**), indicating that treated and non-treated employees had comparable `performance` before the disruption. After the building issues began, performance in the control group declined significantly (**Post = -0.155**, **SE = 0.037**, **p < 0.001**).

Crucially, the **Treatment × Post** interaction is **positive and highly significant** (**0.327**, **SE = 0.050**, **p < 0.001**). This is the DiD estimate and implies that employees who were forced to work remotely experienced a **0.327-unit higher change** in `performance` relative to those who remained on-site after the building issues started. Put differently, while the on-site group shows a drop of **−0.155**, the treated group's implied change is **−0.155 + 0.327 = +0.172**, suggesting a **net improvement in performance** for the forced-WFH group during the post period.

Overall, this baseline model (**N = 7,220**) indicates that the building-issues-driven shift to remote work is associated with a **statistically significant relative increase in performance**, even though the overall explanatory power is modest (**R^2 = 0.010**), which is typical for parsimonious DiD specifications.

Appendix

Panel-Regression (Bonus)

After completing the exploratory data analysis and gaining an initial understanding of weekly employee outcomes and group differences, the next step is to estimate **panel data models** to quantify the impact of the building-issue-induced shift to working from home. The dataset final_panel_weekly contains repeated weekly observations for employees (personid) over time (year_week), which allows us to control for unobserved, time-invariant individual heterogeneity and common time shocks.

Given the building issues that started on **12.12.2022**, we implement a **Difference-in-Differences (DiD) framework in a panel setting** by constructing a treatment structure that distinguishes between (i) employees who were ever affected by the event and (ii) the post-event period. The key treatment variable is defined as the interaction of these two components (wfh_post = treated × post). This setup enables the estimation of causal effects under the standard **parallel trends assumption**.

Following the course approach, we estimate and compare multiple specifications: **Pooled OLS, First Differences (FD), and Fixed Effects (FE)** with **time dummies**. Since the panel is not fully balanced, the FE estimator still remains appropriate and uses all available information. To **address** potential **serial correlation in weekly panel errors**, we complement the baseline results with **robust/cluster-robust standard errors.**

The following section presents a short descriptive summary followed by the panel regression specifications and R code in the exact sequence used during the analysis.

Panel Regression Strategy for the Building-Issue WFH Shock

1. **Defined the panel structure** using employee IDs (personid) and weekly time identifiers (year_week).
2. **Constructed the DiD** design by creating: treated: indicator for employees ever affected by the building issue, post: indicator for weeks after 12.12.2022, wfh_post = treated × post: main DiD treatment variable.
3. **Checked the panel balance and documented that the dataset is unbalanced**
4. **Assessed the parallel trends assumption** using descriptive group comparisons over time.
5. **Estimated baseline pooled models** with weekly time dummies to establish initial effect directions.
6. **Estimated FD models** as an alternative way to remove time-invariant individual heterogeneity.
7. **Estimated two-way FE models** with individual and weekly fixed effects as the preferred specification.
8. **Compared coefficient stability** across Pooled OLS, FD, and FE models to assess robustness.
9. **Tested for serial correlation** in the FE residuals using the Breusch–Godfrey/Wooldridge test.
10. **Reported robust inference** by using heteroskedasticity- and serial-correlation-consistent standard errors.

```r
# creating a tibble to work with

tb <- as_tibble(final_panel_weekly)

# last two weeks have no performance data so we remove them from our regression
tb <- tb %>%
  filter(!(year == 2023 & week %in% c(34, 35)))
```

we did a quick data type check to ensure data types are in the correct formats for our regression

```r
if ("date" %in% names(tb)) {
  tb <- tb %>%
    mutate(date = as.Date(date))
}

tb <- tb %>%
  mutate(
    year = as.integer(year),
    week = as.integer(week)
```

```r
  )

# creating time identifier
tb <- tb %>%
  mutate(
    year_week = paste0(year, "-", sprintf("%02d", week))
  )
```

Next, we also check the WFH indicator robustly and consistently, ensuring that `WFH_due_building_issues` is stored as a numeric 0/1 variable.

```r
# checking the WFH indicator

if ("WFH_due_building_issue" %in% names(tb)) {
  # If already exists, coerce safely to integer 0/1
  tb <- tb %>%
    mutate(
      WFH_due_building_issue = as.integer(as.character(WFH_due_building_issue))
    )

} else if ("WFH_due_building_issues" %in% names(tb)) {
  # If plural version exists, possibly character like "Remote"
  tb <- tb %>%
    mutate(
      WFH_due_building_issue = case_when(
        is.numeric(WFH_due_building_issues) ~ as.integer(WFH_due_building_issues),
        as.character(WFH_due_building_issues) %in% c("Remote", "WFH", "Yes", "1") ~ 1L,
        TRUE ~ 0L
      )
    )

} else {
  # Fallback to avoid breaking the code
  tb <- tb %>% mutate(WFH_due_building_issue = 0L)
}

# Replace NA with 0 to be safe
tb <- tb %>%
  mutate(WFH_due_building_issue = replace_na(WFH_due_building_issue, 0L))
```

after that we start to define our post period which starts from the date of building issues, in our case the 12th of December 2022.

```r
# defining post period with the date but in case there is the problem with the week number as backup

if ("date" %in% names(tb)) {
  tb <- tb %>%
    mutate(post = as.integer(date >= as.Date("2022-12-12")))
} else {
  tb <- tb %>%
    mutate(post = as.integer(year > 2022 | (year == 2022 & week >= 50)))
}
```

```r
# Replace NA with 0
tb <- tb %>% mutate(post = replace_na(post, 0L))
```

Next, we create the "treated" indicator at the person level and the standard DiD treatment variable. In theory this should equal our already existing indicator (WFH_due_building_issue) but we include this step to be sure and safe.

```r
# treated indicator at person level
tb <- tb %>%
  group_by(personid) %>%
  mutate(treated = max(WFH_due_building_issue, na.rm = TRUE)) %>%
  ungroup()

# standard DiD treatment variable: treated * post
tb <- tb %>%
  mutate(wfh_post = treated * post)
```

summary statistics to check that everything is in numeric

```r
sum_df <- tb %>%
  transmute(
    perform1 = as.numeric(perform1),
    phonecall = as.numeric(phonecall),
    phonecallraw = as.numeric(phonecallraw),
    logphonecall = if ("logphonecall" %in% names(tb)) as.numeric(logphonecall) else NA_real_,
    WFH_due_building_issue = as.numeric(WFH_due_building_issue),
    treated = as.numeric(treated),
    post = as.numeric(post),
    wfh_post = as.numeric(wfh_post)
  )

stargazer(
  as.data.frame(sum_df),
  median = TRUE,
  type = "text",
  header = FALSE, font.size = "small",
  title = "Summary Statistics"
)
```

```
##
## Summary Statistics
## =================================================================
## Statistic                N     Mean   St. Dev.  Min   Median  Max
## -----------------------------------------------------------------
## perform1               9,847 -0.016   0.987   -3.031 0.046   4.163
## phonecall              9,736 -0.008   0.964   -3.113 0.066   5.828
## phonecallraw           9,589 440.214 142.528    1      445   1,264
## logphonecall           9,589  6.010   0.481   0.000  6.098   7.142
## WFH_due_building_issue 9,957  0.195   0.396     0       0      1
## treated                9,957  0.529   0.499     0       1      1
## post                   9,957  0.397   0.489     0       0      1
## wfh_post               9,957  0.221   0.415     0       0      1
## -----------------------------------------------------------------
```

in the next step we check for panel balance.

```r
# Check for panel balance

tb %>%
  dplyr::select(year_week, personid) %>%
  table()
```

```
##          personid
## year_week 4122 6278 7720 8834 8854 10098 10356 12426 12974 13980 14048 14220
##   2022-01    1    1    1    1    0     1     1     0     1     1     1     0
##   2022-02    1    1    1    1    1     1     1     1     1     1     1     1
##   2022-03    1    1    1    1    1     1     1     1     1     1     1     1
##   2022-04    1    1    1    1    1     1     1     1     1     1     1     1
##   2022-05    1    1    1    1    0     1     1     1     1     1     1     1
##   2022-06    1    1    1    1    0     1     1     1     1     1     1     1
##   2022-07    1    1    1    1    0     1     1     1     1     1     1     1
##   2022-08    1    1    1    1    1     1     1     1     1     1     1     1
##   2022-09    1    1    1    1    1     1     1     1     1     1     1     1
##   2022-10    1    1    1    1    1     1     1     1     1     1     1     1
##   2022-11    1    1    1    1    1     1     1     1     1     1     1     1
##   2022-12    1    1    1    1    1     1     1     1     1     1     1     1
##   2022-13    1    1    1    1    1     1     1     1     1     1     1     1
##   2022-14    1    1    0    1    1     1     1     1     1     1     1     1
##   2022-15    1    0    0    1    1     1     1     0     1     1     1     1
##   2022-16    1    0    0    1    1     1     1     0     1     1     1     1
##   2022-17    1    0    0    1    1     1     1     0     1     1     1     1
##   2022-18    1    1    0    1    1     1     1     0     1     1     1     1
##   2022-19    1    1    1    1    1     1     1     0     1     1     1     1
##   2022-20    1    1    1    1    1     1     1     0     1     1     1     1
##   2022-21    1    1    1    1    1     1     1     1     1     1     1     1
##   2022-22    1    0    0    1    1     1     1     0     1     1     1     1
##   2022-23    1    0    0    1    1     1     1     0     1     1     1     1
##   2022-24    1    0    0    1    1     1     1     0     1     1     1     1
##   2022-25    1    0    0    1    1     1     1     0     1     1     1     1
##   2022-26    1    0    0    1    1     1     1     0     1     1     1     1
##   2022-27    1    0    0    1    1     1     1     0     1     1     1     1
##   2022-28    1    0    0    1    1     1     1     0     1     1     1     1
##   2022-29    1    0    0    1    1     1     1     0     1     1     1     1
##   2022-30    1    0    0    1    1     1     1     0     1     1     1     1
##   2022-31    1    0    0    1    1     1     1     0     1     1     1     1
##   2022-32    1    0    0    1    1     1     1     0     1     1     1     1
##   2022-33    1    0    0    1    1     1     1     0     1     1     1     1
##   2022-34    1    1    1    1    1     1     1     0     1     1     1     1
##   2022-35    1    1    1    1    1     1     1     0     1     1     1     1
##   2022-36    1    1    1    1    1     1     1     1     1     1     1     1
##   2022-37    1    1    1    1    1     1     1     1     1     1     1     1
##   2022-38    1    1    1    1    1     1     1     1     1     1     1     1
##   2022-39    1    1    1    1    1     1     1     1     1     1     1     1
##   2022-40    1    1    1    1    1     1     1     1     1     1     0     1
##   2022-41    1    1    1    1    1     1     1     1     1     1     1     1
##   2022-42    1    1    1    1    1     1     1     1     1     1     1     1
##   2022-43    1    1    1    1    1     1     1     1     1     1     1     1
##   2022-44    1    1    1    1    1     1     1     1     1     1     0     1
```

```
##    2022-45     1     1     1     1     1      1      1      1      1      1      1      1
##    2022-46     1     0     1     1     1      1      1      1      1      1      1      1
##    2022-47     1     0     1     1     1      1      1      1      1      1      1      1
##    2022-48     1     1     1     1     1      1      1      0      1      1      1      1
##    2022-49     1     1     1     1     1      1      1      0      1      1      1      1
##    2022-50     1     1     1     1     1      0      1      0      1      1      1      1
##    2022-51     1     1     1     1     1      0      1      0      1      1      1      1
##    2022-52     1     1     1     1     1      1      1      0      1      1      1      1
##    2022-53     1     1     1     1     1      1      1      0      1      1      1      1
##    2023-01     1     1     1     1     1      0      1      0      1      1      1      1
##    2023-02     1     1     1     1     1      0      1      0      1      1      1      1
##    2023-03     1     1     1     1     1      0      1      0      1      1      1      1
##    2023-04     1     1     1     1     1      0      1      0      1      1      1      1
##    2023-05     1     1     1     1     1      0      1      0      1      1      1      1
##    2023-06     1     1     1     1     1      0      1      0      1      1      1      1
##    2023-07     1     1     1     1     1      0      1      0      1      1      1      1
##    2023-08     1     1     1     1     1      0      1      0      1      1      1      1
##    2023-09     1     1     1     1     1      0      1      0      1      1      1      1
##    2023-10     1     1     1     1     1      0      1      0      1      1      1      1
##    2023-11     1     1     1     1     1      0      1      0      1      1      1      1
##    2023-12     1     1     1     1     1      0      1      0      1      1      1      1
##    2023-13     1     1     1     1     1      0      1      0      1      1      1      0
##    2023-14     1     1     1     1     1      0      1      0      1      1      1      0
##    2023-15     1     1     1     1     1      0      1      0      1      1      1      0
##    2023-16     1     1     1     1     1      0      1      0      1      1      1      0
##    2023-17     1     1     1     1     1      0      1      1      1      1      1      0
##    2023-18     1     1     1     1     1      0      1      0      1      1      1      0
##    2023-19     1     1     1     1     1      0      1      0      1      1      1      0
##    2023-20     1     1     1     1     1      0      1      0      1      1      1      0
##    2023-21     1     1     1     1     1      0      1      0      1      1      1      0
##    2023-22     1     1     1     1     1      0      1      0      1      1      1      0
##    2023-23     1     1     1     1     1      0      1      0      1      1      1      0
##    2023-24     1     1     1     1     1      0      1      0      1      1      1      0
##    2023-25     1     1     1     1     1      0      1      0      1      1      1      0
##    2023-26     1     1     1     1     1      0      1      0      1      1      1      0
##    2023-27     1     1     1     1     1      0      1      0      1      1      1      0
##    2023-28     1     0     1     1     1      0      1      0      1      1      1      0
##    2023-29     1     1     1     1     1      0      1      0      1      1      1      0
##    2023-30     1     1     1     1     1      0      1      0      1      1      1      0
##    2023-31     1     1     1     1     1      0      1      0      1      1      1      0
##    2023-32     1     1     1     1     1      0      1      0      1      1      1      0
##    2023-33     1     1     1     1     1      0      1      0      1      1      1      0
##          personid
## year_week 14522 14528 15444 16334 16422 16424 16514 16594 16596 17160 17906
##    2022-01     1     0     1     0     1     1     1     0     1     0     0
##    2022-02     1     1     1     1     1     1     1     1     1     1     1
##    2022-03     1     1     1     1     1     1     1     1     1     1     1
##    2022-04     1     1     1     1     1     1     1     1     1     1     1
##    2022-05     1     1     1     1     1     1     1     1     1     1     1
##    2022-06     1     1     1     1     1     1     1     1     1     1     1
##    2022-07     1     1     1     1     1     1     1     1     1     1     1
##    2022-08     1     0     1     1     1     1     1     1     1     1     1
##    2022-09     1     1     1     1     1     1     1     1     1     1     1
##    2022-10     1     1     1     1     1     1     1     1     1     1     1
```

```
##    2022-11      1     1     1     1     1     1     1     1     1     1     1
##    2022-12      1     1     1     1     1     1     1     1     1     1     1
##    2022-13      1     1     1     1     1     1     1     1     1     1     1
##    2022-14      1     1     1     1     0     1     1     0     1     0     0
##    2022-15      1     1     1     1     0     1     1     0     1     1     0
##    2022-16      1     1     1     1     0     1     1     0     1     1     0
##    2022-17      1     1     1     1     0     1     1     0     1     1     0
##    2022-18      1     1     1     1     0     1     1     0     1     1     0
##    2022-19      1     1     1     1     0     1     1     1     1     1     1
##    2022-20      1     1     1     1     0     1     1     1     1     1     1
##    2022-21      1     1     1     1     0     1     1     1     1     1     1
##    2022-22      1     0     0     1     0     1     1     1     1     0     0
##    2022-23      1     0     0     1     0     1     1     1     1     1     0
##    2022-24      1     0     0     1     0     1     1     1     1     0     0
##    2022-25      1     0     0     1     0     1     1     1     1     0     0
##    2022-26      1     0     0     1     1     1     1     1     1     0     0
##    2022-27      1     0     0     1     1     1     1     1     1     0     0
##    2022-28      1     0     0     1     1     1     1     1     1     0     0
##    2022-29      1     0     0     1     1     1     1     1     1     0     0
##    2022-30      1     0     0     1     1     1     1     1     1     0     1
##    2022-31      1     0     0     1     1     1     1     1     1     0     1
##    2022-32      1     0     0     1     1     1     1     1     1     0     1
##    2022-33      1     0     0     1     0     1     1     1     1     0     1
##    2022-34      1     0     1     1     0     1     1     1     1     1     1
##    2022-35      1     1     1     1     1     1     1     1     1     1     1
##    2022-36      1     1     1     1     1     1     1     0     1     1     0
##    2022-37      1     1     1     1     1     1     1     1     1     1     0
##    2022-38      1     1     1     1     1     1     1     1     1     1     0
##    2022-39      1     1     1     1     1     1     1     1     1     1     0
##    2022-40      1     1     1     1     1     1     1     1     1     1     0
##    2022-41      0     1     1     1     1     1     1     1     1     1     0
##    2022-42      0     1     0     1     1     1     1     1     1     1     1
##    2022-43      1     1     1     1     1     1     1     1     1     1     1
##    2022-44      1     1     1     1     1     1     1     1     1     1     1
##    2022-45      1     1     1     1     1     1     0     1     1     1     0
##    2022-46      1     1     1     1     1     0     1     1     1     1     1
##    2022-47      1     1     1     1     1     1     1     1     1     1     1
##    2022-48      0     1     1     1     1     1     1     1     1     1     1
##    2022-49      1     1     1     1     1     1     1     0     1     1     1
##    2022-50      1     1     1     1     1     1     1     1     1     1     1
##    2022-51      1     1     1     1     1     1     1     1     1     1     1
##    2022-52      1     1     1     1     1     1     1     0     1     1     1
##    2022-53      1     1     1     1     1     1     1     1     1     1     1
##    2023-01      1     1     1     0     0     1     1     1     1     1     1
##    2023-02      1     1     1     0     0     1     1     1     1     1     1
##    2023-03      1     0     1     0     0     1     1     1     1     1     1
##    2023-04      1     1     1     0     0     1     1     0     1     1     0
##    2023-05      1     1     1     0     0     1     1     0     1     1     1
##    2023-06      1     1     1     0     0     1     1     1     1     1     1
##    2023-07      1     1     0     0     0     1     1     1     1     1     1
##    2023-08      1     1     1     0     0     1     1     1     1     1     0
##    2023-09      1     1     1     0     0     1     1     1     1     0     1
##    2023-10      1     1     1     0     0     1     1     1     1     1     1
##    2023-11      1     1     1     0     0     1     1     0     1     1     1
```

```
##    2023-12     1     1     1     0     0     1     1     1     1     1     1
##    2023-13     1     1     1     0     0     1     1     1     1     1     0
##    2023-14     1     1     1     0     0     1     1     1     1     1     0
##    2023-15     1     1     1     0     0     1     1     1     1     1     0
##    2023-16     1     1     1     0     0     1     1     1     1     1     0
##    2023-17     1     1     1     0     0     1     1     0     1     1     0
##    2023-18     1     1     1     0     0     1     1     0     1     1     0
##    2023-19     1     1     1     0     0     1     1     0     1     1     0
##    2023-20     1     1     1     0     0     1     1     0     1     1     0
##    2023-21     1     1     1     0     0     1     1     0     1     1     0
##    2023-22     1     1     1     0     0     1     1     0     1     1     0
##    2023-23     1     1     1     0     0     1     1     0     1     1     0
##    2023-24     1     1     1     0     0     1     1     0     1     1     0
##    2023-25     1     1     1     0     0     1     1     0     1     1     0
##    2023-26     1     1     1     0     0     1     1     0     1     1     0
##    2023-27     1     1     1     0     0     1     1     0     1     1     0
##    2023-28     1     1     1     0     0     1     1     0     1     1     0
##    2023-29     1     1     1     0     0     1     1     0     1     1     0
##    2023-30     1     1     1     0     0     1     1     0     1     1     0
##    2023-31     1     1     1     0     0     1     1     0     1     1     0
##    2023-32     1     1     1     0     0     1     1     0     1     1     0
##    2023-33     1     1     1     0     0     1     1     0     1     1     0
##          personid
## year_week 19470 21654 22284 23136 23228 23772 24324 24608 25520 25638 25864
##    2022-01     1     0     1     1     0     1     1     1     1     1     1
##    2022-02     1     1     1     1     1     1     1     1     1     1     1
##    2022-03     1     1     1     1     1     1     1     0     1     1     1
##    2022-04     1     1     1     1     1     1     1     1     1     1     1
##    2022-05     1     0     1     1     1     1     1     1     1     1     1
##    2022-06     1     0     1     1     1     1     1     1     1     1     1
##    2022-07     1     0     1     1     1     1     1     1     1     1     1
##    2022-08     1     1     1     1     1     1     1     1     1     1     1
##    2022-09     1     1     1     1     1     1     1     1     1     1     1
##    2022-10     1     1     1     1     1     1     1     1     1     1     1
##    2022-11     1     1     1     1     1     1     1     1     1     1     1
##    2022-12     1     1     1     1     1     1     1     1     1     1     1
##    2022-13     1     1     1     1     1     1     1     1     1     1     1
##    2022-14     1     1     1     1     0     1     1     1     1     1     0
##    2022-15     1     1     1     1     0     1     1     1     1     1     0
##    2022-16     1     1     1     1     0     1     1     1     1     1     0
##    2022-17     1     1     1     1     0     1     1     1     1     1     0
##    2022-18     1     1     1     1     0     1     1     1     1     1     0
##    2022-19     1     1     1     1     1     1     1     1     1     1     1
##    2022-20     1     1     1     1     1     1     1     1     1     1     1
##    2022-21     1     1     1     1     1     1     1     1     1     1     1
##    2022-22     1     1     1     1     1     1     1     1     1     1     0
##    2022-23     1     1     1     1     0     1     1     1     1     1     0
##    2022-24     1     1     1     1     0     1     1     1     1     1     0
##    2022-25     1     1     1     1     0     1     1     1     1     1     0
##    2022-26     1     1     1     1     0     1     1     1     1     1     0
##    2022-27     1     1     1     1     1     1     1     1     1     1     0
##    2022-28     1     1     1     1     0     0     1     1     1     1     0
##    2022-29     1     1     1     1     0     0     1     1     1     1     0
##    2022-30     1     1     1     1     1     1     1     1     1     1     1
```

```
## 2022-31 1 1 0 1 1 1 1 1 1 1 1
## 2022-32 1 1 1 1 1 1 1 1 1 1 1
## 2022-33 1 1 1 1 1 1 1 1 1 1 1
## 2022-34 1 1 1 1 1 1 1 1 1 1 1
## 2022-35 1 1 1 1 1 1 1 1 1 1 1
## 2022-36 1 1 1 1 1 1 1 1 1 1 1
## 2022-37 1 1 1 1 1 1 1 1 1 1 1
## 2022-38 1 1 1 1 1 1 1 1 1 1 1
## 2022-39 1 1 1 1 1 1 1 1 1 1 1
## 2022-40 1 1 1 1 1 1 1 1 1 1 1
## 2022-41 1 1 1 1 1 1 1 1 1 1 1
## 2022-42 1 1 1 1 1 1 1 1 1 1 1
## 2022-43 1 1 1 1 1 1 1 0 1 1 1
## 2022-44 1 1 1 1 1 1 1 1 1 1 1
## 2022-45 1 1 1 1 1 1 1 1 1 1 1
## 2022-46 1 1 1 1 1 1 1 1 1 1 1
## 2022-47 1 1 1 1 1 1 1 1 1 1 1
## 2022-48 1 0 1 1 1 1 1 1 1 1 1
## 2022-49 1 1 1 1 1 1 1 1 1 1 1
## 2022-50 1 1 1 1 1 1 1 1 1 1 1
## 2022-51 1 1 1 1 1 1 1 1 1 1 1
## 2022-52 1 1 1 1 1 1 1 1 1 1 1
## 2022-53 1 1 1 1 1 1 1 1 1 1 1
## 2023-01 1 1 1 1 1 1 1 1 1 1 1
## 2023-02 1 1 1 1 1 1 1 1 1 1 1
## 2023-03 1 1 1 1 1 1 1 1 1 1 1
## 2023-04 1 1 1 1 1 1 1 1 1 1 1
## 2023-05 1 1 1 1 1 1 1 1 1 1 1
## 2023-06 0 1 1 1 1 1 1 1 1 1 1
## 2023-07 1 1 1 1 1 1 1 1 1 1 1
## 2023-08 1 1 1 1 1 1 1 1 1 1 1
## 2023-09 1 1 1 1 1 1 1 1 1 1 1
## 2023-10 1 1 1 1 1 1 1 1 1 1 1
## 2023-11 1 1 1 1 1 1 1 1 1 1 1
## 2023-12 1 1 1 1 1 1 1 1 1 1 1
## 2023-13 1 1 1 1 1 1 1 1 1 1 1
## 2023-14 1 1 1 1 1 1 1 1 1 1 1
## 2023-15 1 1 1 1 1 1 1 1 1 1 1
## 2023-16 1 1 1 1 1 1 1 1 1 1 1
## 2023-17 1 1 1 1 1 1 1 1 1 1 1
## 2023-18 1 1 1 1 1 1 0 1 1 1 1
## 2023-19 1 1 1 1 1 1 1 1 1 1 1
## 2023-20 1 1 1 1 1 1 0 1 1 1 1
## 2023-21 1 1 1 1 1 1 0 1 1 1 1
## 2023-22 1 1 1 1 1 1 0 1 1 1 1
## 2023-23 1 1 1 1 1 1 0 1 1 1 1
## 2023-24 1 1 1 1 1 1 0 1 1 1 1
## 2023-25 1 1 1 1 1 1 0 1 1 1 1
## 2023-26 1 1 1 1 1 1 0 1 1 1 1
## 2023-27 1 1 1 1 1 1 0 1 1 1 1
## 2023-28 1 1 1 1 1 1 0 1 1 1 1
## 2023-29 1 1 1 1 1 1 0 1 1 1 1
## 2023-30 1 1 1 1 1 1 0 1 1 1 1
## 2023-31 1 1 1 1 1 1 0 1 1 1 1
```

```
##   2023-32     1     1     1     1     1     1     0     1     1     1     1
##   2023-33     1     1     1     1     1     1     0     1     1     1     1
##          personid
## year_week 25962 26328 26634 26934 27704 28190 28224 28484 29172 29230 29808
##   2022-01     1     1     0     1     1     1     1     0     1     1     0
##   2022-02     1     1     1     1     1     1     1     0     1     1     1
##   2022-03     1     1     1     1     1     1     1     0     1     1     1
##   2022-04     1     1     1     1     1     1     1     0     1     1     1
##   2022-05     1     1     1     1     1     1     1     0     1     1     0
##   2022-06     1     1     1     1     1     1     1     0     1     1     0
##   2022-07     1     1     1     1     1     1     1     0     1     1     0
##   2022-08     1     1     1     1     1     1     1     0     1     1     1
##   2022-09     1     1     1     0     1     1     1     0     1     1     1
##   2022-10     1     1     1     0     1     1     1     1     1     1     1
##   2022-11     1     1     1     1     1     1     1     1     1     1     1
##   2022-12     1     1     1     1     1     1     1     1     1     1     1
##   2022-13     1     1     1     1     1     1     1     1     1     1     1
##   2022-14     1     1     0     1     1     1     1     1     1     1     1
##   2022-15     1     1     0     1     1     1     1     1     1     1     1
##   2022-16     1     1     0     1     1     1     1     1     1     1     1
##   2022-17     1     1     0     1     1     1     1     1     1     1     1
##   2022-18     1     1     0     1     1     1     1     1     1     1     1
##   2022-19     1     1     1     1     1     1     1     1     1     1     0
##   2022-20     1     1     1     1     1     1     1     1     1     1     1
##   2022-21     1     1     1     1     1     1     1     1     1     1     1
##   2022-22     1     1     0     1     1     1     1     1     1     1     1
##   2022-23     1     1     0     1     1     1     1     1     1     1     1
##   2022-24     1     1     0     1     1     1     1     1     1     1     1
##   2022-25     1     1     0     1     1     1     1     1     1     1     1
##   2022-26     1     1     0     1     1     1     1     1     1     1     1
##   2022-27     1     1     0     1     1     1     1     1     1     1     1
##   2022-28     1     1     0     1     1     1     0     1     1     1     1
##   2022-29     1     1     1     1     1     1     1     1     1     1     1
##   2022-30     1     1     1     1     1     1     1     1     1     1     1
##   2022-31     1     1     1     1     1     1     1     1     1     1     1
##   2022-32     1     1     1     1     1     1     1     1     1     1     1
##   2022-33     1     1     1     1     1     1     1     1     1     1     1
##   2022-34     1     1     1     1     1     1     1     1     1     1     1
##   2022-35     1     1     1     1     1     1     1     1     1     1     1
##   2022-36     1     1     1     1     1     1     1     1     1     1     1
##   2022-37     1     1     1     1     1     1     1     1     1     1     1
##   2022-38     1     1     1     1     1     1     1     1     1     1     1
##   2022-39     1     1     1     1     1     1     1     1     1     1     1
##   2022-40     1     1     1     1     1     1     1     1     1     1     1
##   2022-41     1     1     1     1     1     1     1     1     1     1     1
##   2022-42     1     1     1     1     1     1     1     1     1     1     1
##   2022-43     1     1     1     1     1     1     1     1     1     1     1
##   2022-44     1     1     1     1     1     1     1     1     1     1     1
##   2022-45     1     1     1     1     1     1     1     1     1     1     1
##   2022-46     1     1     1     1     1     1     1     1     1     1     1
##   2022-47     1     1     1     1     1     1     1     1     1     1     1
##   2022-48     1     1     1     1     1     1     1     1     1     1     1
##   2022-49     1     1     1     1     1     1     1     1     1     1     1
##   2022-50     1     1     1     1     1     1     1     1     1     1     1
```

```
##   2022-51     1     1     1     1     1     1     1     1     1     1     1
##   2022-52     1     1     1     1     1     1     1     1     1     1     1
##   2022-53     1     1     1     1     1     1     1     1     1     1     1
##   2023-01     1     1     1     1     1     1     1     0     1     1     1
##   2023-02     1     1     1     1     1     1     1     1     1     1     1
##   2023-03     1     1     1     1     1     1     1     1     1     1     1
##   2023-04     1     1     1     1     1     1     1     1     1     1     1
##   2023-05     1     1     1     1     1     1     1     1     1     1     1
##   2023-06     1     1     1     1     1     1     1     1     1     1     1
##   2023-07     1     1     1     1     1     1     1     1     1     1     1
##   2023-08     1     1     1     1     1     1     1     1     1     1     1
##   2023-09     1     1     1     1     1     1     1     1     1     1     1
##   2023-10     1     1     1     1     1     1     1     0     1     1     1
##   2023-11     1     1     1     1     1     1     1     1     1     1     1
##   2023-12     1     1     1     1     1     1     1     1     1     1     1
##   2023-13     1     1     1     1     1     1     1     1     1     1     1
##   2023-14     1     1     1     1     1     1     1     0     1     1     1
##   2023-15     1     1     1     1     1     1     1     0     1     1     1
##   2023-16     1     1     1     1     1     1     1     0     1     0     1
##   2023-17     1     1     1     1     1     1     1     0     1     0     1
##   2023-18     1     1     1     1     1     1     1     0     1     0     0
##   2023-19     1     1     1     1     1     1     1     0     1     0     0
##   2023-20     1     1     1     1     1     1     1     0     1     0     1
##   2023-21     1     1     1     1     1     1     1     0     1     0     0
##   2023-22     1     1     1     1     1     1     1     0     1     0     0
##   2023-23     1     1     1     1     1     1     1     0     1     0     0
##   2023-24     1     1     1     0     1     1     1     0     1     0     0
##   2023-25     1     1     0     0     1     1     1     0     1     0     0
##   2023-26     1     1     0     0     1     1     1     0     1     0     0
##   2023-27     1     1     0     0     1     1     1     0     1     0     0
##   2023-28     1     1     0     0     1     1     1     0     1     0     0
##   2023-29     1     1     0     0     1     1     1     0     1     0     0
##   2023-30     1     1     0     0     1     1     1     0     1     0     0
##   2023-31     1     1     0     0     1     1     1     0     1     0     0
##   2023-32     1     1     0     0     1     1     1     0     1     0     0
##   2023-33     1     1     0     0     1     1     1     0     1     0     0
##          personid
## year_week 30014 31136 31150 31292 31888 31936 32320 32804 33128 33278 33350
##   2022-01     1     1     1     1     1     1     1     1     1     1     1
##   2022-02     1     1     1     1     1     1     1     1     1     1     1
##   2022-03     1     1     1     1     1     1     1     1     1     1     1
##   2022-04     1     1     1     1     1     1     1     1     1     1     1
##   2022-05     1     1     1     1     1     1     1     1     1     1     1
##   2022-06     1     1     1     1     1     1     1     1     1     1     1
##   2022-07     1     1     1     1     1     1     0     1     1     1     1
##   2022-08     1     1     1     1     1     1     1     1     1     1     1
##   2022-09     1     1     1     1     1     1     1     1     1     1     1
##   2022-10     1     1     1     1     1     1     1     1     1     1     1
##   2022-11     1     1     1     1     1     1     1     1     1     1     1
##   2022-12     1     1     1     1     1     1     1     1     0     1     1
##   2022-13     1     1     1     1     1     1     1     1     1     1     1
##   2022-14     1     1     1     1     1     1     1     1     1     1     1
##   2022-15     1     1     1     1     1     1     1     1     1     1     1
##   2022-16     1     1     1     1     1     1     1     1     1     1     1
```

```
##     2022-17     1     1     1     1     1     1     1     1     1     1     1
##     2022-18     1     1     1     1     1     1     1     1     1     1     1
##     2022-19     1     1     1     1     1     1     1     1     1     1     1
##     2022-20     1     1     1     1     1     1     1     1     1     1     1
##     2022-21     1     1     1     1     1     1     1     1     1     1     1
##     2022-22     1     1     1     1     1     1     1     1     1     1     1
##     2022-23     1     1     1     1     1     1     1     1     1     1     1
##     2022-24     1     1     1     1     1     1     1     1     1     1     1
##     2022-25     1     1     1     1     1     1     1     1     1     1     1
##     2022-26     0     1     1     1     1     1     1     1     1     1     1
##     2022-27     1     1     1     1     1     1     1     1     1     1     1
##     2022-28     1     1     1     1     1     1     1     1     1     1     1
##     2022-29     1     1     1     1     1     1     1     1     1     1     1
##     2022-30     1     1     1     1     1     1     1     1     1     1     1
##     2022-31     1     1     1     1     1     1     1     1     1     1     1
##     2022-32     1     1     1     1     1     1     1     1     1     1     1
##     2022-33     1     1     1     1     1     1     1     1     1     1     1
##     2022-34     1     1     1     1     1     1     1     1     1     1     1
##     2022-35     1     1     1     1     1     1     1     1     1     1     1
##     2022-36     1     1     1     1     1     1     1     1     1     0     1
##     2022-37     1     1     1     1     1     1     1     1     1     1     0
##     2022-38     1     1     1     1     1     1     1     1     1     0     0
##     2022-39     1     1     1     1     1     1     0     1     1     1     0
##     2022-40     1     1     1     1     1     1     1     1     1     1     1
##     2022-41     1     1     1     1     1     1     1     1     1     1     1
##     2022-42     1     1     1     1     1     1     1     1     1     1     1
##     2022-43     1     1     1     1     1     1     1     1     1     1     1
##     2022-44     1     1     1     1     1     1     1     1     1     1     1
##     2022-45     1     1     1     1     1     1     1     1     1     1     1
##     2022-46     1     1     1     1     1     1     1     1     1     1     1
##     2022-47     1     1     1     1     1     1     1     1     1     1     1
##     2022-48     1     1     1     1     1     1     1     1     1     1     0
##     2022-49     1     1     1     1     1     1     1     1     1     1     1
##     2022-50     1     1     1     1     1     1     1     1     1     1     1
##     2022-51     1     1     1     1     1     1     1     1     1     1     1
##     2022-52     1     1     1     1     1     1     1     1     1     1     1
##     2022-53     1     1     1     1     1     1     1     1     1     1     1
##     2023-01     1     1     1     1     1     1     0     1     1     1     1
##     2023-02     1     1     0     1     1     1     0     1     1     1     1
##     2023-03     1     1     1     1     1     1     0     1     1     1     1
##     2023-04     1     1     1     1     1     1     1     0     1     1     1
##     2023-05     1     1     0     1     1     1     1     0     1     1     1
##     2023-06     1     1     1     1     1     1     1     0     1     1     1
##     2023-07     1     1     1     1     1     1     1     0     1     1     1
##     2023-08     1     1     1     1     1     1     1     0     1     1     1
##     2023-09     1     1     1     1     1     1     1     0     1     1     1
##     2023-10     1     1     1     1     1     1     1     0     1     1     1
##     2023-11     1     1     1     1     1     1     1     0     1     1     1
##     2023-12     1     1     1     1     1     1     1     0     1     1     1
##     2023-13     1     1     1     1     1     1     1     0     1     1     1
##     2023-14     1     1     1     1     1     1     1     0     1     1     1
##     2023-15     1     1     1     1     1     1     1     0     1     1     1
##     2023-16     1     1     1     1     1     1     1     0     1     1     1
##     2023-17     1     1     0     1     1     1     1     0     1     1     1
```

```
##   2023-18     1     1     0     1     1     1     1     0     1     1     1
##   2023-19     1     1     0     1     1     1     1     0     1     1     1
##   2023-20     1     1     0     1     1     1     1     0     1     1     1
##   2023-21     1     1     0     1     1     1     1     0     1     1     1
##   2023-22     1     1     0     1     1     1     1     0     1     1     1
##   2023-23     1     1     0     1     1     1     1     0     1     1     1
##   2023-24     1     1     0     1     1     1     1     0     1     1     1
##   2023-25     1     1     0     1     1     1     1     0     1     1     1
##   2023-26     1     1     0     1     1     1     1     0     1     1     1
##   2023-27     1     1     0     1     1     1     1     0     1     1     1
##   2023-28     1     1     0     1     1     1     1     0     1     1     1
##   2023-29     1     1     0     1     1     1     1     0     1     1     1
##   2023-30     1     1     0     1     1     1     1     0     1     1     1
##   2023-31     1     1     0     1     1     1     1     0     1     1     1
##   2023-32     1     1     0     1     1     1     1     0     1     1     1
##   2023-33     1     1     0     1     1     1     1     0     1     1     1
##          personid
## year_week 33354 34890 35006 35344 35822 36032 36288 36314 36494 36908 37276
##   2022-01     1     1     1     1     1     1     1     1     1     1     1
##   2022-02     1     1     1     1     1     1     1     1     1     1     1
##   2022-03     1     1     1     1     1     1     1     1     1     1     1
##   2022-04     1     1     1     1     1     1     1     1     1     1     1
##   2022-05     1     1     1     1     1     1     1     1     1     1     1
##   2022-06     1     1     1     1     1     1     1     1     1     1     1
##   2022-07     1     1     1     1     1     1     1     1     1     1     1
##   2022-08     1     1     1     1     1     1     1     1     1     1     1
##   2022-09     1     1     1     1     1     1     1     1     1     1     1
##   2022-10     1     1     1     1     1     1     1     1     1     1     1
##   2022-11     1     1     1     1     1     1     1     1     1     1     1
##   2022-12     1     1     1     1     1     1     1     1     1     1     1
##   2022-13     1     1     1     1     1     1     1     1     1     1     1
##   2022-14     1     1     1     1     1     1     1     1     1     1     1
##   2022-15     1     1     1     1     1     1     1     1     1     1     1
##   2022-16     1     1     1     1     1     1     1     1     1     1     1
##   2022-17     1     1     1     1     1     1     1     1     1     1     1
##   2022-18     1     1     1     1     1     1     1     1     1     1     1
##   2022-19     1     1     1     1     1     1     1     1     1     1     1
##   2022-20     1     1     1     1     1     1     1     1     1     1     1
##   2022-21     1     1     1     1     1     1     1     1     1     1     1
##   2022-22     1     1     1     1     1     1     1     1     1     1     1
##   2022-23     1     1     1     1     1     1     1     1     1     1     1
##   2022-24     1     1     1     1     1     1     1     1     1     1     1
##   2022-25     1     1     1     1     1     1     1     1     1     1     1
##   2022-26     1     1     1     1     1     1     1     1     1     1     1
##   2022-27     1     1     1     1     1     1     1     1     1     1     1
##   2022-28     1     1     1     1     1     1     1     1     1     1     1
##   2022-29     1     1     1     1     1     1     1     1     1     1     1
##   2022-30     1     1     1     1     1     1     1     1     1     1     1
##   2022-31     1     1     1     1     1     1     1     1     1     1     1
##   2022-32     1     1     0     1     1     1     1     1     1     1     1
##   2022-33     1     1     1     1     1     1     1     1     1     1     1
##   2022-34     1     1     1     1     1     1     1     1     1     1     1
##   2022-35     1     1     1     1     1     1     1     1     1     1     1
##   2022-36     1     1     1     1     1     1     1     1     1     1     1
```

```
##   2022-37     0     1     1     1     1     1     1     1     1     1     1
##   2022-38     1     1     1     1     1     1     1     1     1     1     1
##   2022-39     1     1     1     1     1     1     1     1     1     1     1
##   2022-40     1     1     1     1     1     1     1     1     1     1     1
##   2022-41     1     1     1     1     1     1     1     1     1     1     1
##   2022-42     0     1     1     1     1     1     1     1     1     1     1
##   2022-43     1     1     1     1     1     1     1     1     1     1     1
##   2022-44     1     1     1     1     1     1     1     1     1     1     1
##   2022-45     1     1     1     1     1     1     1     1     1     1     1
##   2022-46     1     1     1     1     1     1     1     0     1     1     1
##   2022-47     1     1     1     1     1     1     1     1     1     1     1
##   2022-48     1     1     1     1     1     1     1     1     1     1     1
##   2022-49     1     1     1     1     1     1     1     1     1     1     1
##   2022-50     1     1     1     1     1     1     1     1     1     1     1
##   2022-51     1     1     1     1     1     1     1     1     1     1     1
##   2022-52     1     1     1     1     1     1     1     1     1     1     1
##   2022-53     1     1     1     1     1     1     1     1     1     1     1
##   2023-01     1     1     1     1     1     1     1     1     1     1     1
##   2023-02     1     1     1     1     1     1     1     1     1     1     1
##   2023-03     1     1     1     1     1     1     1     1     1     1     1
##   2023-04     1     0     1     1     1     1     1     1     0     1     0
##   2023-05     1     0     1     1     1     1     1     1     1     1     0
##   2023-06     1     0     1     1     1     1     1     1     0     1     0
##   2023-07     1     0     1     1     1     1     1     1     0     1     0
##   2023-08     1     0     0     1     1     1     1     1     0     1     1
##   2023-09     1     0     1     1     1     1     1     1     0     1     1
##   2023-10     1     0     1     1     1     1     1     1     0     1     1
##   2023-11     1     0     0     1     1     1     1     1     0     1     1
##   2023-12     1     0     0     0     1     1     1     1     0     1     0
##   2023-13     1     0     0     1     1     1     1     1     0     1     0
##   2023-14     1     0     0     1     1     1     1     1     0     1     0
##   2023-15     1     0     0     1     1     1     1     1     0     1     0
##   2023-16     1     0     0     1     1     1     1     1     0     1     0
##   2023-17     1     0     0     1     1     1     1     1     0     1     0
##   2023-18     1     0     0     1     1     1     1     1     0     1     0
##   2023-19     1     0     0     1     1     1     1     1     0     1     0
##   2023-20     1     0     0     1     1     1     1     1     0     0     0
##   2023-21     1     0     0     1     1     1     1     1     0     1     0
##   2023-22     1     0     0     1     1     1     1     1     0     1     0
##   2023-23     1     0     0     1     1     1     1     1     0     1     0
##   2023-24     1     0     0     1     1     1     1     1     0     1     0
##   2023-25     1     0     0     1     1     1     1     1     0     1     0
##   2023-26     1     0     0     1     1     1     1     1     0     1     0
##   2023-27     1     0     0     1     1     1     1     1     0     1     0
##   2023-28     1     0     0     1     1     1     1     1     0     1     0
##   2023-29     1     0     0     1     1     1     1     1     0     0     0
##   2023-30     1     0     0     1     1     1     1     1     0     1     0
##   2023-31     1     0     0     1     1     1     1     1     0     1     0
##   2023-32     1     0     0     1     0     1     1     1     0     1     0
##   2023-33     1     0     0     1     0     1     1     1     0     1     0
##          personid
## year_week 37292 37294 37798 38038 38290 38552 38566 38580 38712 38842 38862
##   2022-01     1     1     1     1     1     1     1     1     1     1     1
##   2022-02     1     1     1     1     1     1     1     1     1     1     1
```

```
##   2022-03   1   1   1   1   1   1   1   1   1   1   1
##   2022-04   1   1   1   1   1   1   1   1   1   1   1
##   2022-05   1   1   1   1   1   1   1   1   1   1   1
##   2022-06   1   1   1   1   1   1   1   1   1   1   1
##   2022-07   1   1   1   1   1   1   1   1   1   1   1
##   2022-08   1   1   1   1   1   1   1   1   1   1   1
##   2022-09   1   1   1   1   1   1   1   1   1   1   1
##   2022-10   1   1   1   1   1   1   1   1   1   1   1
##   2022-11   1   1   1   1   1   1   1   1   1   1   1
##   2022-12   1   1   1   1   1   1   1   1   1   1   1
##   2022-13   1   1   1   1   1   1   1   1   1   1   1
##   2022-14   1   1   1   1   1   1   1   1   1   1   1
##   2022-15   1   1   1   1   1   1   1   1   1   1   1
##   2022-16   1   1   1   1   1   1   1   1   1   1   1
##   2022-17   1   1   1   1   1   1   1   1   1   1   1
##   2022-18   1   1   1   1   1   1   1   1   1   1   1
##   2022-19   1   1   1   1   1   1   1   1   1   1   1
##   2022-20   1   1   1   1   1   1   1   1   1   1   1
##   2022-21   1   1   1   1   1   1   1   1   1   1   1
##   2022-22   1   1   1   1   1   1   1   1   1   1   1
##   2022-23   1   1   1   1   0   1   1   1   1   1   1
##   2022-24   1   1   1   1   1   1   1   1   1   1   1
##   2022-25   1   1   1   1   1   1   1   1   1   1   1
##   2022-26   1   1   1   1   1   1   1   1   1   1   1
##   2022-27   1   1   1   1   1   1   1   1   1   1   1
##   2022-28   1   1   1   1   1   1   1   1   1   1   1
##   2022-29   1   1   1   1   1   1   1   1   1   1   1
##   2022-30   1   1   1   1   1   1   1   1   1   1   1
##   2022-31   1   1   1   1   1   1   1   1   1   1   1
##   2022-32   1   1   1   1   1   1   1   1   1   1   1
##   2022-33   1   1   1   1   1   1   1   1   1   1   1
##   2022-34   1   1   1   1   1   1   1   1   1   1   1
##   2022-35   1   1   1   1   1   1   1   1   1   1   1
##   2022-36   1   1   1   1   1   1   1   1   1   1   1
##   2022-37   1   1   1   1   1   1   1   1   1   1   1
##   2022-38   1   1   1   1   1   1   1   1   1   1   1
##   2022-39   1   1   1   1   1   1   1   1   1   1   1
##   2022-40   1   1   1   1   1   1   1   1   1   1   1
##   2022-41   1   1   1   1   1   1   1   1   1   1   1
##   2022-42   1   1   1   1   1   1   1   1   1   1   1
##   2022-43   1   1   1   1   1   1   1   1   0   1   1
##   2022-44   1   1   1   1   1   1   1   1   1   1   1
##   2022-45   1   1   1   1   1   1   1   1   1   1   1
##   2022-46   1   1   1   1   1   1   1   1   1   1   1
##   2022-47   1   1   1   1   1   1   1   1   1   1   1
##   2022-48   1   1   1   1   1   1   1   1   1   1   1
##   2022-49   1   1   1   1   1   1   1   1   1   1   1
##   2022-50   1   1   1   1   1   1   1   1   1   1   1
##   2022-51   1   1   1   1   1   1   1   1   1   1   1
##   2022-52   1   1   1   0   1   1   1   1   1   0   1
##   2022-53   1   1   1   1   1   1   1   1   1   0   1
##   2023-01   1   1   1   1   1   1   1   1   1   0   1
##   2023-02   1   1   1   1   1   1   1   1   1   0   1
##   2023-03   1   1   1   1   1   1   1   1   1   0   1
```

```
##    2023-04     1     1     1     1     1     1     1     1     1     0     1
##    2023-05     1     1     1     1     1     1     1     1     1     0     1
##    2023-06     1     1     1     1     1     1     1     1     1     0     1
##    2023-07     1     1     1     1     1     1     1     1     1     0     1
##    2023-08     1     1     1     1     1     1     1     1     1     0     1
##    2023-09     1     1     1     1     0     1     1     1     1     0     1
##    2023-10     1     1     1     1     0     1     1     1     1     0     1
##    2023-11     1     1     1     1     0     1     1     1     1     0     1
##    2023-12     1     1     1     1     1     1     1     1     1     0     1
##    2023-13     1     1     1     1     1     1     1     1     1     0     1
##    2023-14     1     1     1     1     1     1     1     1     1     0     1
##    2023-15     1     1     1     1     1     0     1     1     1     0     1
##    2023-16     1     1     1     1     1     0     1     1     1     0     1
##    2023-17     1     1     1     1     1     0     1     1     1     0     1
##    2023-18     1     1     1     1     1     0     1     1     1     0     1
##    2023-19     1     1     1     1     1     0     1     1     1     0     1
##    2023-20     1     1     1     1     1     0     1     1     1     0     1
##    2023-21     1     1     1     1     1     0     1     1     1     0     1
##    2023-22     1     1     1     1     1     0     1     1     1     0     1
##    2023-23     1     1     1     1     1     0     1     1     1     0     1
##    2023-24     1     1     1     1     1     0     1     1     1     0     1
##    2023-25     1     1     1     1     1     0     1     1     1     0     1
##    2023-26     1     1     1     1     1     0     1     1     1     0     1
##    2023-27     1     1     1     1     1     0     1     1     1     0     1
##    2023-28     1     1     1     1     1     0     1     1     1     0     1
##    2023-29     1     1     1     1     1     0     1     1     1     0     1
##    2023-30     1     1     1     1     1     0     1     1     1     0     1
##    2023-31     1     1     1     1     1     0     1     1     1     0     1
##    2023-32     1     1     1     1     1     0     1     1     1     0     0
##    2023-33     1     1     1     1     1     0     1     1     1     0     0
##          personid
## year_week 38878 38898 39096 39144 39164 39458 39466 39478 39634 39942 39990
##    2022-01     1     1     1     1     1     1     1     1     1     1     1
##    2022-02     1     1     1     1     1     1     1     1     1     1     1
##    2022-03     1     1     1     1     1     1     1     1     1     1     1
##    2022-04     1     1     1     1     1     1     1     1     1     1     1
##    2022-05     1     1     1     1     1     1     1     1     1     1     1
##    2022-06     1     1     1     1     1     1     1     1     1     1     1
##    2022-07     1     1     1     1     1     1     1     1     1     1     1
##    2022-08     1     1     1     1     1     1     1     1     1     1     1
##    2022-09     1     1     1     1     1     1     1     1     1     1     1
##    2022-10     1     1     1     1     1     1     1     1     1     1     1
##    2022-11     1     1     1     1     1     1     1     1     1     1     1
##    2022-12     1     1     1     1     1     1     1     1     1     1     1
##    2022-13     1     1     1     1     1     1     1     1     1     1     1
##    2022-14     1     1     1     1     1     1     1     1     1     1     1
##    2022-15     1     1     1     1     1     1     1     1     1     1     1
##    2022-16     1     1     1     1     1     1     1     1     1     1     1
##    2022-17     1     1     1     1     1     1     1     1     1     1     1
##    2022-18     1     1     1     1     1     1     1     1     1     1     1
##    2022-19     1     1     1     1     1     1     1     1     1     1     1
##    2022-20     1     1     1     1     1     1     1     1     1     1     1
##    2022-21     1     1     1     1     1     1     1     1     1     1     1
##    2022-22     1     1     1     1     1     1     1     1     1     1     1
```

```
##   2022-23    1   1   1   1   1   1   1   1   1   1   1
##   2022-24    1   1   1   1   1   1   1   1   1   1   1
##   2022-25    1   1   1   1   1   1   1   1   1   1   1
##   2022-26    1   1   1   1   1   1   1   1   1   1   1
##   2022-27    1   1   1   1   1   1   1   1   1   1   1
##   2022-28    1   1   1   1   1   1   1   1   1   1   1
##   2022-29    1   1   1   1   1   1   1   1   1   1   1
##   2022-30    1   1   1   1   1   1   1   1   1   1   1
##   2022-31    1   0   1   1   1   1   1   1   1   1   1
##   2022-32    1   0   1   1   1   1   1   1   1   1   1
##   2022-33    1   0   1   1   1   1   1   1   1   1   1
##   2022-34    1   0   1   1   1   1   1   1   1   1   1
##   2022-35    1   1   1   1   1   1   1   1   1   1   1
##   2022-36    1   1   1   1   1   1   1   1   1   1   1
##   2022-37    1   1   1   1   1   1   1   1   1   1   1
##   2022-38    1   1   1   1   1   1   1   1   1   1   1
##   2022-39    1   1   1   1   1   1   1   1   1   1   1
##   2022-40    1   1   1   1   0   0   1   1   1   1   1
##   2022-41    1   1   1   1   1   1   1   1   1   1   1
##   2022-42    1   1   1   1   1   1   1   1   1   1   1
##   2022-43    1   1   1   1   1   1   1   1   1   1   1
##   2022-44    1   1   1   1   1   1   1   1   0   1   1
##   2022-45    1   1   1   1   1   1   1   1   0   1   1
##   2022-46    1   1   1   1   1   1   1   1   1   1   1
##   2022-47    1   1   1   1   1   1   1   1   1   1   1
##   2022-48    1   1   1   1   1   1   1   1   1   1   1
##   2022-49    1   1   1   1   1   1   1   1   1   1   1
##   2022-50    1   1   1   1   1   1   1   1   1   1   1
##   2022-51    1   1   1   1   1   1   1   1   1   1   1
##   2022-52    1   1   1   1   1   1   1   1   1   1   1
##   2022-53    1   1   1   1   1   1   1   1   1   0   1
##   2023-01    1   1   1   1   1   1   1   0   1   1   1
##   2023-02    1   1   1   1   1   1   1   1   1   1   1
##   2023-03    1   1   1   1   1   1   1   1   1   1   1
##   2023-04    1   1   1   1   1   1   1   1   1   1   1
##   2023-05    1   1   1   1   1   1   1   0   1   1   1
##   2023-06    1   1   1   1   1   1   1   1   1   1   1
##   2023-07    1   1   1   1   1   1   1   0   1   1   1
##   2023-08    1   1   1   1   1   1   1   0   1   1   1
##   2023-09    1   1   1   1   1   1   1   0   1   1   1
##   2023-10    1   1   1   1   1   1   1   0   1   1   1
##   2023-11    1   1   1   1   1   1   1   0   1   1   1
##   2023-12    1   1   1   1   1   1   1   0   1   1   1
##   2023-13    1   1   1   1   1   1   1   0   1   1   1
##   2023-14    1   1   1   1   1   1   1   0   1   1   1
##   2023-15    1   1   1   1   1   1   1   0   1   1   1
##   2023-16    1   1   1   1   1   1   1   0   1   1   1
##   2023-17    1   1   1   1   1   1   1   0   1   0   1
##   2023-18    1   1   1   1   1   1   1   0   1   1   1
##   2023-19    1   1   1   1   1   1   1   0   1   1   1
##   2023-20    1   1   1   1   1   1   1   0   1   1   1
##   2023-21    1   1   1   1   1   1   1   0   1   1   1
##   2023-22    1   1   1   1   1   1   1   0   1   1   1
##   2023-23    1   1   1   1   1   1   1   0   1   1   1
```

```
##    2023-24     1     1     1     1     1     1     1     0     1     1     1
##    2023-25     1     1     1     1     1     1     1     0     1     1     1
##    2023-26     1     1     1     1     1     1     1     0     1     1     1
##    2023-27     1     1     1     1     1     1     1     0     1     1     1
##    2023-28     1     1     1     1     1     1     1     0     1     0     1
##    2023-29     1     1     1     1     1     1     1     0     1     0     1
##    2023-30     1     1     1     1     1     1     1     0     1     1     1
##    2023-31     1     1     1     1     1     1     1     0     1     0     1
##    2023-32     1     1     1     1     1     1     1     0     1     0     1
##    2023-33     1     1     1     1     1     1     1     0     1     0     1
##            personid
## year_week 40008 40034 40062 40162 40174 40192 40316 40322 40328 40336 40346
##    2022-01     1     1     1     1     1     1     1     1     1     1     1
##    2022-02     1     1     1     1     1     1     1     1     1     1     1
##    2022-03     1     1     1     1     1     1     1     1     1     1     1
##    2022-04     1     1     1     1     1     1     1     1     1     1     1
##    2022-05     1     1     1     1     1     1     1     1     1     1     1
##    2022-06     1     1     1     1     1     1     1     1     1     1     1
##    2022-07     1     1     1     1     1     1     1     1     1     1     1
##    2022-08     1     1     1     1     1     1     1     1     1     1     1
##    2022-09     1     1     1     1     1     1     1     1     1     1     1
##    2022-10     1     1     1     1     1     1     1     1     1     1     1
##    2022-11     1     1     1     1     1     1     1     1     1     1     1
##    2022-12     1     1     1     1     1     1     1     1     1     1     1
##    2022-13     1     1     1     1     1     1     1     1     1     1     1
##    2022-14     1     1     1     1     1     1     1     1     1     1     1
##    2022-15     1     1     1     1     1     1     1     1     1     1     1
##    2022-16     1     1     1     1     1     1     1     1     1     1     1
##    2022-17     1     1     1     1     1     1     1     1     1     1     1
##    2022-18     1     1     1     1     1     1     1     1     1     1     1
##    2022-19     1     1     1     1     1     1     1     1     1     1     1
##    2022-20     1     1     1     1     1     1     1     1     1     1     1
##    2022-21     1     1     1     1     1     1     1     1     1     0     1
##    2022-22     1     1     1     1     1     1     1     1     1     1     1
##    2022-23     1     1     1     1     1     1     1     1     1     1     1
##    2022-24     1     1     1     1     1     1     1     1     1     1     1
##    2022-25     1     1     1     1     1     1     1     1     1     1     1
##    2022-26     1     1     1     1     1     1     1     1     1     1     1
##    2022-27     1     1     1     1     1     1     1     1     1     1     1
##    2022-28     1     1     1     1     1     1     1     1     1     1     1
##    2022-29     1     1     1     1     1     1     1     1     1     0     1
##    2022-30     1     1     1     1     1     1     1     1     1     1     1
##    2022-31     1     1     1     1     1     1     1     1     1     1     1
##    2022-32     1     1     1     1     1     1     1     1     1     1     1
##    2022-33     1     1     1     1     1     1     1     1     1     1     1
##    2022-34     1     1     1     1     1     1     1     1     1     1     1
##    2022-35     1     1     1     1     1     1     1     1     1     1     1
##    2022-36     1     1     1     1     1     1     1     1     1     1     1
##    2022-37     1     1     1     1     1     1     1     1     1     0     1
##    2022-38     1     1     1     1     1     1     1     1     1     0     0
##    2022-39     1     1     1     1     1     1     1     1     1     1     1
##    2022-40     1     1     1     0     1     1     1     1     1     1     1
##    2022-41     1     1     1     1     1     1     1     1     1     1     1
##    2022-42     1     1     1     1     1     1     1     1     1     0     1
```

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##    2022-43     1     1     1     1     1     1     1     1     1     0     0
##    2022-44     1     1     1     1     1     1     1     0     1     1     1
##    2022-45     1     1     1     1     1     1     1     0     1     1     1
##    2022-46     1     1     1     1     1     1     0     1     1     0     1
##    2022-47     1     1     1     1     1     1     1     1     1     0     1
##    2022-48     1     1     1     1     1     1     1     1     1     0     1
##    2022-49     1     1     1     1     1     1     1     1     1     1     1
##    2022-50     1     0     1     1     1     1     1     1     1     0     1
##    2022-51     1     1     1     1     1     1     1     1     1     0     1
##    2022-52     1     1     1     1     1     1     1     1     1     1     1
##    2022-53     1     1     1     1     0     1     1     1     1     0     1
##    2023-01     1     1     1     1     0     0     1     1     1     0     1
##    2023-02     1     1     1     1     1     1     1     1     1     0     1
##    2023-03     1     1     1     0     1     1     1     1     1     0     1
##    2023-04     1     1     1     0     1     0     1     1     1     1     1
##    2023-05     1     1     1     1     1     1     1     1     1     1     1
##    2023-06     1     1     1     0     1     1     1     1     1     0     1
##    2023-07     1     1     1     0     0     1     1     1     1     1     1
##    2023-08     1     1     0     1     0     1     1     1     1     1     1
##    2023-09     1     1     0     1     0     1     1     1     1     1     0
##    2023-10     1     1     0     1     0     1     1     1     1     1     0
##    2023-11     1     0     0     0     0     1     1     1     1     0     0
##    2023-12     1     1     0     1     0     1     1     1     1     0     0
##    2023-13     1     0     0     1     0     1     1     1     1     0     0
##    2023-14     1     0     0     1     0     1     1     1     1     0     0
##    2023-15     1     0     0     1     0     1     1     1     1     1     0
##    2023-16     1     0     0     1     0     1     1     1     1     1     0
##    2023-17     1     0     0     1     0     1     1     1     1     1     0
##    2023-18     1     0     0     1     0     1     1     1     1     1     0
##    2023-19     1     0     0     1     0     1     1     1     1     1     0
##    2023-20     1     0     0     1     0     1     1     1     1     0     0
##    2023-21     1     0     0     1     0     1     1     1     1     1     0
##    2023-22     1     0     0     1     0     1     1     1     1     0     0
##    2023-23     1     0     0     1     0     1     1     1     1     0     0
##    2023-24     0     0     0     1     0     1     1     1     1     0     0
##    2023-25     0     0     0     1     0     1     1     1     1     1     0
##    2023-26     1     0     0     1     0     1     1     1     1     1     0
##    2023-27     0     0     0     1     0     1     1     1     1     1     0
##    2023-28     0     0     0     1     0     1     1     1     1     1     0
##    2023-29     0     0     0     1     0     1     1     1     1     1     0
##    2023-30     0     0     0     1     0     1     1     1     1     1     0
##    2023-31     0     0     0     1     0     1     1     1     1     1     0
##    2023-32     0     0     0     1     0     0     1     1     1     1     0
##    2023-33     0     0     0     1     0     0     1     1     1     1     0
##          personid
## year_week 40456 40472 40490 41286 41320 41332 42096 42104 42108 42152 42308
##    2022-01     1     1     1     1     1     1     0     0     1     0     0
##    2022-02     1     1     1     1     1     1     1     1     1     1     1
##    2022-03     1     1     1     1     1     1     1     1     1     1     1
##    2022-04     1     1     1     1     1     1     1     1     1     1     1
##    2022-05     1     1     1     1     1     1     1     1     1     1     1
##    2022-06     1     1     1     1     1     1     1     1     1     1     1
##    2022-07     1     1     1     1     1     1     1     1     1     1     1
##    2022-08     1     1     1     1     1     1     1     1     1     1     1
```

```
##    2022-09      1      1      1      1      1      1      1      1      1      1      1
##    2022-10      1      1      1      1      1      1      1      1      1      1      1
##    2022-11      1      1      1      1      1      1      1      1      1      1      1
##    2022-12      1      1      1      1      1      1      1      1      1      1      1
##    2022-13      1      1      1      1      1      1      1      1      1      1      1
##    2022-14      1      1      1      1      1      1      1      1      1      1      1
##    2022-15      1      1      1      1      1      1      1      1      1      1      1
##    2022-16      1      1      1      1      1      1      1      1      1      1      1
##    2022-17      1      1      1      1      1      1      1      1      1      1      1
##    2022-18      1      1      1      1      1      1      1      1      1      1      1
##    2022-19      1      1      1      1      1      1      1      1      1      1      1
##    2022-20      1      1      1      1      1      1      1      1      1      1      1
##    2022-21      1      1      1      1      1      1      1      1      1      1      1
##    2022-22      1      1      1      1      1      1      1      1      1      1      1
##    2022-23      1      1      1      1      1      1      1      1      1      1      1
##    2022-24      1      1      1      1      1      1      1      1      1      1      1
##    2022-25      1      1      1      1      1      1      1      1      1      1      1
##    2022-26      1      1      1      1      1      1      1      1      1      1      1
##    2022-27      1      1      1      1      1      1      1      1      1      1      1
##    2022-28      1      1      1      1      1      1      1      1      1      1      1
##    2022-29      1      1      1      1      1      1      1      1      1      1      1
##    2022-30      1      1      1      1      1      1      1      1      1      1      1
##    2022-31      1      1      1      1      1      1      1      1      1      1      1
##    2022-32      1      1      1      1      1      1      1      1      1      1      1
##    2022-33      1      1      1      1      1      1      1      1      1      1      1
##    2022-34      1      1      1      1      1      1      1      1      1      1      1
##    2022-35      1      1      1      1      1      1      1      1      1      1      1
##    2022-36      1      1      1      1      1      1      1      1      1      1      1
##    2022-37      1      1      1      1      1      1      1      1      1      1      1
##    2022-38      1      1      1      1      1      1      1      1      1      1      1
##    2022-39      1      1      1      1      1      1      0      1      0      1      1
##    2022-40      1      1      1      1      1      1      1      1      1      1      1
##    2022-41      1      1      1      1      1      1      1      1      1      1      1
##    2022-42      1      1      1      1      1      1      1      1      1      1      1
##    2022-43      1      1      1      1      1      1      1      1      1      1      1
##    2022-44      1      1      1      1      1      1      1      1      1      1      0
##    2022-45      1      1      1      1      0      1      1      1      1      1      1
##    2022-46      1      1      1      1      1      1      1      1      1      1      1
##    2022-47      1      1      1      1      1      1      1      1      1      1      1
##    2022-48      1      1      1      1      1      1      1      1      1      1      1
##    2022-49      1      1      1      1      1      1      1      1      1      1      1
##    2022-50      1      1      1      1      1      1      1      1      1      1      0
##    2022-51      1      1      1      1      1      1      0      1      1      1      0
##    2022-52      1      1      1      1      0      1      0      0      1      1      0
##    2022-53      1      1      1      1      1      0      0      1      1      1      1
##    2023-01      1      1      1      1      1      1      0      1      1      1      1
##    2023-02      1      1      1      1      0      1      0      1      1      1      1
##    2023-03      1      1      1      1      0      1      0      1      1      1      1
##    2023-04      1      1      1      1      0      0      0      1      1      1      1
##    2023-05      1      1      1      1      0      1      0      1      1      1      1
##    2023-06      1      1      1      1      0      0      0      1      1      1      1
##    2023-07      1      1      1      1      0      0      0      1      1      1      1
##    2023-08      1      1      1      1      0      0      0      1      1      1      0
##    2023-09      1      1      1      1      0      0      0      1      1      1      0
```

```
##   2023-10     1     1     1     1     0     0     0     1     1     1     0
##   2023-11     1     1     1     1     0     0     0     1     1     1     0
##   2023-12     1     1     1     1     0     0     0     0     1     1     0
##   2023-13     1     1     1     0     0     0     0     0     1     1     0
##   2023-14     1     1     1     0     0     0     0     0     1     1     0
##   2023-15     1     1     1     0     0     0     0     0     1     1     0
##   2023-16     1     1     1     0     0     0     0     0     1     1     0
##   2023-17     1     1     1     1     0     0     0     0     1     1     0
##   2023-18     1     1     1     1     0     0     0     0     1     1     0
##   2023-19     1     1     1     1     0     0     0     0     1     1     0
##   2023-20     1     1     1     1     0     0     0     0     1     1     0
##   2023-21     1     1     1     1     0     0     0     0     1     1     0
##   2023-22     1     1     1     1     0     0     0     0     1     1     0
##   2023-23     1     1     1     1     0     0     0     0     1     1     0
##   2023-24     1     1     1     1     0     0     0     0     1     1     0
##   2023-25     1     1     1     1     0     0     0     0     1     1     0
##   2023-26     1     1     1     1     0     0     0     0     1     1     0
##   2023-27     1     1     1     1     0     0     0     0     1     1     0
##   2023-28     1     1     1     1     0     0     0     0     1     1     0
##   2023-29     1     1     1     1     0     0     0     0     1     1     0
##   2023-30     1     1     1     1     0     0     0     0     1     1     0
##   2023-31     1     1     1     1     0     0     0     0     1     1     0
##   2023-32     1     1     1     1     0     0     0     0     1     1     0
##   2023-33     1     1     1     1     0     0     0     0     1     1     0
##          personid
## year_week 42592 42618 42624 42628 42632 42634 42682 43258 43264 43288 43524
##   2022-01     0     0     0     0     0     0     0     0     0     0     0
##   2022-02     0     0     0     0     0     0     0     0     0     0     0
##   2022-03     0     0     0     0     0     0     0     0     0     0     0
##   2022-04     0     0     0     0     0     0     0     0     0     0     0
##   2022-05     1     1     1     1     1     1     1     0     0     0     0
##   2022-06     1     1     1     1     1     1     1     0     0     0     0
##   2022-07     1     1     1     1     1     1     1     0     0     0     0
##   2022-08     1     1     1     1     1     1     1     0     0     0     0
##   2022-09     1     1     1     1     1     1     1     0     0     0     0
##   2022-10     1     1     1     1     1     1     1     0     0     0     0
##   2022-11     1     1     1     1     1     1     1     0     0     0     0
##   2022-12     1     1     1     1     1     1     1     1     1     1     0
##   2022-13     1     1     1     1     1     1     1     1     1     1     0
##   2022-14     1     1     1     1     1     1     1     1     1     1     1
##   2022-15     1     1     1     1     1     1     1     1     1     1     1
##   2022-16     1     1     1     1     1     1     1     1     1     1     1
##   2022-17     1     1     1     1     1     1     1     1     1     1     1
##   2022-18     1     1     1     1     1     1     1     1     1     1     0
##   2022-19     1     1     1     1     1     1     1     1     1     1     1
##   2022-20     1     1     1     1     1     1     1     1     1     1     1
##   2022-21     1     1     1     1     1     1     1     1     1     1     1
##   2022-22     1     1     1     1     1     1     1     1     1     1     1
##   2022-23     1     1     1     1     1     1     1     1     1     1     1
##   2022-24     1     1     1     1     1     1     1     1     1     1     1
##   2022-25     1     1     1     1     1     1     1     1     1     1     1
##   2022-26     1     1     1     1     1     1     1     1     1     1     1
##   2022-27     1     1     1     1     1     1     1     1     1     1     1
##   2022-28     1     1     1     1     1     1     1     1     1     1     1
```

```
## 2022-29 1 1 1 1 1 0 1 1 1 1 1
## 2022-30 1 1 1 1 1 1 1 1 1 1 1
## 2022-31 1 1 1 1 1 1 1 1 1 1 1
## 2022-32 1 1 1 1 1 1 1 1 1 1 1
## 2022-33 1 1 1 1 1 1 1 1 1 1 1
## 2022-34 1 1 1 1 1 1 1 1 1 1 1
## 2022-35 1 1 1 1 1 1 1 1 1 1 1
## 2022-36 1 0 1 1 1 1 1 1 1 1 1
## 2022-37 1 0 1 1 1 1 1 1 0 0 1
## 2022-38 1 1 1 1 1 1 1 1 1 0 1
## 2022-39 1 1 1 1 1 1 1 0 1 0 1
## 2022-40 1 1 1 1 1 1 1 0 1 1 0
## 2022-41 1 1 1 1 1 1 0 1 1 1 0
## 2022-42 1 1 1 1 1 0 1 1 1 1 1
## 2022-43 1 1 1 1 1 0 1 1 1 1 1
## 2022-44 1 1 1 1 1 0 1 1 1 1 1
## 2022-45 1 1 1 0 1 0 1 1 1 1 1
## 2022-46 1 1 1 1 1 1 1 1 1 1 1
## 2022-47 1 1 1 1 1 1 1 1 1 1 1
## 2022-48 1 1 1 1 1 1 1 1 0 1 1
## 2022-49 1 1 1 1 1 1 1 1 0 1 1
## 2022-50 1 1 1 1 1 1 1 1 0 0 1
## 2022-51 1 1 1 1 1 1 0 1 1 0 1
## 2022-52 1 1 1 1 1 1 0 1 1 1 1
## 2022-53 1 0 1 1 1 1 0 1 1 1 0
## 2023-01 1 0 1 1 1 1 0 1 1 0 1
## 2023-02 1 0 1 1 1 1 0 1 1 0 1
## 2023-03 1 1 1 1 0 1 0 1 1 0 1
## 2023-04 1 1 1 1 1 1 0 1 1 1 1
## 2023-05 1 0 1 1 1 1 0 1 1 1 1
## 2023-06 1 0 1 1 1 1 0 1 1 1 1
## 2023-07 1 0 1 1 1 1 0 1 1 1 1
## 2023-08 1 0 1 1 1 1 0 1 1 1 1
## 2023-09 1 0 1 1 1 1 0 1 1 1 0
## 2023-10 1 0 1 1 1 1 0 1 1 1 0
## 2023-11 1 0 1 1 1 1 0 1 1 0 0
## 2023-12 1 0 1 1 1 1 0 1 1 1 0
## 2023-13 1 0 1 1 1 1 0 1 1 1 0
## 2023-14 1 0 1 1 1 0 0 1 1 0 0
## 2023-15 1 0 1 1 1 1 0 1 1 0 0
## 2023-16 1 0 1 1 1 0 0 1 1 0 0
## 2023-17 1 0 1 1 1 1 0 1 1 0 0
## 2023-18 1 0 1 1 1 1 0 1 1 0 0
## 2023-19 1 0 1 1 1 1 0 1 0 0 0
## 2023-20 1 0 1 1 1 0 0 1 1 0 0
## 2023-21 1 0 1 1 1 1 0 1 1 0 0
## 2023-22 1 0 1 1 1 1 0 1 1 0 0
## 2023-23 1 0 1 1 1 1 0 1 1 0 0
## 2023-24 1 0 1 1 1 1 0 1 1 0 0
## 2023-25 1 0 1 1 1 0 0 1 1 0 0
## 2023-26 1 0 1 1 1 1 0 1 1 0 0
## 2023-27 1 0 1 1 1 1 0 1 1 0 0
## 2023-28 1 0 1 1 1 1 0 1 1 0 0
## 2023-29 1 0 1 1 0 0 0 1 1 0 0
```

```
##   2023-30     1     0     1     1     1     1     0     1     1     0     0
##   2023-31     1     0     1     1     1     0     0     1     1     0     0
##   2023-32     1     0     1     1     0     0     0     1     1     0     0
##   2023-33     1     0     1     1     1     0     0     1     1     0     0
##            personid
## year_week 43534 43570 43926 44256 44266 44282 44408 44782 44784 44794 44800
##   2022-01     0     0     0     0     0     0     0     0     0     0     0
##   2022-02     0     0     0     0     0     0     0     0     0     0     0
##   2022-03     0     0     0     0     0     0     0     0     0     0     0
##   2022-04     0     0     0     0     0     0     0     0     0     0     0
##   2022-05     0     0     0     0     0     0     0     0     0     0     0
##   2022-06     0     0     0     0     0     0     0     0     0     0     0
##   2022-07     0     0     0     0     0     0     0     0     0     0     0
##   2022-08     0     0     0     0     0     0     0     0     0     0     0
##   2022-09     0     0     0     0     0     0     0     0     0     0     0
##   2022-10     0     0     0     0     0     0     0     0     0     0     0
##   2022-11     0     0     0     0     0     0     0     0     0     0     0
##   2022-12     0     0     0     0     0     0     0     0     0     0     0
##   2022-13     0     0     0     0     0     0     0     0     0     0     0
##   2022-14     1     0     0     0     0     0     0     0     0     0     0
##   2022-15     1     1     0     0     0     0     0     0     0     0     0
##   2022-16     1     1     0     0     0     0     0     0     0     0     0
##   2022-17     1     1     1     0     0     0     0     0     0     0     0
##   2022-18     0     1     1     0     1     1     0     0     0     0     0
##   2022-19     1     1     1     1     1     1     1     0     0     0     0
##   2022-20     1     1     1     1     1     1     1     0     0     0     0
##   2022-21     1     1     1     1     1     1     1     0     0     0     0
##   2022-22     1     1     1     1     1     1     1     0     0     1     0
##   2022-23     1     1     1     1     1     1     1     1     1     1     0
##   2022-24     1     1     1     1     1     1     1     1     1     1     1
##   2022-25     1     1     1     1     1     1     1     1     1     1     1
##   2022-26     1     1     1     1     1     1     1     1     1     1     1
##   2022-27     1     1     1     1     1     1     1     1     1     1     1
##   2022-28     1     1     1     1     1     1     1     1     1     1     1
##   2022-29     1     1     1     1     1     1     1     1     1     1     1
##   2022-30     1     1     1     1     1     1     1     1     1     1     1
##   2022-31     1     1     1     1     1     1     1     1     1     1     1
##   2022-32     1     1     1     1     1     1     1     1     1     1     1
##   2022-33     1     1     1     1     1     1     1     1     1     1     1
##   2022-34     1     1     1     1     1     1     1     1     1     1     1
##   2022-35     1     1     1     1     1     1     1     1     1     1     1
##   2022-36     1     1     1     1     1     1     1     1     1     1     1
##   2022-37     1     1     1     1     1     1     1     1     1     1     1
##   2022-38     0     1     1     1     1     1     1     1     1     1     1
##   2022-39     0     1     1     1     0     1     1     1     1     1     1
##   2022-40     1     1     1     1     1     1     1     1     1     1     1
##   2022-41     1     1     1     1     1     1     1     1     1     1     1
##   2022-42     1     1     1     1     1     1     1     1     1     1     1
##   2022-43     1     1     1     1     1     1     1     1     1     1     1
##   2022-44     1     1     1     1     1     1     1     1     1     1     1
##   2022-45     1     1     1     1     1     1     1     1     1     1     1
##   2022-46     1     1     1     1     1     1     1     1     1     0     1
##   2022-47     1     1     1     1     1     1     1     1     1     1     1
##   2022-48     1     1     1     1     1     1     1     1     1     1     1
```

```
##   2022-49     1     1     1     0     1     1     1     1     1     1     1
##   2022-50     1     1     1     1     1     1     1     1     1     1     1
##   2022-51     1     1     1     0     1     1     1     1     1     1     1
##   2022-52     1     1     1     1     1     1     1     1     1     1     1
##   2022-53     1     1     1     1     1     1     1     1     1     1     1
##   2023-01     1     1     1     1     0     1     1     1     1     0     1
##   2023-02     0     1     1     1     1     1     1     1     1     0     1
##   2023-03     1     1     1     1     1     1     1     1     1     0     1
##   2023-04     1     1     1     0     1     1     1     1     1     0     1
##   2023-05     1     1     1     0     1     1     1     1     1     0     1
##   2023-06     1     1     1     0     1     1     1     1     1     0     1
##   2023-07     1     1     1     0     1     1     1     1     1     0     1
##   2023-08     1     1     1     0     1     1     1     1     1     0     1
##   2023-09     1     1     1     1     1     1     1     1     1     0     1
##   2023-10     1     1     1     0     1     1     1     1     1     0     1
##   2023-11     1     1     1     0     1     1     1     1     1     0     1
##   2023-12     1     1     1     1     1     1     1     1     1     0     1
##   2023-13     1     1     1     1     1     1     1     1     1     0     1
##   2023-14     1     1     1     1     1     1     1     1     1     0     1
##   2023-15     1     1     1     1     1     1     1     1     1     0     1
##   2023-16     1     1     1     1     1     1     1     1     1     0     1
##   2023-17     1     1     1     1     1     1     1     1     1     0     1
##   2023-18     1     1     1     1     1     1     1     1     1     0     1
##   2023-19     1     1     1     1     1     1     1     1     1     0     1
##   2023-20     1     1     1     1     1     1     1     1     1     0     1
##   2023-21     1     1     1     0     1     1     1     1     1     0     1
##   2023-22     1     1     1     0     1     1     1     1     1     0     1
##   2023-23     1     1     1     0     1     1     1     1     1     0     1
##   2023-24     1     1     1     0     1     1     1     1     1     0     1
##   2023-25     1     1     1     1     1     1     1     1     1     0     1
##   2023-26     1     1     1     0     1     1     1     1     1     0     1
##   2023-27     1     1     1     0     1     1     1     1     1     0     1
##   2023-28     1     1     1     0     1     1     1     1     1     0     1
##   2023-29     1     1     1     0     1     1     1     1     1     0     1
##   2023-30     0     1     1     0     1     1     1     1     1     0     1
##   2023-31     1     1     1     0     1     1     1     1     1     0     1
##   2023-32     1     1     1     0     1     1     1     1     1     0     1
##   2023-33     1     1     1     0     1     1     1     1     1     0     1
##          personid
## year_week 45254 45442
##   2022-01     0     0
##   2022-02     0     0
##   2022-03     0     0
##   2022-04     0     0
##   2022-05     0     0
##   2022-06     0     0
##   2022-07     0     0
##   2022-08     0     0
##   2022-09     0     0
##   2022-10     0     0
##   2022-11     0     0
##   2022-12     0     0
##   2022-13     0     0
##   2022-14     0     0
```

```
##    2022-15     0     0
##    2022-16     0     0
##    2022-17     0     0
##    2022-18     0     0
##    2022-19     0     0
##    2022-20     0     0
##    2022-21     0     0
##    2022-22     0     0
##    2022-23     1     0
##    2022-24     1     0
##    2022-25     1     0
##    2022-26     1     1
##    2022-27     0     1
##    2022-28     1     1
##    2022-29     1     1
##    2022-30     1     1
##    2022-31     1     1
##    2022-32     1     1
##    2022-33     1     1
##    2022-34     1     1
##    2022-35     1     1
##    2022-36     1     1
##    2022-37     1     1
##    2022-38     1     1
##    2022-39     1     1
##    2022-40     1     1
##    2022-41     1     1
##    2022-42     1     1
##    2022-43     1     1
##    2022-44     1     1
##    2022-45     1     1
##    2022-46     1     1
##    2022-47     1     1
##    2022-48     1     1
##    2022-49     1     1
##    2022-50     1     1
##    2022-51     1     1
##    2022-52     1     1
##    2022-53     1     1
##    2023-01     1     1
##    2023-02     1     1
##    2023-03     1     1
##    2023-04     1     1
##    2023-05     1     1
##    2023-06     1     1
##    2023-07     1     1
##    2023-08     1     1
##    2023-09     1     1
##    2023-10     1     1
##    2023-11     1     1
##    2023-12     1     1
##    2023-13     1     1
##    2023-14     1     1
##    2023-15     1     1
```

```
##   2023-16     1      1
##   2023-17     1      1
##   2023-18     1      1
##   2023-19     1      1
##   2023-20     1      1
##   2023-21     1      1
##   2023-22     1      1
##   2023-23     1      1
##   2023-24     1      1
##   2023-25     1      1
##   2023-26     1      1
##   2023-27     1      1
##   2023-28     1      1
##   2023-29     1      1
##   2023-30     1      1
##   2023-31     1      1
##   2023-32     1      1
##   2023-33     1      1
```

```
is.pbalanced(tb, index = c("personid", "year_week"))
```

```
## [1] FALSE
```

In this case we get false which indicates an unbalanced panel. Next on, we check when the treatment occurred in terms of weeks and years.

```
# When did treatment occur?

tb %>%
  dplyr::select(WFH_due_building_issue, year, week) %>%
  table()
```

```
## , , week = 1
##
##                        year
## WFH_due_building_issue 2022 2023
##                      0   94   59
##                      1    0   59
##
## , , week = 2
##
##                        year
## WFH_due_building_issue 2022 2023
##                      0  110   64
##                      1    0   56
##
## , , week = 3
##
##                        year
## WFH_due_building_issue 2022 2023
##                      0  109   63
##                      1    0   57
##
```

```
## , , week = 4
##
##                       year
## WFH_due_building_issue 2022 2023
##                      0  110   60
##                      1    0   56
##
## , , week = 5
##
##                       year
## WFH_due_building_issue 2022 2023
##                      0  114   61
##                      1    0   57
##
## , , week = 6
##
##                       year
## WFH_due_building_issue 2022 2023
##                      0  114   59
##                      1    0   57
##
## , , week = 7
##
##                       year
## WFH_due_building_issue 2022 2023
##                      0  113   60
##                      1    0   55
##
## , , week = 8
##
##                       year
## WFH_due_building_issue 2022 2023
##                      0  116   58
##                      1    0   56
##
## , , week = 9
##
##                       year
## WFH_due_building_issue 2022 2023
##                      0  116   57
##                      1    0   56
##
## , , week = 10
##
##                       year
## WFH_due_building_issue 2022 2023
##                      0  117   53
##                      1    0   59
##
## , , week = 11
##
##                       year
## WFH_due_building_issue 2022 2023
##                      0  118   50
```

```
##                       1    0   57
##
## , , week = 12
##
##                        year
## WFH_due_building_issue 2022 2023
##                      0  120   59
##                      1    0   51
##
## , , week = 13
##
##                        year
## WFH_due_building_issue 2022 2023
##                      0  121   55
##                      1    0   52
##
## , , week = 14
##
##                        year
## WFH_due_building_issue 2022 2023
##                      0  115   52
##                      1    0   52
##
## , , week = 15
##
##                        year
## WFH_due_building_issue 2022 2023
##                      0  115   52
##                      1    0   53
##
## , , week = 16
##
##                        year
## WFH_due_building_issue 2022 2023
##                      0  115   54
##                      1    0   49
##
## , , week = 17
##
##                        year
## WFH_due_building_issue 2022 2023
##                      0  116   58
##                      1    0   45
##
## , , week = 18
##
##                        year
## WFH_due_building_issue 2022 2023
##                      0  117   55
##                      1    0   46
##
## , , week = 19
##
##                        year
```

```
## WFH_due_building_issue 2022 2023
##                      0  126   51
##                      1    0   50
##
## , , week = 20
##
##                       year
## WFH_due_building_issue 2022 2023
##                      0  127   50
##                      1    0   49
##
## , , week = 21
##
##                       year
## WFH_due_building_issue 2022 2023
##                      0  127   50
##                      1    0   50
##
## , , week = 22
##
##                       year
## WFH_due_building_issue 2022 2023
##                      0  120   50
##                      1    0   49
##
## , , week = 23
##
##                       year
## WFH_due_building_issue 2022 2023
##                      0  122   55
##                      1    0   44
##
## , , week = 24
##
##                       year
## WFH_due_building_issue 2022 2023
##                      0  123   53
##                      1    0   44
##
## , , week = 25
##
##                       year
## WFH_due_building_issue 2022 2023
##                      0  123   54
##                      1    0   43
##
## , , week = 26
##
##                       year
## WFH_due_building_issue 2022 2023
##                      0  124   54
##                      1    0   44
##
## , , week = 27
```

```
##
##                         year
## WFH_due_building_issue 2022 2023
##                      0  125   53
##                      1    0   44
##
## , , week = 28
##
##                         year
## WFH_due_building_issue 2022 2023
##                      0  123   52
##                      1    0   43
##
## , , week = 29
##
##                         year
## WFH_due_building_issue 2022 2023
##                      0  123   50
##                      1    0   43
##
## , , week = 30
##
##                         year
## WFH_due_building_issue 2022 2023
##                      0  129   54
##                      1    0   42
##
## , , week = 31
##
##                         year
## WFH_due_building_issue 2022 2023
##                      0  127   51
##                      1    0   44
##
## , , week = 32
##
##                         year
## WFH_due_building_issue 2022 2023
##                      0  127   48
##                      1    0   43
##
## , , week = 33
##
##                         year
## WFH_due_building_issue 2022 2023
##                      0  127   48
##                      1    0   44
##
## , , week = 34
##
##                         year
## WFH_due_building_issue 2022 2023
##                      0  131    0
##                      1    0    0
```

```
##
## , , week = 35
##
##                        year
## WFH_due_building_issue 2022 2023
##                      0  134    0
##                      1    0    0
##
## , , week = 36
##
##                        year
## WFH_due_building_issue 2022 2023
##                      0  131    0
##                      1    0    0
##
## , , week = 37
##
##                        year
## WFH_due_building_issue 2022 2023
##                      0  128    0
##                      1    0    0
##
## , , week = 38
##
##                        year
## WFH_due_building_issue 2022 2023
##                      0  128    0
##                      1    0    0
##
## , , week = 39
##
##                        year
## WFH_due_building_issue 2022 2023
##                      0  126    0
##                      1    0    0
##
## , , week = 40
##
##                        year
## WFH_due_building_issue 2022 2023
##                      0  128    0
##                      1    0    0
##
## , , week = 41
##
##                        year
## WFH_due_building_issue 2022 2023
##                      0  131    0
##                      1    0    0
##
## , , week = 42
##
##                        year
## WFH_due_building_issue 2022 2023
```

```
##                       0  130    0
##                       1    0    0
##
## , , week = 43
##
##                        year
## WFH_due_building_issue 2022 2023
##                       0  130    0
##                       1    0    0
##
## , , week = 44
##
##                        year
## WFH_due_building_issue 2022 2023
##                       0  130    0
##                       1    0    0
##
## , , week = 45
##
##                        year
## WFH_due_building_issue 2022 2023
##                       0  128    0
##                       1    0    0
##
## , , week = 46
##
##                        year
## WFH_due_building_issue 2022 2023
##                       0  129    0
##                       1    0    0
##
## , , week = 47
##
##                        year
## WFH_due_building_issue 2022 2023
##                       0  133    0
##                       1    0    0
##
## , , week = 48
##
##                        year
## WFH_due_building_issue 2022 2023
##                       0  112    0
##                       1   17    0
##
## , , week = 49
##
##                        year
## WFH_due_building_issue 2022 2023
##                       0   81    0
##                       1   50    0
##
## , , week = 50
##
```

```
##                         year
## WFH_due_building_issue 2022 2023
##                      0   76    0
##                      1   52    0
##
## , , week = 51
##
##                         year
## WFH_due_building_issue 2022 2023
##                      0   69    0
##                      1   58    0
##
## , , week = 52
##
##                         year
## WFH_due_building_issue 2022 2023
##                      0   71    0
##                      1   55    0
##
## , , week = 53
##
##                         year
## WFH_due_building_issue 2022 2023
##                      0   68    0
##                      1   57    0
```

```r
tb %>%
  dplyr::select(post, year, week) %>%
  table()
```

```
## , , week = 1
##
##     year
## post 2022 2023
##    0   94    0
##    1    0  118
##
## , , week = 2
##
##     year
## post 2022 2023
##    0  110    0
##    1    0  120
##
## , , week = 3
##
##     year
## post 2022 2023
##    0  109    0
##    1    0  120
##
## , , week = 4
##
##     year
```

```
## post 2022 2023
##    0  110    0
##    1    0  116
##
## , , week = 5
##
##     year
## post 2022 2023
##    0  114    0
##    1    0  118
##
## , , week = 6
##
##     year
## post 2022 2023
##    0  114    0
##    1    0  116
##
## , , week = 7
##
##     year
## post 2022 2023
##    0  113    0
##    1    0  115
##
## , , week = 8
##
##     year
## post 2022 2023
##    0  116    0
##    1    0  114
##
## , , week = 9
##
##     year
## post 2022 2023
##    0  116    0
##    1    0  113
##
## , , week = 10
##
##     year
## post 2022 2023
##    0  117    0
##    1    0  112
##
## , , week = 11
##
##     year
## post 2022 2023
##    0  118    0
##    1    0  107
##
## , , week = 12
```

```
##
##     year
## post 2022 2023
##    0  120    0
##    1    0  110
##
## , , week = 13
##
##     year
## post 2022 2023
##    0  121    0
##    1    0  107
##
## , , week = 14
##
##     year
## post 2022 2023
##    0  115    0
##    1    0  104
##
## , , week = 15
##
##     year
## post 2022 2023
##    0  115    0
##    1    0  105
##
## , , week = 16
##
##     year
## post 2022 2023
##    0  115    0
##    1    0  103
##
## , , week = 17
##
##     year
## post 2022 2023
##    0  116    0
##    1    0  103
##
## , , week = 18
##
##     year
## post 2022 2023
##    0  117    0
##    1    0  101
##
## , , week = 19
##
##     year
## post 2022 2023
##    0  126    0
##    1    0  101
```

```
##
## , , week = 20
##
##      year
## post 2022 2023
##    0  127    0
##    1    0   99
##
## , , week = 21
##
##      year
## post 2022 2023
##    0  127    0
##    1    0  100
##
## , , week = 22
##
##      year
## post 2022 2023
##    0  120    0
##    1    0   99
##
## , , week = 23
##
##      year
## post 2022 2023
##    0  122    0
##    1    0   99
##
## , , week = 24
##
##      year
## post 2022 2023
##    0  123    0
##    1    0   97
##
## , , week = 25
##
##      year
## post 2022 2023
##    0  123    0
##    1    0   97
##
## , , week = 26
##
##      year
## post 2022 2023
##    0  124    0
##    1    0   98
##
## , , week = 27
##
##      year
## post 2022 2023
```

```
##    0  125    0
##    1    0   97
##
## , , week = 28
##
##     year
## post 2022 2023
##    0  123    0
##    1    0   95
##
## , , week = 29
##
##     year
## post 2022 2023
##    0  123    0
##    1    0   93
##
## , , week = 30
##
##     year
## post 2022 2023
##    0  129    0
##    1    0   96
##
## , , week = 31
##
##     year
## post 2022 2023
##    0  127    0
##    1    0   95
##
## , , week = 32
##
##     year
## post 2022 2023
##    0  127    0
##    1    0   91
##
## , , week = 33
##
##     year
## post 2022 2023
##    0  127    0
##    1    0   92
##
## , , week = 34
##
##     year
## post 2022 2023
##    0  131    0
##    1    0    0
##
## , , week = 35
##
```

```
##      year
## post 2022 2023
##    0  134    0
##    1    0    0
##
## , , week = 36
##
##      year
## post 2022 2023
##    0  131    0
##    1    0    0
##
## , , week = 37
##
##      year
## post 2022 2023
##    0  128    0
##    1    0    0
##
## , , week = 38
##
##      year
## post 2022 2023
##    0  128    0
##    1    0    0
##
## , , week = 39
##
##      year
## post 2022 2023
##    0  126    0
##    1    0    0
##
## , , week = 40
##
##      year
## post 2022 2023
##    0  128    0
##    1    0    0
##
## , , week = 41
##
##      year
## post 2022 2023
##    0  131    0
##    1    0    0
##
## , , week = 42
##
##      year
## post 2022 2023
##    0  130    0
##    1    0    0
##
```

```
## , , week = 43
##
##      year
## post 2022 2023
##    0  130    0
##    1    0    0
##
## , , week = 44
##
##      year
## post 2022 2023
##    0  130    0
##    1    0    0
##
## , , week = 45
##
##      year
## post 2022 2023
##    0  128    0
##    1    0    0
##
## , , week = 46
##
##      year
## post 2022 2023
##    0  129    0
##    1    0    0
##
## , , week = 47
##
##      year
## post 2022 2023
##    0  133    0
##    1    0    0
##
## , , week = 48
##
##      year
## post 2022 2023
##    0  129    0
##    1    0    0
##
## , , week = 49
##
##      year
## post 2022 2023
##    0  131    0
##    1    0    0
##
## , , week = 50
##
##      year
## post 2022 2023
##    0    0    0
```

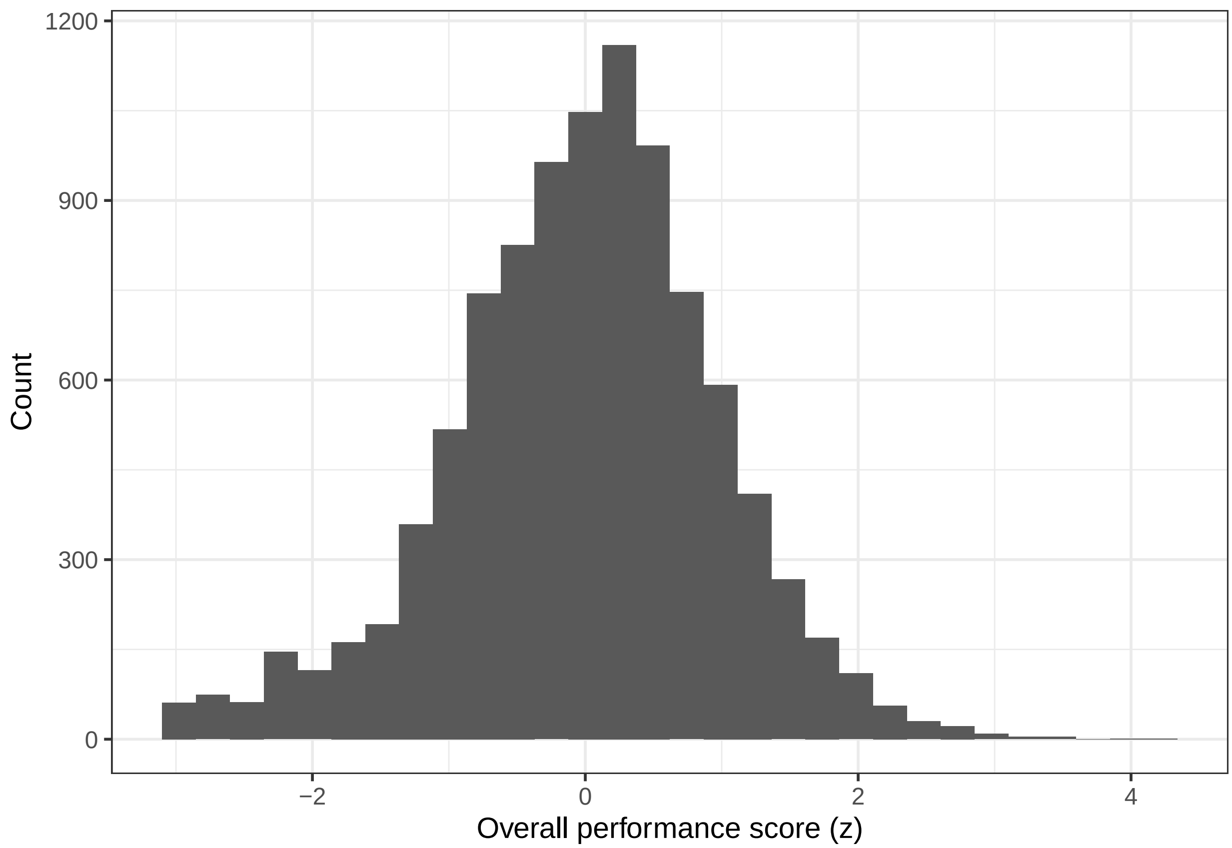
```
##    1  128    0
##
## , , week = 51
##
##     year
## post 2022 2023
##    0    0    0
##    1  127    0
##
## , , week = 52
##
##     year
## post 2022 2023
##    0    0    0
##    1  126    0
##
## , , week = 53
##
##     year
## post 2022 2023
##    0    0    0
##    1  125    0
```

Now we can have a brief look at the outcome distribution to see how performance looks like in general.

```r
# Outcome distribution (main outcome = perform1)

ggplot(tb, aes(x = perform1)) +
  geom_histogram() +
  theme_bw() +
  labs(x = "Overall performance score (z)", y = "Count")
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

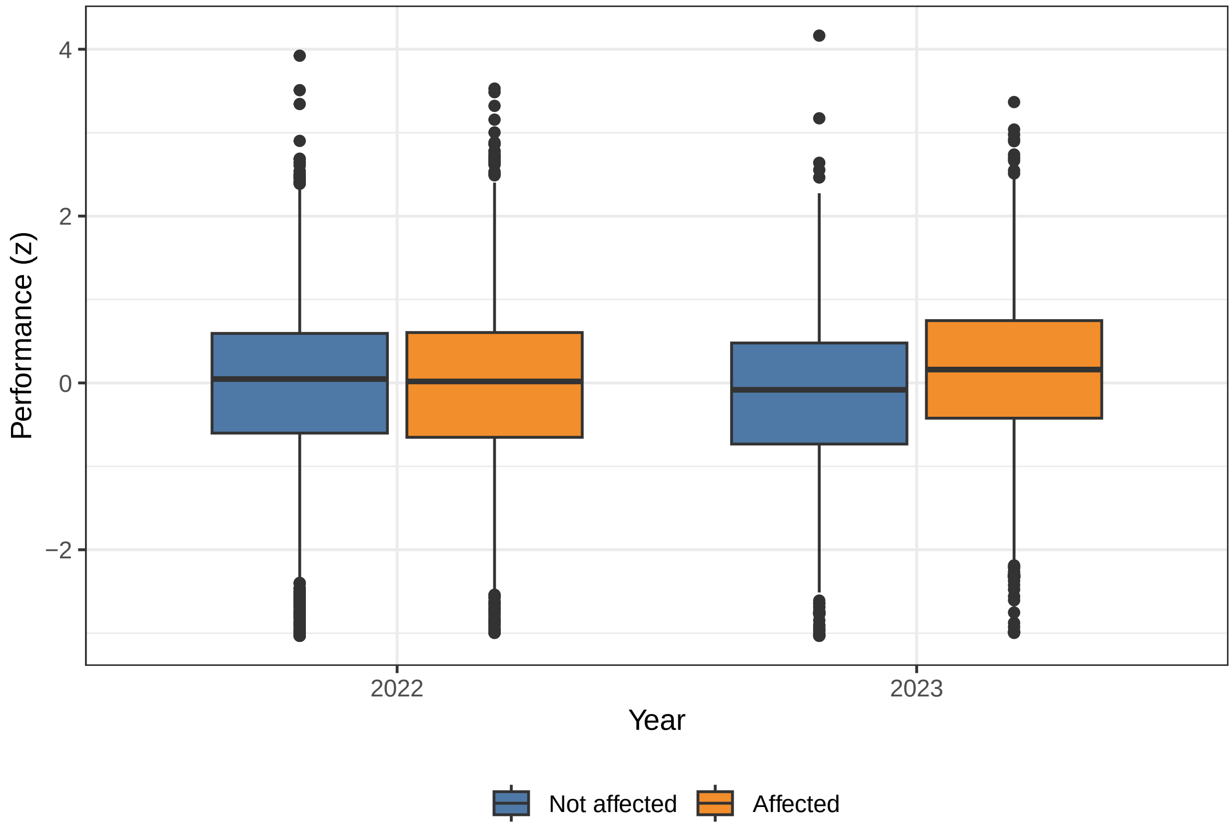
```
## Warning: Removed 110 rows containing non-finite outside the scale range
## (`stat_bin()`).
```



Next, we check the parallel trends assumption by plotting performance over time as we have seen in lab8 for treated vs non-treated groups.

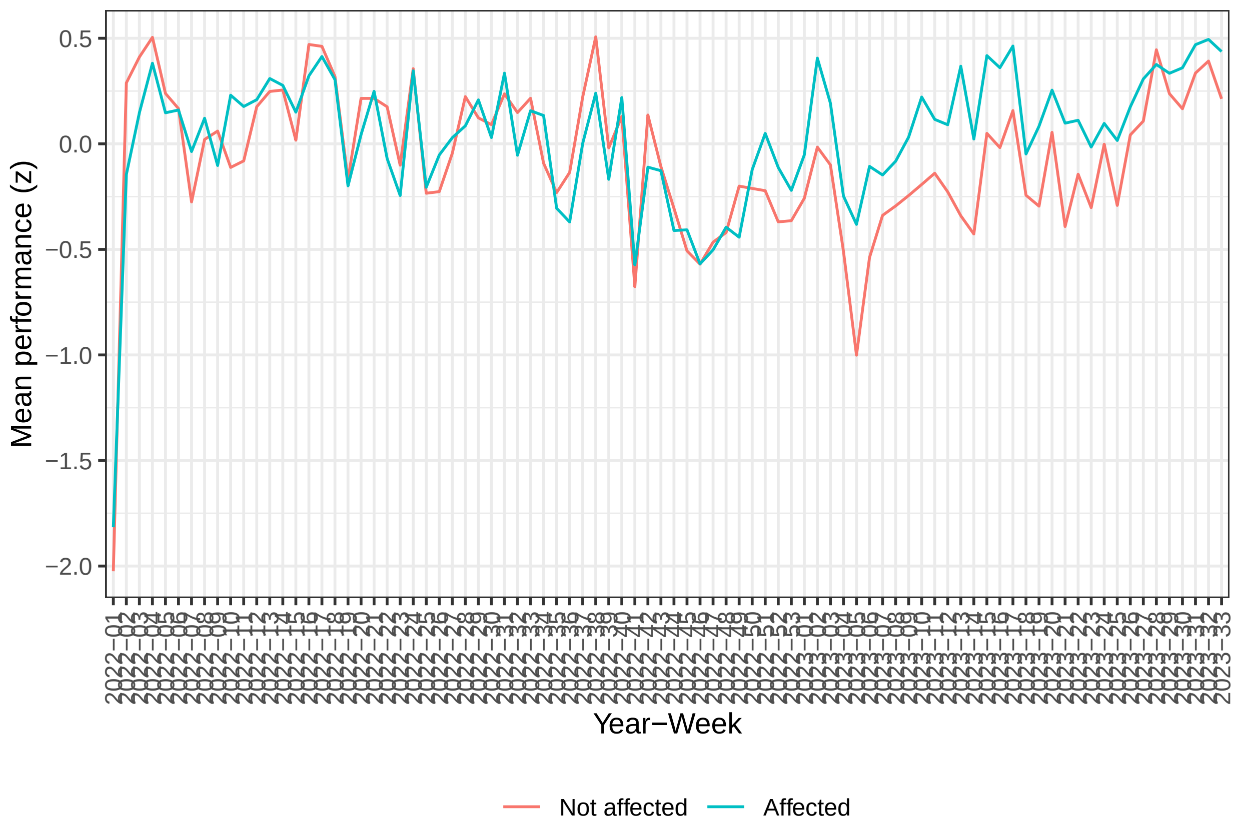
```
# Trend assumption (informal check)

# By year: treated vs not treated
ggplot(tb, aes(
  x = factor(year),
  y = perform1,
  fill = factor(treated, levels = c(0, 1), labels = c("Not affected", "Affected"))
)) +
  geom_boxplot() +
  theme_bw() +
  theme(legend.position = "bottom") +
  scale_fill_tableau() +
  labs(x = "Year", y = "Performance (z)", fill = "")
```

```
## Warning: Removed 110 rows containing non-finite outside the scale range
## (`stat_boxplot()`).
```




```r
# Weekly mean trend line (can be dense but informative)
ggplot(tb, aes(
  x = year_week,
  y = perform1,
  color = factor(treated, levels = c(0, 1), labels = c("Not affected", "Affected"))
)) +
  stat_summary(fun = mean, geom = "line", aes(group = factor(treated))) +
  theme_bw() +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5),
        legend.position = "bottom") +
  labs(x = "Year-Week", y = "Mean performance (z)", color = "")
```

```
## Warning: Removed 110 rows containing non-finite outside the scale range
## (`stat_summary()`).
```



Before the event, the average performance trends of the treated and control groups appear broadly parallel, providing support for the parallel trends assumption

Panel Regressions

Pooled OLS

```r
# Pooled OLS (no person FE)

out.pl <- plm(
  perform1 ~ wfh_post + factor(year_week),
  data  = tb,
  index = c("personid", "year_week"),
  model = "pooling"
)

stargazer(
  out.pl, type = "text",
  omit.stat = c("ser", "f"),
  no.space = TRUE, header = FALSE,
  title = "Pooled OLS results"
)
```

```
##
## Pooled OLS results
## =====================================================
```

```
##                               Dependent variable:
##                           ---------------------------
##                                     perform1
## ---------------------------------------------------
## wfh_post                            0.277***
##                                      (0.030)
## factor(year_week)2022-02            1.986***
##                                      (0.131)
## factor(year_week)2022-03            2.196***
##                                      (0.132)
## factor(year_week)2022-04            2.360***
##                                      (0.131)
## factor(year_week)2022-05            2.111***
##                                      (0.130)
## factor(year_week)2022-06            2.082***
##                                      (0.130)
## factor(year_week)2022-07            1.763***
##                                      (0.130)
## factor(year_week)2022-08            1.990***
##                                      (0.130)
## factor(year_week)2022-09            1.896***
##                                      (0.130)
## factor(year_week)2022-10            1.979***
##                                      (0.129)
## factor(year_week)2022-11            1.968***
##                                      (0.129)
## factor(year_week)2022-12            2.111***
##                                      (0.129)
## factor(year_week)2022-13            2.198***
##                                      (0.128)
## factor(year_week)2022-14            2.185***
##                                      (0.130)
## factor(year_week)2022-15            2.006***
##                                      (0.130)
## factor(year_week)2022-16            2.310***
##                                      (0.130)
## factor(year_week)2022-17            2.354***
##                                      (0.130)
## factor(year_week)2022-18            2.229***
##                                      (0.129)
## factor(year_week)2022-19            1.733***
##                                      (0.127)
## factor(year_week)2022-20            2.044***
##                                      (0.127)
## factor(year_week)2022-21            2.151***
##                                      (0.127)
## factor(year_week)2022-22            1.963***
##                                      (0.129)
## factor(year_week)2022-23            1.741***
##                                      (0.128)
## factor(year_week)2022-24            2.269***
##                                      (0.128)
## factor(year_week)2022-25            1.699***
##                                      (0.128)
```

```
## factor(year_week)2022-26          1.781***
##                                    (0.128)
## factor(year_week)2022-27          1.913***
##                                    (0.128)
## factor(year_week)2022-28          2.070***
##                                    (0.128)
## factor(year_week)2022-29          2.085***
##                                    (0.128)
## factor(year_week)2022-30          1.977***
##                                    (0.127)
## factor(year_week)2022-31          2.205***
##                                    (0.127)
## factor(year_week)2022-32          1.961***
##                                    (0.127)
## factor(year_week)2022-33          2.103***
##                                    (0.127)
## factor(year_week)2022-34          1.940***
##                                    (0.126)
## factor(year_week)2022-35          1.649***
##                                    (0.126)
## factor(year_week)2022-36          1.664***
##                                    (0.126)
## factor(year_week)2022-37          2.033***
##                                    (0.127)
## factor(year_week)2022-38          2.294***
##                                    (0.127)
## factor(year_week)2022-39          1.825***
##                                    (0.127)
## factor(year_week)2022-40          2.094***
##                                    (0.127)
## factor(year_week)2022-41          1.293***
##                                    (0.126)
## factor(year_week)2022-42          1.929***
##                                    (0.127)
## factor(year_week)2022-43          1.801***
##                                    (0.127)
## factor(year_week)2022-44          1.561***
##                                    (0.127)
## factor(year_week)2022-45          1.460***
##                                    (0.127)
## factor(year_week)2022-46          1.349***
##                                    (0.127)
## factor(year_week)2022-47          1.434***
##                                    (0.126)
## factor(year_week)2022-48          1.510***
##                                    (0.127)
## factor(year_week)2022-49          1.594***
##                                    (0.127)
## factor(year_week)2022-50          1.614***
##                                    (0.129)
## factor(year_week)2022-51          1.693***
##                                    (0.129)
## factor(year_week)2022-52          1.538***
##                                    (0.129)
```

```
## factor(year_week)2022-53          1.485***
##                                   (0.129)
## factor(year_week)2023-01          1.621***
##                                   (0.131)
## factor(year_week)2023-02          1.978***
##                                   (0.130)
## factor(year_week)2023-03          1.826***
##                                   (0.131)
## factor(year_week)2023-04          1.400***
##                                   (0.132)
## factor(year_week)2023-05          1.106***
##                                   (0.131)
## factor(year_week)2023-06          1.467***
##                                   (0.132)
## factor(year_week)2023-07          1.531***
##                                   (0.132)
## factor(year_week)2023-08          1.588***
##                                   (0.131)
## factor(year_week)2023-09          1.673***
##                                   (0.133)
## factor(year_week)2023-10          1.802***
##                                   (0.132)
## factor(year_week)2023-11          1.766***
##                                   (0.134)
## factor(year_week)2023-12          1.712***
##                                   (0.134)
## factor(year_week)2023-13          1.814***
##                                   (0.135)
## factor(year_week)2023-14          1.588***
##                                   (0.135)
## factor(year_week)2023-15          2.020***
##                                   (0.134)
## factor(year_week)2023-16          1.957***
##                                   (0.135)
## factor(year_week)2023-17          2.091***
##                                   (0.137)
## factor(year_week)2023-18          1.629***
##                                   (0.138)
## factor(year_week)2023-19          1.679***
##                                   (0.136)
## factor(year_week)2023-20          1.928***
##                                   (0.137)
## factor(year_week)2023-21          1.647***
##                                   (0.135)
## factor(year_week)2023-22          1.762***
##                                   (0.136)
## factor(year_week)2023-23          1.621***
##                                   (0.136)
## factor(year_week)2023-24          1.815***
##                                   (0.136)
## factor(year_week)2023-25          1.644***
##                                   (0.137)
## factor(year_week)2023-26          1.876***
##                                   (0.137)
```

```
## factor(year_week)2023-27          1.981***
##                                    (0.138)
## factor(year_week)2023-28          2.156***
##                                    (0.139)
## factor(year_week)2023-29          2.049***
##                                    (0.139)
## factor(year_week)2023-30          2.037***
##                                    (0.138)
## factor(year_week)2023-31          2.170***
##                                    (0.138)
## factor(year_week)2023-32          2.205***
##                                    (0.140)
## factor(year_week)2023-33          2.099***
##                                    (0.139)
## Constant                          -1.918***
##                                    (0.096)
## -----------------------------------------------------
## Observations                        9,847
## R2                                  0.112
## Adjusted R2                         0.104
## =====================================================
## Note:                     *p<0.1; **p<0.05; ***p<0.01
```

First Differences

```r
# First Differences (without intercept)
out.fd <- plm(
  perform1 ~ 0 + wfh_post + factor(year_week),
  data  = tb,
  index = c("personid", "year_week"),
  model = "fd"
)

stargazer(
  out.fd, type = "text",
  omit.stat = c("ser", "f"),
  no.space = TRUE, header = FALSE,
  title = "First-Differences (without intercept) results"
)
```

```
##
## First-Differences (without intercept) results
## =====================================================
##                              Dependent variable:
##                           ---------------------------
##                                   perform1
## -----------------------------------------------------
## wfh_post                           0.267*
##                                    (0.155)
## factor(year_week)2022-01           -0.959
##                                    (0.683)
## factor(year_week)2022-02            1.061
##                                    (0.676)
```

```
## factor(year_week)2022-03           1.259*
##                                    (0.671)
## factor(year_week)2022-04           1.444**
##                                    (0.666)
## factor(year_week)2022-05           1.305**
##                                    (0.661)
## factor(year_week)2022-06           1.281*
##                                    (0.656)
## factor(year_week)2022-07            0.956
##                                    (0.651)
## factor(year_week)2022-08           1.246*
##                                    (0.646)
## factor(year_week)2022-09           1.132*
##                                    (0.641)
## factor(year_week)2022-10           1.241*
##                                    (0.635)
## factor(year_week)2022-11           1.250**
##                                    (0.630)
## factor(year_week)2022-12           1.459**
##                                    (0.624)
## factor(year_week)2022-13           1.548**
##                                    (0.619)
## factor(year_week)2022-14           1.477**
##                                    (0.616)
## factor(year_week)2022-15           1.287**
##                                    (0.614)
## factor(year_week)2022-16          1.620***
##                                    (0.610)
## factor(year_week)2022-17          1.716***
##                                    (0.606)
## factor(year_week)2022-18          1.652***
##                                    (0.602)
## factor(year_week)2022-19           1.270**
##                                    (0.597)
## factor(year_week)2022-20          1.604***
##                                    (0.592)
## factor(year_week)2022-21          1.722***
##                                    (0.587)
## factor(year_week)2022-22           1.429**
##                                    (0.586)
## factor(year_week)2022-23           1.088*
##                                    (0.585)
## factor(year_week)2022-24           1.493**
##                                    (0.584)
## factor(year_week)2022-25            0.794
##                                    (0.582)
## factor(year_week)2022-26            0.786
##                                    (0.579)
## factor(year_week)2022-27            0.817
##                                    (0.576)
## factor(year_week)2022-28            0.848
##                                    (0.573)
## factor(year_week)2022-29            0.782
##                                    (0.570)
```

```
## factor(year_week)2022-30             0.663
##                                     (0.566)
## factor(year_week)2022-31             0.819
##                                     (0.562)
## factor(year_week)2022-32             0.511
##                                     (0.558)
## factor(year_week)2022-33             0.574
##                                     (0.553)
## factor(year_week)2022-34             0.445
##                                     (0.548)
## factor(year_week)2022-35             0.173
##                                     (0.542)
## factor(year_week)2022-36             0.185
##                                     (0.537)
## factor(year_week)2022-37             0.519
##                                     (0.533)
## factor(year_week)2022-38             0.773
##                                     (0.528)
## factor(year_week)2022-39             0.302
##                                     (0.523)
## factor(year_week)2022-40             0.584
##                                     (0.518)
## factor(year_week)2022-41            -0.272
##                                     (0.513)
## factor(year_week)2022-42             0.372
##                                     (0.508)
## factor(year_week)2022-43             0.240
##                                     (0.502)
## factor(year_week)2022-44             0.046
##                                     (0.497)
## factor(year_week)2022-45            -0.077
##                                     (0.492)
## factor(year_week)2022-46            -0.220
##                                     (0.488)
## factor(year_week)2022-47            -0.153
##                                     (0.483)
## factor(year_week)2022-48            -0.143
##                                     (0.480)
## factor(year_week)2022-49            -0.085
##                                     (0.477)
## factor(year_week)2022-50            -0.108
##                                     (0.470)
## factor(year_week)2022-51            -0.066
##                                     (0.466)
## factor(year_week)2022-52            -0.206
##                                     (0.462)
## factor(year_week)2022-53            -0.254
##                                     (0.458)
## factor(year_week)2023-01            -0.160
##                                     (0.455)
## factor(year_week)2023-02             0.218
##                                     (0.450)
## factor(year_week)2023-03             0.126
##                                     (0.446)
```

```
## factor(year_week)2023-04            -0.339
##                                     (0.442)
## factor(year_week)2023-05            -0.610
##                                     (0.437)
## factor(year_week)2023-06            -0.273
##                                     (0.431)
## factor(year_week)2023-07            -0.228
##                                     (0.425)
## factor(year_week)2023-08            -0.181
##                                     (0.419)
## factor(year_week)2023-09            -0.131
##                                     (0.413)
## factor(year_week)2023-10             0.035
##                                     (0.406)
## factor(year_week)2023-11            -0.053
##                                     (0.399)
## factor(year_week)2023-12            -0.107
##                                     (0.392)
## factor(year_week)2023-13            -0.035
##                                     (0.385)
## factor(year_week)2023-14            -0.294
##                                     (0.377)
## factor(year_week)2023-15             0.158
##                                     (0.368)
## factor(year_week)2023-16             0.073
##                                     (0.358)
## factor(year_week)2023-17             0.208
##                                     (0.350)
## factor(year_week)2023-18            -0.351
##                                     (0.341)
## factor(year_week)2023-19            -0.232
##                                     (0.330)
## factor(year_week)2023-20             0.005
##                                     (0.320)
## factor(year_week)2023-21            -0.274
##                                     (0.308)
## factor(year_week)2023-22            -0.179
##                                     (0.296)
## factor(year_week)2023-23            -0.292
##                                     (0.284)
## factor(year_week)2023-24            -0.139
##                                     (0.270)
## factor(year_week)2023-25            -0.313
##                                     (0.255)
## factor(year_week)2023-26            -0.102
##                                     (0.239)
## factor(year_week)2023-27            -0.037
##                                     (0.223)
## factor(year_week)2023-28             0.135
##                                     (0.206)
## factor(year_week)2023-29             0.038
##                                     (0.186)
## factor(year_week)2023-30             0.075
##                                     (0.162)
```

```
## factor(year_week)2023-31            0.160
##                                    (0.133)
## factor(year_week)2023-32            0.079
##                                    (0.095)
## ----------------------------------------------------
## Observations                        9,712
## R2                                  0.116
## Adjusted R2                         0.108
## ====================================================
## Note:                    *p<0.1; **p<0.05; ***p<0.01
```

Fixed Effects

```
# Fixed Effects (within)
out.fe <- plm(
  perform1 ~ 0 + wfh_post + factor(year_week),
  data  = tb,
  index = c("personid", "year_week"),
  model = "within"
)

stargazer(
  out.fe, type = "text",
  omit.stat = c("ser", "f"),
  no.space = TRUE, header = FALSE,
  title = "Fixed effects results"
)
```

```
##
## Fixed effects results
## ====================================================
##                             Dependent variable:
##                          ---------------------------
##                                   perform1
## ----------------------------------------------------
## wfh_post                          0.295***
##                                    (0.033)
## factor(year_week)2022-01          -2.094***
##                                    (0.117)
## factor(year_week)2022-02           -0.131
##                                    (0.113)
## factor(year_week)2022-03            0.073
##                                    (0.113)
## factor(year_week)2022-04           0.243**
##                                    (0.113)
## factor(year_week)2022-05            0.016
##                                    (0.112)
## factor(year_week)2022-06           -0.013
##                                    (0.112)
## factor(year_week)2022-07          -0.329***
##                                    (0.112)
## factor(year_week)2022-08           -0.107
##                                    (0.112)
```

```
## factor(year_week)2022-09           -0.201*
##                                    (0.112)
## factor(year_week)2022-10           -0.119
##                                    (0.112)
## factor(year_week)2022-11           -0.133
##                                    (0.111)
## factor(year_week)2022-12            0.033
##                                    (0.111)
## factor(year_week)2022-13            0.121
##                                    (0.111)
## factor(year_week)2022-14            0.132
##                                    (0.112)
## factor(year_week)2022-15           -0.050
##                                    (0.112)
## factor(year_week)2022-16           0.254**
##                                    (0.112)
## factor(year_week)2022-17          0.305***
##                                    (0.112)
## factor(year_week)2022-18            0.178
##                                    (0.112)
## factor(year_week)2022-19          -0.321***
##                                    (0.110)
## factor(year_week)2022-20           -0.005
##                                    (0.110)
## factor(year_week)2022-21            0.102
##                                    (0.110)
## factor(year_week)2022-22           -0.065
##                                    (0.111)
## factor(year_week)2022-23          -0.269**
##                                    (0.111)
## factor(year_week)2022-24           0.265**
##                                    (0.111)
## factor(year_week)2022-25          -0.305***
##                                    (0.111)
## factor(year_week)2022-26           -0.210*
##                                    (0.110)
## factor(year_week)2022-27           -0.096
##                                    (0.110)
## factor(year_week)2022-28            0.077
##                                    (0.111)
## factor(year_week)2022-29            0.076
##                                    (0.110)
## factor(year_week)2022-30           -0.030
##                                    (0.109)
## factor(year_week)2022-31           0.205*
##                                    (0.110)
## factor(year_week)2022-32           -0.044
##                                    (0.110)
## factor(year_week)2022-33            0.093
##                                    (0.110)
## factor(year_week)2022-34           -0.073
##                                    (0.109)
## factor(year_week)2022-35          -0.364***
##                                    (0.109)
```

```
## factor(year_week)2022-36          -0.350***
##                                    (0.109)
## factor(year_week)2022-37           -0.011
##                                    (0.110)
## factor(year_week)2022-38            0.254**
##                                    (0.110)
## factor(year_week)2022-39           -0.214*
##                                    (0.110)
## factor(year_week)2022-40            0.076
##                                    (0.110)
## factor(year_week)2022-41          -0.729***
##                                    (0.109)
## factor(year_week)2022-42           -0.093
##                                    (0.109)
## factor(year_week)2022-43          -0.225**
##                                    (0.109)
## factor(year_week)2022-44          -0.440***
##                                    (0.109)
## factor(year_week)2022-45          -0.557***
##                                    (0.110)
## factor(year_week)2022-46          -0.671***
##                                    (0.110)
## factor(year_week)2022-47          -0.584***
##                                    (0.109)
## factor(year_week)2022-48          -0.530***
##                                    (0.110)
## factor(year_week)2022-49          -0.442***
##                                    (0.109)
## factor(year_week)2022-50          -0.441***
##                                    (0.109)
## factor(year_week)2022-51          -0.359***
##                                    (0.108)
## factor(year_week)2022-52          -0.496***
##                                    (0.108)
## factor(year_week)2022-53          -0.572***
##                                    (0.109)
## factor(year_week)2023-01          -0.441***
##                                    (0.110)
## factor(year_week)2023-02           -0.094
##                                    (0.110)
## factor(year_week)2023-03          -0.222**
##                                    (0.110)
## factor(year_week)2023-04          -0.654***
##                                    (0.111)
## factor(year_week)2023-05          -0.933***
##                                    (0.110)
## factor(year_week)2023-06          -0.593***
##                                    (0.111)
## factor(year_week)2023-07          -0.536***
##                                    (0.111)
## factor(year_week)2023-08          -0.481***
##                                    (0.110)
## factor(year_week)2023-09          -0.405***
##                                    (0.112)
```

```
## factor(year_week)2023-10          -0.266**
##                                    (0.111)
## factor(year_week)2023-11          -0.330***
##                                    (0.113)
## factor(year_week)2023-12          -0.385***
##                                    (0.113)
## factor(year_week)2023-13          -0.285**
##                                    (0.113)
## factor(year_week)2023-14          -0.502***
##                                    (0.114)
## factor(year_week)2023-15           -0.070
##                                    (0.113)
## factor(year_week)2023-16           -0.134
##                                    (0.113)
## factor(year_week)2023-17           -0.012
##                                    (0.115)
## factor(year_week)2023-18          -0.501***
##                                    (0.116)
## factor(year_week)2023-19          -0.434***
##                                    (0.114)
## factor(year_week)2023-20           -0.192*
##                                    (0.115)
## factor(year_week)2023-21          -0.449***
##                                    (0.114)
## factor(year_week)2023-22          -0.346***
##                                    (0.114)
## factor(year_week)2023-23          -0.484***
##                                    (0.114)
## factor(year_week)2023-24          -0.279**
##                                    (0.115)
## factor(year_week)2023-25          -0.451***
##                                    (0.115)
## factor(year_week)2023-26           -0.212*
##                                    (0.115)
## factor(year_week)2023-27           -0.123
##                                    (0.116)
## factor(year_week)2023-28            0.049
##                                    (0.117)
## factor(year_week)2023-29           -0.044
##                                    (0.116)
## factor(year_week)2023-30           -0.055
##                                    (0.116)
## factor(year_week)2023-31            0.080
##                                    (0.116)
## factor(year_week)2023-32            0.095
##                                    (0.117)
## ----------------------------------------------------
## Observations                        9,847
## R2                                  0.146
## Adjusted R2                         0.126
## ====================================================
## Note:                    *p<0.1; **p<0.05; ***p<0.01
```

Pooled OLS with Person Dummies

```r
# Pooled OLS with person dummies
out.pool <- plm(
  perform1 ~ wfh_post + factor(year_week) + factor(personid),
  data  = tb,
  index = c("personid", "year_week"),
  model = "pooling"
)

stargazer(
  out.pool, type = "text",
  omit.stat = c("ser", "f"),
  omit = c(".*personid.*"),
  omit.labels = c("Person Dummies"),
  no.space = TRUE, header = FALSE,
  title = "Pooled OLS (with person dummies) results"
)
```

```
##
## Pooled OLS (with person dummies) results
## ====================================================
##                              Dependent variable:
##                          ---------------------------
##                                   perform1
## ----------------------------------------------------
## wfh_post                          0.295***
##                                    (0.033)
## factor(year_week)2022-02          1.963***
##                                    (0.110)
## factor(year_week)2022-03          2.168***
##                                    (0.110)
## factor(year_week)2022-04          2.337***
##                                    (0.110)
## factor(year_week)2022-05          2.110***
##                                    (0.109)
## factor(year_week)2022-06          2.081***
##                                    (0.109)
## factor(year_week)2022-07          1.765***
##                                    (0.109)
## factor(year_week)2022-08          1.988***
##                                    (0.109)
## factor(year_week)2022-09          1.894***
##                                    (0.109)
## factor(year_week)2022-10          1.976***
##                                    (0.108)
## factor(year_week)2022-11          1.961***
##                                    (0.108)
## factor(year_week)2022-12          2.128***
##                                    (0.108)
## factor(year_week)2022-13          2.215***
##                                    (0.108)
## factor(year_week)2022-14          2.227***
##                                    (0.109)
## factor(year_week)2022-15          2.045***
```

```
##                                     (0.109)
## factor(year_week)2022-16          2.349***
##                                     (0.109)
## factor(year_week)2022-17          2.399***
##                                     (0.109)
## factor(year_week)2022-18          2.273***
##                                     (0.108)
## factor(year_week)2022-19          1.774***
##                                     (0.107)
## factor(year_week)2022-20          2.089***
##                                     (0.107)
## factor(year_week)2022-21          2.196***
##                                     (0.107)
## factor(year_week)2022-22          2.029***
##                                     (0.108)
## factor(year_week)2022-23          1.826***
##                                     (0.108)
## factor(year_week)2022-24          2.359***
##                                     (0.107)
## factor(year_week)2022-25          1.789***
##                                     (0.107)
## factor(year_week)2022-26          1.884***
##                                     (0.107)
## factor(year_week)2022-27          1.999***
##                                     (0.107)
## factor(year_week)2022-28          2.171***
##                                     (0.107)
## factor(year_week)2022-29          2.170***
##                                     (0.107)
## factor(year_week)2022-30          2.065***
##                                     (0.106)
## factor(year_week)2022-31          2.299***
##                                     (0.107)
## factor(year_week)2022-32          2.051***
##                                     (0.107)
## factor(year_week)2022-33          2.188***
##                                     (0.107)
## factor(year_week)2022-34          2.022***
##                                     (0.106)
## factor(year_week)2022-35          1.730***
##                                     (0.105)
## factor(year_week)2022-36          1.745***
##                                     (0.106)
## factor(year_week)2022-37          2.084***
##                                     (0.106)
## factor(year_week)2022-38          2.349***
##                                     (0.106)
## factor(year_week)2022-39          1.880***
##                                     (0.107)
## factor(year_week)2022-40          2.170***
##                                     (0.106)
## factor(year_week)2022-41          1.366***
##                                     (0.106)
## factor(year_week)2022-42          2.001***
```

```
##                                       (0.106)
## factor(year_week)2022-43            1.869***
##                                       (0.106)
## factor(year_week)2022-44            1.654***
##                                       (0.106)
## factor(year_week)2022-45            1.538***
##                                       (0.107)
## factor(year_week)2022-46            1.424***
##                                       (0.106)
## factor(year_week)2022-47            1.510***
##                                       (0.106)
## factor(year_week)2022-48            1.564***
##                                       (0.106)
## factor(year_week)2022-49            1.652***
##                                       (0.106)
## factor(year_week)2022-50            1.654***
##                                       (0.108)
## factor(year_week)2022-51            1.736***
##                                       (0.108)
## factor(year_week)2022-52            1.599***
##                                       (0.108)
## factor(year_week)2022-53            1.523***
##                                       (0.109)
## factor(year_week)2023-01            1.654***
##                                       (0.110)
## factor(year_week)2023-02            2.001***
##                                       (0.110)
## factor(year_week)2023-03            1.872***
##                                       (0.110)
## factor(year_week)2023-04            1.440***
##                                       (0.111)
## factor(year_week)2023-05            1.162***
##                                       (0.110)
## factor(year_week)2023-06            1.501***
##                                       (0.111)
## factor(year_week)2023-07            1.559***
##                                       (0.111)
## factor(year_week)2023-08            1.614***
##                                       (0.111)
## factor(year_week)2023-09            1.689***
##                                       (0.112)
## factor(year_week)2023-10            1.828***
##                                       (0.111)
## factor(year_week)2023-11            1.764***
##                                       (0.113)
## factor(year_week)2023-12            1.709***
##                                       (0.113)
## factor(year_week)2023-13            1.810***
##                                       (0.114)
## factor(year_week)2023-14            1.593***
##                                       (0.114)
## factor(year_week)2023-15            2.025***
##                                       (0.113)
## factor(year_week)2023-16            1.961***
```

```
##                                    (0.114)
## factor(year_week)2023-17          2.083***
##                                    (0.116)
## factor(year_week)2023-18          1.593***
##                                    (0.116)
## factor(year_week)2023-19          1.661***
##                                    (0.114)
## factor(year_week)2023-20          1.903***
##                                    (0.116)
## factor(year_week)2023-21          1.645***
##                                    (0.114)
## factor(year_week)2023-22          1.748***
##                                    (0.115)
## factor(year_week)2023-23          1.611***
##                                    (0.115)
## factor(year_week)2023-24          1.815***
##                                    (0.115)
## factor(year_week)2023-25          1.644***
##                                    (0.115)
## factor(year_week)2023-26          1.883***
##                                    (0.115)
## factor(year_week)2023-27          1.972***
##                                    (0.116)
## factor(year_week)2023-28          2.144***
##                                    (0.117)
## factor(year_week)2023-29          2.050***
##                                    (0.117)
## factor(year_week)2023-30          2.040***
##                                    (0.116)
## factor(year_week)2023-31          2.174***
##                                    (0.116)
## factor(year_week)2023-32          2.189***
##                                    (0.118)
## factor(year_week)2023-33          2.094***
##                                    (0.117)
## Constant                          -1.692***
##                                    (0.117)
## ---------------------------------------------------
## Person Dummies                        Yes
## ---------------------------------------------------
## Observations                         9,847
## R2                                   0.386
## Adjusted R2                          0.372
## ===================================================
## Note:                   *p<0.1; **p<0.05; ***p<0.01
```

to interpret our models we will use the summary table we have seen in the lab8.

```r
# Summary table

stargazer(
  out.pool, out.pl, out.fd, out.fe,
  type = "text",
  column.labels = c("Pool with dummies", "Pool no dummies", "FD", "FE"),
```

```r
  omit.stat = c("ser", "f"),
  omit = c("factor\\(year_week\\).*", ".*personid.*"),
  omit.labels = c("Time Dummies", "Person Dummies"),
  model.names = FALSE,
  no.space = TRUE, header = FALSE,
  title = "Summary results"
)
```

```
##
## Summary results
## ===================================================================
##                                Dependent variable:
##                  --------------------------------------------------
##                                      perform1
##                  Pool with dummies Pool no dummies   FD       FE
##                         (1)               (2)         (3)      (4)
## -------------------------------------------------------------------
## wfh_post             0.295***          0.277***     0.267*  0.295***
##                      (0.033)           (0.030)     (0.155) (0.033)
## Constant            -1.692***         -1.918***
##                      (0.117)           (0.096)
## -------------------------------------------------------------------
## Time Dummies           Yes               Yes         Yes      Yes
## Person Dummies         Yes               No          No       No
## -------------------------------------------------------------------
## Observations          9,847             9,847       9,712    9,847
## R2                    0.386             0.112       0.116    0.146
## Adjusted R2           0.372             0.104       0.108    0.126
## ===================================================================
## Note:                                  *p<0.1; **p<0.05; ***p<0.01
```

The panel regression estimates the impact of the **building-issue-induced WFH shock using a Difference-in-Differences (DiD) setup**, where the key variable is wfh_post = treated × post. The dependent variable perform1 is an overall **performance z-score**, so coefficients can be interpreted in **standard deviation units.** Across specifications, the estimated effect of wfh_post is **consistently positive and statistically significant: 0.295*** in the pooled model with person dummies, **0.277*** in pooled OLS without person dummies, **0.267*** in first differences, and **0.295*** in the fixed-effects model. This stability strongly suggests that the result is not driven by modeling choice but reflects a robust pattern in the data. Substantively, the preferred **FE estimate (~0.295)** implies that employees affected by the building issues experienced an **increase of about 0.30 standard deviations in performance** after the event, relative to unaffected employees and relative to the pre-period. Interpreted within the DiD logic, this is the additional **post-event shift** for the treated group beyond general time trends and time-invariant individual differences. The consistency across Pool/FD/FE strengthens the credibility of the estimated effect, assuming the parallel trends assumption is reasonably satisfied.

Breusch–Godfrey/Wooldridge test for serial correlation in FE residuals

```r
pbgtest(out.fe)
```

```
##
##  Breusch-Godfrey/Wooldridge test for serial correlation in panel models
##
## data:  perform1 ~ 0 + wfh_post + factor(year_week)
```

```
## chisq = 1067.3, df = 27, p-value < 2.2e-16
## alternative hypothesis: serial correlation in idiosyncratic errors
```

The Breusch–Godfrey/Wooldridge test **strongly rejects the null hypothesis of no serial correlation (p-value $<$ 2.2e-16).** This **indicates substantial serial correlation in the weekly panel residuals** of the FE specification. In practical terms, this does not invalidate the estimated coefficient itself, but it does mean that **conventional (non-robust) standard errors are likely biased** downward, which can overstate statistical significance.

Therefore, **inference should rely on robust or cluster-robust standard errors,** ideally clustered at the person level for this weekly employee panel.

Because of that the Robust standard errors are calculated next.

Robust Standard Errors for FE model

```r
# Robust SEs (Arellano)

robust_se <- sqrt(diag(plm::vcovHC(out.fe, method = "arellano")))

stargazer(
  out.fe, out.fe,
  se = list(NULL, robust_se),
  column.labels = c("Non-Robust SEs", "Robust SEs"),
  type = "text",
  omit.stat = c("ser", "f"),
  omit = c("factor\\(year_week\\).*"),
  omit.labels = c("Time Dummies"),
  model.names = FALSE,
  dep.var.labels.include = FALSE,
  no.space = TRUE, header = FALSE,
  title = "Serial correlation results"
)
```

```
##
## Serial correlation results
## =========================================
##                    Dependent variable:
##                ----------------------------
##                 Non-Robust SEs  Robust SEs
##                      (1)           (2)
## -----------------------------------------
## wfh_post          0.295***      0.295***
##                   (0.033)       (0.059)
## -----------------------------------------
## Time Dummies        Yes           Yes
## -----------------------------------------
## Observations       9,847         9,847
## R2                 0.146         0.146
## Adjusted R2        0.126         0.126
## =========================================
## Note:          *p<0.1; **p<0.05; ***p<0.01
```

As already mentioned, the estimated DiD effect of the building-issue-induced WFH shock on overall performance is positive and economically meaningful. The FE coefficient on wfh_post is approximately 0.295, implying an increase of about 0.30 standard deviations in the performance z-score for affected employees in the post period relative to unaffected employees.

Given evidence of serial correlation, **we report Arellano-robust standard errors. The robust correction increases the standard error from 0.033 to 0.059,** but the estimated **effect remains statistically significant,** indicating that the **main result is robust to serial-correlation-consistent inference.**

Plots that have additionally been used in the ppt. presentation

Average performance for promotion for male and female

```
final_all %>%
  group_by(gender) %>%
  summarise(Average_Performance = mean(mean_overall_perf_z_score)) %>%
  arrange(desc(Average_Performance))
```

```
## # A tibble: 2 x 2
##   gender Average_Performance
##   <fct>                <dbl>
## 1 Female               0.154
## 2 Male                -0.280
```

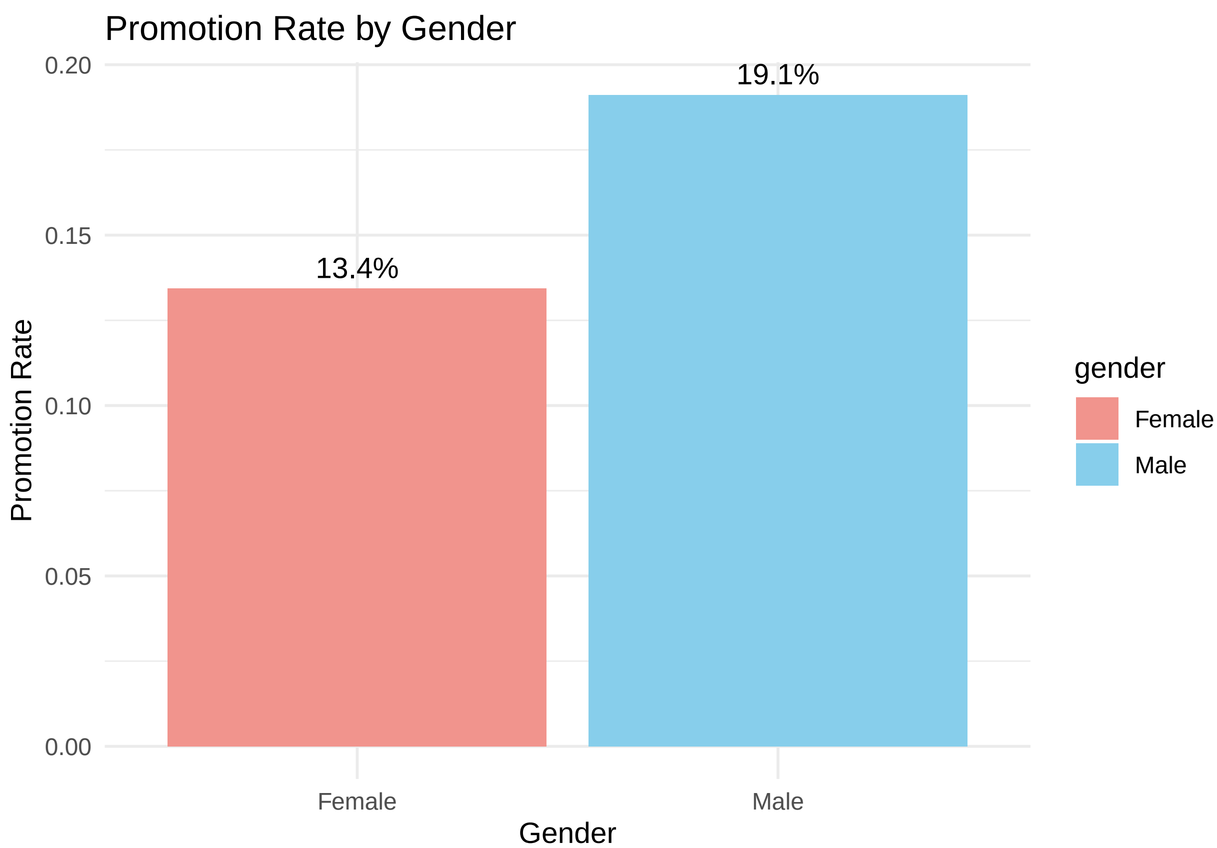
Average performance when promoted for male and female

```
final_all %>%
  filter(promote_switch == 1) %>%
  group_by(gender) %>%
  summarise(Average_Performance_Promoted = mean(mean_overall_perf_z_score)) %>%
  arrange(desc(Average_Performance_Promoted))
```

```
## # A tibble: 2 x 2
##   gender Average_Performance_Promoted
##   <fct>                         <dbl>
## 1 Female                       0.398
## 2 Male                        -0.0283
```

Promotion rate by gender

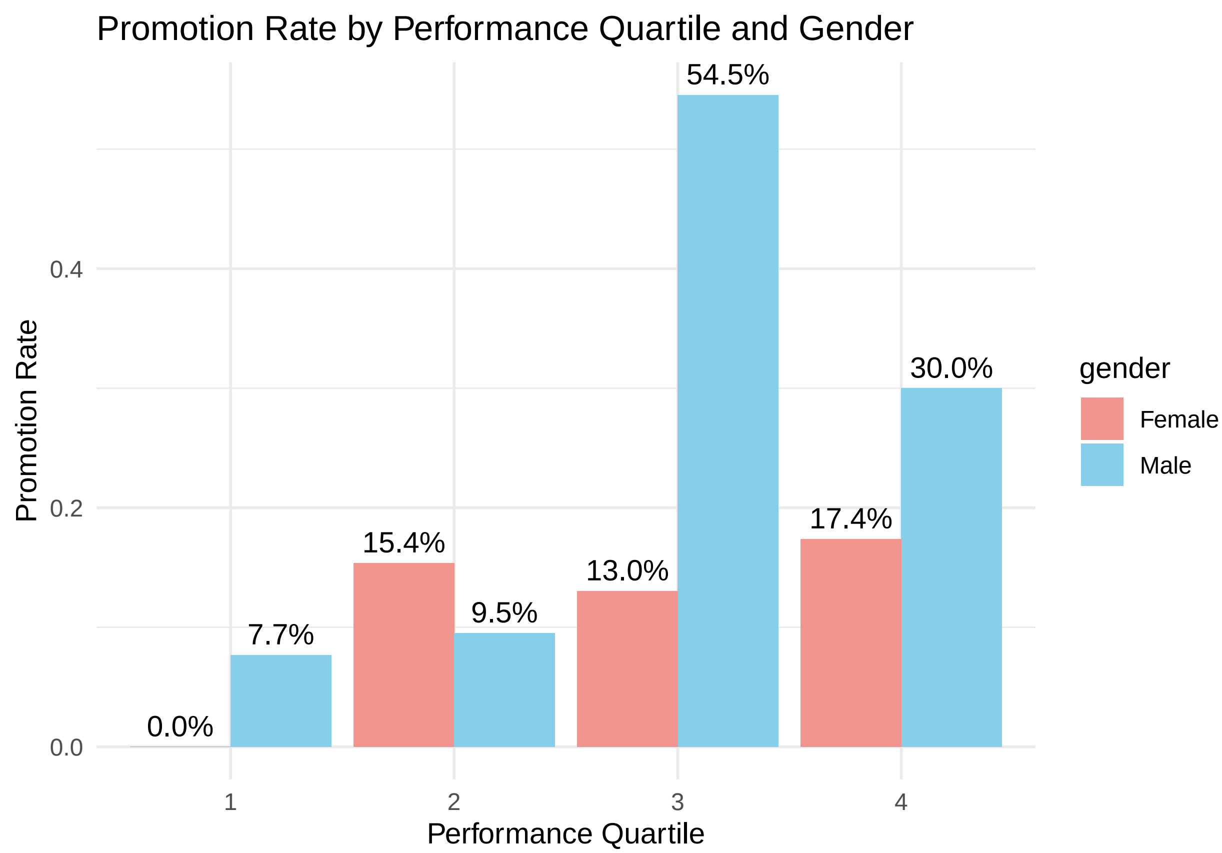
```
final_all %>%
  group_by(gender) %>%
  summarise(Promotion_Rate = mean(promote_switch)) %>%
  arrange(desc(Promotion_Rate)) %>%
  ggplot(aes(x = gender, y = Promotion_Rate, fill = gender)) +
  geom_bar(stat = "identity") +
  scale_fill_manual(values = c("Male" = "skyblue", "Female" = "#F1948D")) +
  geom_text(aes(label = scales::percent(Promotion_Rate, accuracy = 0.1)), vjust = -0.5) +
  labs(title = "Promotion Rate by Gender", x = "Gender", y = "Promotion Rate") +
  theme_minimal()
```



Promotionrate by performance quartile

```
final_all <- final_all %>%
  mutate(performance_quartile = ntile(mean_overall_perf_z_score, 4))

final_all %>%
  group_by(performance_quartile, gender) %>%
  summarise(Promotion_Rate = mean(promote_switch)) %>%
  arrange(performance_quartile, desc(Promotion_Rate)) %>%
  ggplot(aes(x = factor(performance_quartile), y = Promotion_Rate, fill = gender)) +
  geom_bar(stat = "identity", position = "dodge") +
  scale_fill_manual(values = c("Male" = "skyblue", "Female" = "#F1948D")) +
  geom_text(aes(label = scales::percent(Promotion_Rate, accuracy = 0.1)),
            position = position_dodge(width = 0.9), vjust = -0.5) +
  labs(title = "Promotion Rate by Performance Quartile and Gender",
       x = "Performance Quartile",
       y = "Promotion Rate") +
  theme_minimal()
```

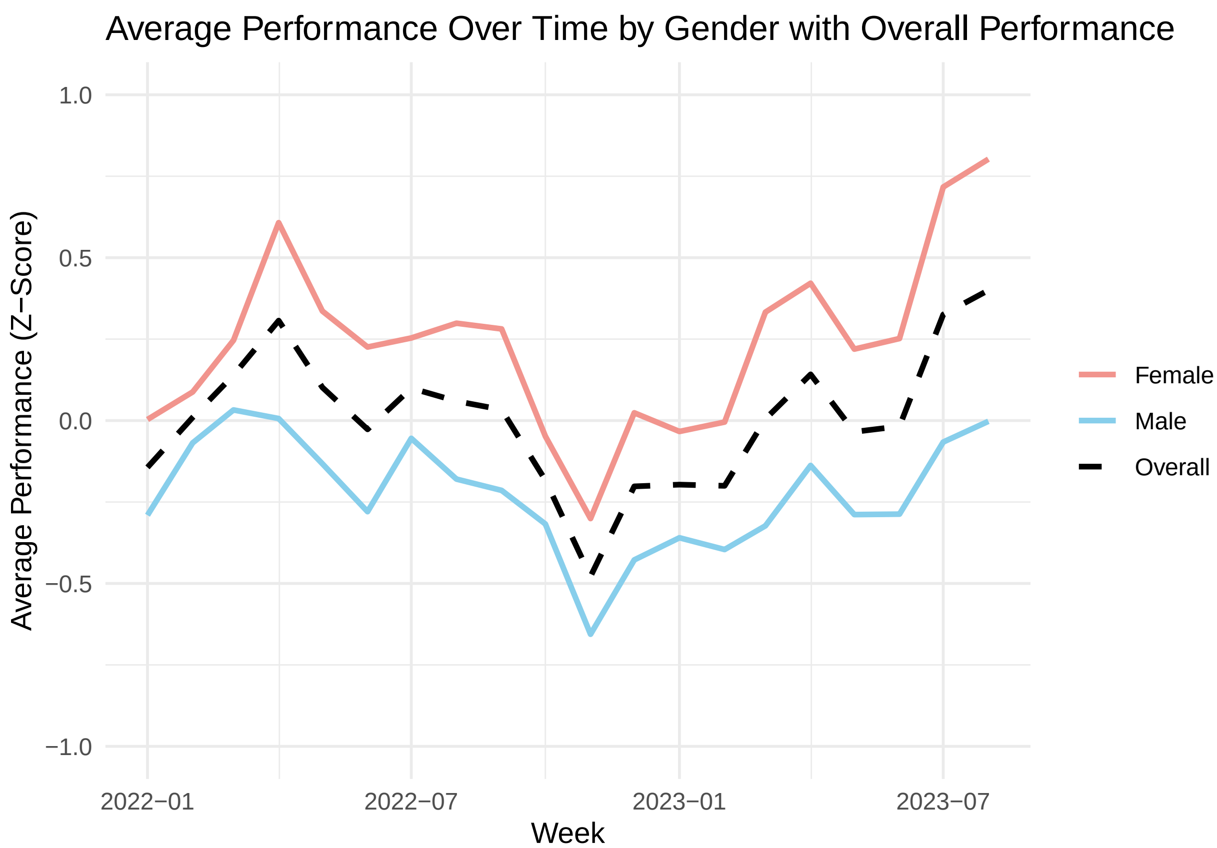
```
## `summarise()` has grouped output by 'performance_quartile'. You can override
## using the `.groups` argument.
```



Average performance over months for male, female and overall

```
final_panel_weekly %>%
  group_by(month, gender) %>%
  summarise(Average_Performance = mean(perform1, na.rm = TRUE)) %>%
  ungroup() %>%
  group_by(month) %>%
  summarise(Overall_Average_Performance = mean(Average_Performance, na.rm = TRUE)) %>%
  left_join(final_panel_weekly %>%
              group_by(month, gender) %>%
              summarise(Average_Performance = mean(perform1, na.rm = TRUE)), by = "month") %>%
  ggplot(aes(x = month)) +
  geom_line(aes(y = Average_Performance, color = gender), size = 1) +
  geom_line(aes(y = Overall_Average_Performance, color = "Overall"), size = 1, linetype = "dashed") +
  scale_color_manual(values = c("Male" = "skyblue", "Female" = "#F1948D", "Overall" = "black")) +
  labs(title = "Average Performance Over Time by Gender with Overall Performance",
       x = "Week",
       y = "Average Performance (Z-Score)") +
  theme_minimal() +
  theme(legend.title = element_blank()) +
  scale_y_continuous(limits = c(-1, 1))
```

```
## `summarise()` has grouped output by 'month'. You can override using the
## `.groups` argument.
## `summarise()` has grouped output by 'month'. You can override using the
## `.groups` argument.
```


Average Performance Over Time by Gender with Overall Performance
1.0
0.5
0.0
−0.5
−1.0
Average Performance (Z−Score)
2022−01
2022−07
2023−01
2023−07
Week
Female
Male
Overall

……