Final Version of Assignment One

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Assignment One

Welcome

Dear fellow survivor of this course

If you are reading this, we have both made it this far, congratulations to us! I hope this assignment makes sense, runs without errors, and causes minimal emotional damage.

May your marking be fair, your coffee strong, and your rubric generous.

1 Project One

QUESTION ONE

```
down <- nrow(airquality)
across <- ncol(airquality)
sum <- 0

print('The following rows have missing information: ')
```

```
[1] "The following rows have missing information: "
```

```
for(i in 1:down){
  for(j in 1:across){
    if(is.na(airquality[i,j])){
      sum <- sum + 1
      print(i)
      break}
  }
}
```

```
[1] 5
[1] 6
[1] 10
[1] 11
[1] 25
[1] 26
[1] 27
[1] 32
[1] 33
[1] 34
[1] 35
[1] 36
[1] 37
[1] 39
```

```
[1] 42
[1] 43
[1] 45
[1] 46
[1] 52
[1] 53
[1] 54
[1] 55
[1] 56
[1] 57
[1] 58
[1] 59
[1] 60
[1] 61
[1] 65
[1] 72
[1] 75
[1] 83
[1] 84
[1] 96
[1] 97
[1] 98
[1] 102
[1] 103
[1] 107
[1] 115
[1] 119
[1] 150
```

```r
print(paste0('In total there are ', sum, ' rows with missing information.' ))
```

```
[1] "In total there are 42 rows with missing information."
```

QUESTION TWO

```r
my_table <- data.frame(
  Column = c('Temperature', 'Ozone'),
  Mean = c(mean(airquality[,4]), mean(airquality[,1], na.rm=TRUE)),
  SD = c(sd(airquality[,4]), sd(airquality[,1], na.rm=TRUE)),
  Min = c(min(airquality[,4]), min(airquality[,1], na.rm=TRUE)),
  Max = c(max(airquality[,4]), max(airquality[,1], na.rm=TRUE))
```

```
)

print(my_table)
```

```
       Column     Mean       SD Min Max
1 Temperature 77.88235  9.46527  56  97
2       Ozone 42.12931 32.98788   1 168
```

QUESTION THREE

```
data(cars)

Y <- cars$dist
X <- cbind(1, cars$speed)

my_funct <- function(design, response) {

  a <- t(design)%*%design
  b <- solve(a)
  c <- t(design)%*%response
  d <- b%*%c

  return(d)
}

print(my_funct(X, Y))
```

```
           [,1]
[1,] -17.579095
[2,]   3.932409
```

QUESTION FOUR

```
model <- lm(cars$dist~cars$speed, data=cars )
summary(model)
```

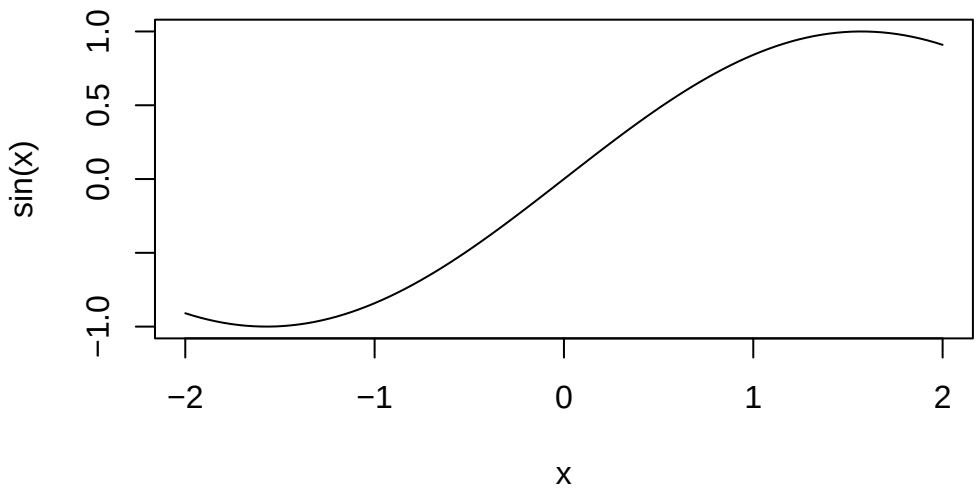
```
Call:
lm(formula = cars$dist ~ cars$speed, data = cars)
```

```
Residuals:
    Min      1Q  Median      3Q     Max
-29.069  -9.525  -2.272   9.215  43.201

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -17.5791     6.7584  -2.601   0.0123 *
cars$speed    3.9324     0.4155   9.464 1.49e-12 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 15.38 on 48 degrees of freedom
Multiple R-squared:  0.6511,    Adjusted R-squared:  0.6438
F-statistic: 89.57 on 1 and 48 DF,  p-value: 1.49e-12
```

2 Day Three Practical Q3 & Q4

QUESTION FOUR

```
curve(sin(x), from = -2, to = 2)
```



QUESTION FIVE

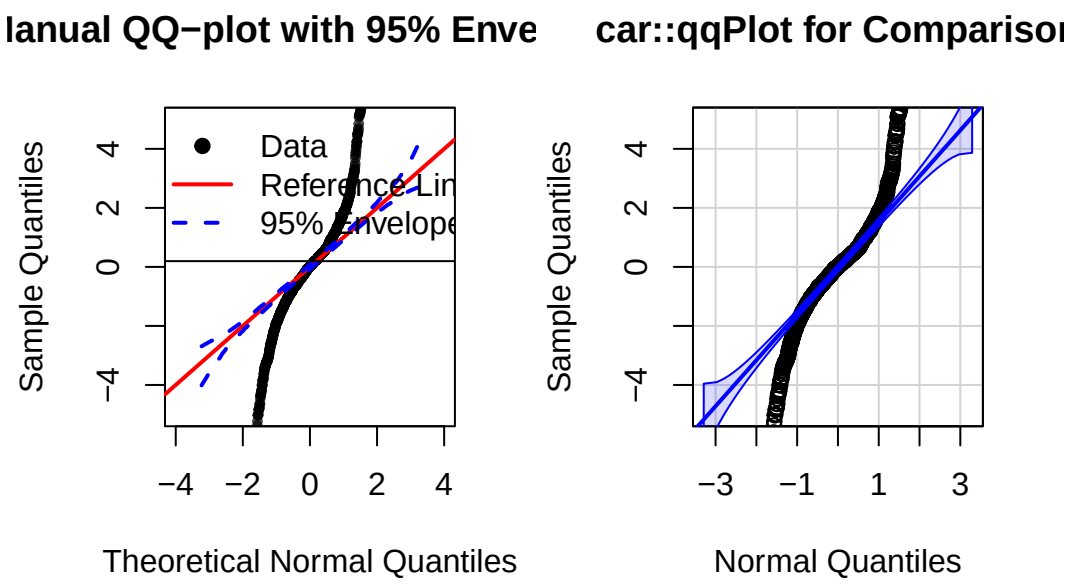
```
randoms <- rt(1000, 1)

#Creating a manual QQ-plot with 95% confidence interval

sorted_randoms <- sort(randoms)

n <- length(randoms)
i <- 1:n
```

```r
# Calculate plotting positions (probabilities)
p <- (i - 3/8) / (n + 1/4)

# Generate normal quantiles by simulation (since we can't use qnorm)
large_normal_sample <- rnorm(1000000)  # Large normal reference
theoretical_quantiles <- quantile(large_normal_sample, probs = p)

# Calculate 95% probability envelopes by simulation
n_sim <- 1000  # Number of simulations
envelope_matrix <- matrix(NA, nrow = n_sim, ncol = n)

# Simulate many normal samples of size n
for (j in 1:n_sim) {
    sim_sample <- rnorm(n)
    sim_sorted <- sort(sim_sample)
    envelope_matrix[j, ] <- sim_sorted
}

# Calculate 2.5% and 97.5% percentiles at each position
lower_envelope <- apply(envelope_matrix, 2, quantile, probs = 0.025)
upper_envelope <- apply(envelope_matrix, 2, quantile, probs = 0.975)

# Create the QQ-plot
par(mfrow = c(1, 2))  # Split plot window

# Manual QQ-plot
plot(theoretical_quantiles, sorted_randoms,
     xlab = "Theoretical Normal Quantiles",
     ylab = "Sample Quantiles",
     main = "Manual QQ-plot with 95% Envelopes",
     pch = 19, cex = 0.6,
     ylim = c(-5, 5), xlim = c(-4, 4),
     col = rgb(0, 0, 0, 0.7))

# Add reference line (y = x)
abline(a = 0, b = 1, col = "red", lwd = 2)

# Add 95% probability bands
lines(theoretical_quantiles, lower_envelope,
      col = "blue", lty = 2, lwd = 2)
lines(theoretical_quantiles, upper_envelope,
      col = "blue", lty = 2, lwd = 2)
```

```r
# Add legend
legend("topleft",
       legend = c("Data", "Reference Line", "95% Envelope"),
       col = c("black", "red", "blue"),
       pch = c(19, NA, NA),
       lty = c(NA, 1, 2),
       lwd = c(NA, 2, 2))

# Check with car::qqPlot for comparison
library(car)
```

```
Loading required package: carData
```

```r
qqPlot(randoms, envelope = 0.95, ylim = c(-5, 5),
       main = "car::qqPlot for Comparison",
       xlab = "Normal Quantiles",
       ylab = "Sample Quantiles")
```




```
[1] 843 140
```

3 Day Four Practical

QUESTION ONE

```
library(tidyverse)
```

```
Warning: package 'tidyverse' was built under R version 4.3.3
```

```
Warning: package 'tidyr' was built under R version 4.3.3
```

```
Warning: package 'purrr' was built under R version 4.3.3
```

```
Warning: package 'dplyr' was built under R version 4.3.3
```

```
Warning: package 'forcats' was built under R version 4.3.3
```

```
Warning: package 'lubridate' was built under R version 4.3.3
```

```
-- 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   1.6.0
v ggplot2   4.0.2     v tibble    3.2.1
v lubridate 1.9.4     v tidyr     1.3.1
v purrr     1.0.4
-- 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 becor
```

```
library(nycflights13)
```

```
Warning: package 'nycflights13' was built under R version 4.3.3
```

```
#The line below renames the first 10 columns of flights and prints the flights data set with

flights |> rename(Year = year, Month = month, Day = day, Dep_Time = dep_time, Sched_Dep_Time
```

```
# A tibble: 336,776 x 19
    Year Month   Day Dep_Time Sched_Dep_Time Dep_Delay Arr_Time Sched_Arr_Time
   <int> <int> <int>    <int>          <int>     <dbl>    <int>          <int>
 1  2013     1     2     2130           2130         0        1             18
 2  2013     1    11     2157           2000       117        1           2208
 3  2013     1    11     2253           2249         4        1           2357
 4  2013     1    14     2122           2130        -8        1              2
 5  2013     1    14     2246           2250        -4        1              7
 6  2013     1    15     2304           2245        19        1           2357
 7  2013     1    16     2018           2025        -7        1           2329
 8  2013     1    16     2303           2245        18        1           2357
 9  2013     1    19     2107           2110        -3        1           2355
10  2013     1    22     2246           2249        -3        1           2357
# i 336,766 more rows
# i 11 more variables: Arr_Delay <dbl>, Carrier <chr>, flight <int>,
#   tailnum <chr>, origin <chr>, dest <chr>, air_time <dbl>, distance <dbl>,
#   hour <dbl>, minute <dbl>, time_hour <dttm>
```

QUESTION TWO

```
#Creates flight1 tibble that contains flights that occured in month 1 ONLY
flight1 <- flights |> filter(month == 1)

#Gets the average distance of each carrier
carrier_dist_vec_mean <- flight1 |> group_by(carrier) |> summarise(MEAN = mean(distance, na.

#Gets the standard deviation of the distance for each carrier
carrier_dist_vec_sd <- flight1 |> group_by(carrier) |> summarise(SD = sd(distance, na.rm = T

#Creates one tibble with both the mean and sd distance for each carrier
dist_tbl <- carrier_dist_vec_mean |> left_join(carrier_dist_vec_sd)
```

```
Joining with `by = join_by(carrier)`
```

```
#Arranges the carrier rows from that with the least to the highest mean distance
dist_tbl |> arrange(MEAN)
```

```
# A tibble: 16 x 3
   carrier  MEAN    SD
   <chr>   <dbl> <dbl>
 1 YV       229    0
 2 9E       476. 334.
 3 EV       522. 294.
 4 US       536. 553.
 5 MQ       566. 223.
 6 FL       691. 142.
 7 OO       733   NA
 8 WN       942. 496.
 9 B6      1062. 681.
10 DL      1220. 644.
11 AA      1350. 626.
12 UA      1462. 778.
13 F9      1620    0
14 AS      2402    0
15 VX      2495.  98.2
16 HA      4983    0
```

QUESTION THREE

```
########## NA ##############

carrierOO <- flight1 |> filter(carrier == 'OO') |> select(carrier, distance)

carrierOO
```

```
# A tibble: 1 x 2
  carrier distance
  <chr>      <dbl>
1 OO           733
```

```
print('Explanation of NA: Carrier OO has NA as the standard deviation of the distance, that i
```

```
[1] "Explanation of NA: Carrier OO has NA as the standard deviation of the distance, that is
```

```
########## ZERO ##############

carrierYV <- flight1 |> filter(carrier == 'YV') |> select(carrier, distance)

carrierYV
```

```
# A tibble: 46 x 2
   carrier distance
   <chr>      <dbl>
 1 YV           229
 2 YV           229
 3 YV           229
 4 YV           229
 5 YV           229
 6 YV           229
 7 YV           229
 8 YV           229
 9 YV           229
10 YV           229
# i 36 more rows
```

```
print('Explanaition of ZERO: The standard deviation of the distance for the YV carrier is ze
```

```
[1] "Explanaition of ZERO: The standard deviation of the distance for the YV carrier is zero
```

QUESTION FOUR

```
#Getting the Average Departure delay for each carrier in each month in the long format
switched <- flights |> group_by(carrier, month) |> summarise(Av_Dep_Delay = mean(dep_delay, r
```

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

```
#Converting into wide data
switched2 <- switched |> pivot_wider(names_from = carrier, values_from = Av_Dep_Delay)

switched2
```

```
# A tibble: 12 x 17
   month  `9E`    AA     AS    B6    DL    EV    F9    FL    HA    MQ    OO
   <int> <dbl> <dbl>  <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
 1     1 16.9   6.93  7.35   9.49  3.85 24.2  10     1.97 54.4   6.49 67
 2     2 16.5   8.28  0.722 13.8   5.54 21.5  29.8   5.18 17.4   8.09 NA
 3     3 13.4   8.70  8.42  14.2   9.93 26.2  16.8  17.3   1.16  7.19 NA
 4     4 13.6  11.7  11.3   15.2   8.17 22.8  24.6  13.1  -2.1  13.7  NA
 5     5 22.7   9.66  6.77   9.78  9.74 20.2  35.9  19.2  -1.45 13.9  NA
```

```
 6     6 29.0  14.6  13.1   20.4  18.7  25.5  29.4  38.8   1.47 20.8  61
 7     7 31.4  12.1   2.42  24.9  20.6  26.5  31.8  41.2  -1.71 20.7  NA
 8     8 17.3   7.17  2.87  15.7   9.85 16.3  22.2  23.4   1.68 10.1  64
 9     9  7.75  5.69 -4.52   6.63  5.53  8.24  8.26 16.9  -5.44  5.35 -4.94
10    10  9.33  3.00  0.677  2.96  3.42 13.4   9.70 13.7  -5.10  4.48 NA
11    11  7.56  3.10  3.08   3.52  2.85  9.83 13.5  16.9  -5.44  3.28  0.8
12    12 19.8  11.7  18.0   17.0  10.8  27.9  13.1  26.1  -3.14 12.7  NA
# i 5 more variables: UA <dbl>, US <dbl>, VX <dbl>, WN <dbl>, YV <dbl>
```

QUESTION FIVE

```
#Getting number of all flights with a delayed departure time and arrived with NO delay
meet_Condition <- flights |> filter(dep_delay > 0) |> filter(arr_delay <= 0) |> count()

#Getting number of total flights
total_Flights <- flights |> count()

#Calculating the proportion
prop_Delayed <- meet_Condition/total_Flights

#Renaming the column
prop_Delayed <- prop_Delayed |> rename(Prop_Delayed = n)

prop_Delayed
```

```
  Prop_Delayed
1    0.1052391
```

QUESTION SIX

```
routes <- flights |> group_by(origin, dest) |> summarize(n_airlines = n_distinct(carrier)) |>
```

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

```
routes
```

```
# A tibble: 128 x 3
# Groups:   origin [3]
   origin dest  n_airlines
```

```
   <chr>  <chr>      <int>
 1 EWR    ATL            4
 2 EWR    AUS            2
 3 EWR    BDL            2
 4 EWR    BNA            2
 5 EWR    BOS            3
 6 EWR    BWI            2
 7 EWR    CHS            2
 8 EWR    CLE            2
 9 EWR    CLT            3
10 EWR    CVG            2
# i 118 more rows
```

```
#Joining the routes with at least two airlines with rest of the flights data
joint <- routes |> left_join(flights, by = join_by(origin, dest))

#Grouping to get each route+carrier combo then calc it's average arrival delay
joint2 <- joint |> group_by(origin, dest, carrier) |> summarise(Av_Arr_Delay = mean(arr_delay
```

```
`summarise()` has grouped output by 'origin', 'dest'. You can override using
the `.groups` argument.
```

```
joint2
```

```
# A tibble: 343 x 4
# Groups:   origin, dest [128]
   origin dest  carrier Av_Arr_Delay
   <chr>  <chr> <chr>          <dbl>
 1 EWR    ATL   9E             -6.25
 2 EWR    ATL   DL             10.00
 3 EWR    ATL   EV             19.5
 4 EWR    ATL   UA             10.5
 5 EWR    AUS   UA              4.28
 6 EWR    AUS   WN            -11.2
 7 EWR    BDL   EV              6.78
 8 EWR    BDL   UA             22.6
 9 EWR    BNA   EV             17.7
10 EWR    BNA   WN             -2.13
# i 333 more rows
```

```
# Airline with the best average arrival delay

best <- joint2 |> group_by(origin, dest) |> summarise(best_av_arr_delay = min(Av_Arr_Delay))
```

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

```
best2 <- best |> left_join(joint2, join_by(best_av_arr_delay == Av_Arr_Delay)) |> select(!ori
```

```
Warning in left_join(best, joint2, join_by(best_av_arr_delay == Av_Arr_Delay)): Detected an u
to-many relationship between `x` and `y`.
i Row 17 of `x` matches multiple rows in `y`.
i Row 41 of `y` matches multiple rows in `x`.
i If a many-to-many relationship is expected, set `relationship =
  "many-to-many"` to silence this warning.
```

```
best2
```

```
# A tibble: 134 x 4
   origin.x dest.x best_av_arr_delay carrier
   <chr>    <chr>              <dbl> <chr>
 1 EWR      ATL                -6.25  9E
 2 EWR      AUS               -11.2   WN
 3 EWR      BDL                 6.78  EV
 4 EWR      BNA                -2.13  WN
 5 EWR      BOS                -4.01  EV
 6 EWR      BWI                 5.95  WN
 7 EWR      CHS               -14     UA
 8 EWR      CLE                -3.71  EV
 9 EWR      CLT                 0.920 US
10 EWR      CVG                 1.40  9E
# i 124 more rows
```

```
#Airline with the worst arrival delay

worst <- joint2 |> group_by(origin, dest) |> summarise(worst_av_arr_delay = max(Av_Arr_Delay)
```

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

```
worst2 <- worst |> left_join(joint2, join_by(worst_av_arr_delay == Av_Arr_Delay)) |> select(
```

```
Warning in left_join(worst, joint2, join_by(worst_av_arr_delay == Av_Arr_Delay)): Detected ar
to-many relationship between `x` and `y`.
i Row 75 of `x` matches multiple rows in `y`.
i Row 194 of `y` matches multiple rows in `x`.
i If a many-to-many relationship is expected, set `relationship =
  "many-to-many"` to silence this warning.
```

```
worst2
```

```
# A tibble: 130 x 4
   origin.x dest.x worst_av_arr_delay carrier
   <chr>    <chr>                <dbl> <chr>
 1 EWR      ATL                  19.5  EV
 2 EWR      AUS                   4.28 UA
 3 EWR      BDL                  22.6  UA
 4 EWR      BNA                  17.7  EV
 5 EWR      BOS                   6.87 B6
 6 EWR      BWI                  20.1  EV
 7 EWR      CHS                  16.2  EV
 8 EWR      CLE                   5.97 UA
 9 EWR      CLT                  20.5  EV
10 EWR      CVG                  21.2  EV
# i 120 more rows
```

```
#Combining

results <- best2 |> left_join(worst2, join_by(origin.x, dest.x))
```

```
Warning in left_join(best2, worst2, join_by(origin.x, dest.x)): Detected an unexpected many-
to-many relationship between `x` and `y`.
i Row 77 of `x` matches multiple rows in `y`.
i Row 17 of `y` matches multiple rows in `x`.
i If a many-to-many relationship is expected, set `relationship =
  "many-to-many"` to silence this warning.
```

```
results
```

```
# A tibble: 136 x 6
   origin.x dest.x best_av_arr_delay carrier.x worst_av_arr_delay carrier.y
   <chr>    <chr>              <dbl> <chr>                  <dbl> <chr>
 1 EWR      ATL                -6.25 9E                     19.5  EV
 2 EWR      AUS               -11.2  WN                      4.28 UA
 3 EWR      BDL                 6.78 EV                     22.6  UA
 4 EWR      BNA                -2.13 WN                     17.7  EV
 5 EWR      BOS                -4.01 EV                      6.87 B6
 6 EWR      BWI                 5.95 WN                     20.1  EV
 7 EWR      CHS               -14    UA                     16.2  EV
 8 EWR      CLE                -3.71 EV                      5.97 UA
 9 EWR      CLT                 0.920 US                    20.5  EV
10 EWR      CVG                 1.40 9E                     21.2  EV
# i 126 more rows
```

```
results2 <- results |> mutate(diff = sqrt((best_av_arr_delay - worst_av_arr_delay)**2))

results3 <- results2 |> summarise(greatest_diff = max(diff, na.rm = TRUE)) |> left_join(resul

results3
```

```
# A tibble: 1 x 7
  greatest_diff origin.x dest.x best_av_arr_delay carrier.x worst_av_arr_delay
          <dbl> <chr>    <chr>              <dbl> <chr>                  <dbl>
1          127. JFK      ATL                 1.40 9E                       128
# i 1 more variable: carrier.y <chr>
```

```
#Trying to find the reason

reason <- results |> mutate(diff = sqrt((best_av_arr_delay - worst_av_arr_delay)**2))

reason2 <- reason |> summarise(terrible = max(worst_av_arr_delay, na.rm = TRUE))

reason2
```

```
# A tibble: 1 x 1
  terrible
     <dbl>
1      128
```

```
print('The above code shows that the worst average arrival delay was 128, it so happens that
```

```
[1] "The above code shows that the worst average arrival delay was 128, it so happens that t
```

QUESTION SEVEN

```
given_data <- structure(list(id = c("id_1", "id_2", "id_3", "id_4", "id_5",
"id_6", "id_7", "id_8", "id_9", "id_10", "id_11", "id_12", "id_13",
"id_14", "id_15", "id_16", "id_17", "id_18", "id_19", "id_20",
"id_21", "id_22", "id_23", "id_24", "id_25", "id_26", "id_27",
"id_28", "id_29", "id_30", "id_31", "id_32", "id_33", "id_34",
"id_35", "id_36", "id_37", "id_38", "id_39", "id_40", "id_41",
"id_42", "id_43", "id_44", "id_45", "id_46", "id_47", "id_48",
"id_49", "id_50"), age = c(50L, 34L, 70L, 33L, 22L, 61L, 69L,
73L, 62L, 56L, 71L, 33L, 73L, 44L, 45L, 46L, 24L, 70L, 46L, 76L,
47L, 76L, 28L, 48L, 54L, 27L, 45L, 26L, 61L, 28L, 38L, 55L, 33L,
36L, 62L, 58L, 72L, 31L, 34L, 51L, 61L, 64L, 26L, 28L, 60L, 29L,
42L, 46L, 79L, 72L), gender = c("male", "male", "male", "female",
"female", "male", "female", "male", "male", "female", "female",
"male", "male", "female", "male", "male", "male", "male", "female",
"male", "male", "male", "male", "female", "femal", "male", "female",
"female", "female", "female", "male", "female", "female", "female",
"male", "male", "female", "male", "female", "female", "male",
"female", "female", "male", "male", "female", "male", "male",
"male", "female"), height = c(174.4, 197.7, 174.1, 194.5, NA,
180.4, 170.5, 157.4, 196.8, 165.1, 153, 197.4, 186, 157.1, 177.5,
197.7, 179.3, 170.2, 182.4, NA, 165.4, 161, 168.5, 199.2, 157.7,
154.6, 157.1, 184.5, 181, 194.6, 183.6, 186.9, 176.1, 183, 191.1,
189.3, 199, 172, 165.6, 170.5, 150.5, 159.2, 192.1, 161.6, 162,
153.8, 162.3, 186.6, 192.4, 174.9), weight = c(69.4, 62.3, 55.6,
69.5, 78.6, 60.8, 72.2, 60.9, 75.1, 67.7, 82.5, 68.7, 67.8, 76.7,
87, 61.1, 70.6, 63.3, 81.5, 59.2, 93.2, 87.3, 83.4, 80.9, 68.6,
76.5, 93.7, 79.1, 92, 65.6, 85.4, 63.3, 79.7, 74.1, 63.3, 78.2,
95.7, 95.1, 63.7, 66.1, 99.3, 81, 96.9, 73.3, 70.3, 83, 57.6,
78.6, 61.9, 98.1), blood_type = c("O", "A", "O", "O", "B", "AB",
"O", "O", "O", "AB", "A", "O", "O", "O", "B", "A", "B", "AB",
"O", "AB", "A", "AB", "O", "B", "A", "A", "B", "AB", "A", "B",
"B", "A", "O", "O", "O", "B", "O", "A", "A", "B", "A", "O", "AB",
"A", "A", "O", "O", "B", "A", "O"), disease_status = c("diseased",
"healthy", "healthy", "healthy", "healthy", "healthy", "diseased",
"healthy", "diseased", "Healthy", "diseased", "healthy", "diseased",
```

```
"healthy", "diseased", "healthy", "healthy", "healthy", "healthy",
"healthy", "healthy", "diseased", "healthy", "diseased", "healthy",
"healthy", "healthy", "healthy", "diseased", "diseased", "healthy",
"healthy", "healthy", "diseased", "diseased", "diseased", "healthy",
"diseased", "healthy", "healthy", "healthy", "healthy", "healthy",
"diseased", "diseased", "diseased", "healthy", "healthy", "diseased",
"diseased"), cholesterol = c(228, 223, 213, 198, 166, 151, 195,
199, 189, 196, 221, 156, 185, 230, 234, 174, 185, 236, 235, 180,
165, 220, 160, 153, 250, 153, 184, 242, 212, 179, 224, 233, 181,
199, 220, 214, 214, 248, 191, 162, 203, 173, 199, 187, 248, 189,
173, 212, 164, 247), glucose = c(96, 78, 101, 119, 103, 91, 86,
NA, 77, 80, 115, 85, 88, 109, NA, 71, 90, 94, 91, 87, 113, 93,
97, 118, 109, 80, 85, 119, 99, 108, 89, 108, 97, 116, 79, 84,
75, 81, 119, NA, 106, 109, 75, 82, 84, 75, 76, 120, 119, 77),
    smoker = c("yes", "yes", "yes", "yes", "no", "yes", "no",
    "yes", "no", "no", "no", "no", "no", "yes", "no", "yes",
    "yes", "yes", "yes", "yes", "yes", "yes", "yes", "yes", "no",
    "no", "yes", "yes", "yes", "no", "no", "yes", "no", "yes",
    "no", "yes", "no", "yes", "yes", "yes", "no", "no", "yes",
    "no", "no", "no", "no", "no", "no", "yes"), exercise = c("occasional",
    "regular", "occasional", "regular", "none", "occasional",
    "regular", "none", "occasional", "none", "occasional", "none",
    "none", "regular", "occasional", "none", "regular", "regular",
    "none", "occasional", "none", "occasional", "occasional",
    "occasional", "regular", "occasional", "regular", "regular",
    "regular", "occasional", "occasional", "none", "none", "regular",
    "occasional", "occasional", "none", "none", "none", "none",
    "occasional", "regular", "regular", "none", "regular", "occasional",
    "occasional", "none", "occasional", "regular"), income = c(84820L,
    81547L, 22588L, 72490L, 74533L, 25338L, 41469L, 57315L, 63629L,
    88662L, 62615L, 56261L, 58499L, 82232L, 77584L, 77275L, 38468L,
    54510L, 91326L, 78611L, 31402L, 29586L, 21441L, 58269L, 84173L,
    88295L, 37940L, 43750L, 69750L, 92356L, 82518L, 91455L, 68866L,
    51178L, 68275L, 27689L, 35418L, 81318L, 62405L, 86851L, 25654L,
    47553L, 74474L, 51409L, 22607L, 55360L, 96351L, 21516L, 41927L,
    55810L), education = c("master", "bachelor", "PhD", "master",
    "bachelor", "highschool", "PhD", "highschool", "PhD", "PhD",
    "bachelor", "highschool", "master", "bachelor", "PhD", "PhD",
    "PhD", "bachelor", "master", "highschool", "PhD", "highschool",
    "bachelor", "master", "highschool", "highschool", "master",
    "master", "bachelor", "PhD", "highschool", "PhD", "master",
    "master", "master", "PhD", "highschool", "master", "master",
```

```
    "highschool", "bachelor", "highschool", "bachelor", "PhD",
    "bachelor", "highschool", "master", "highschool", "bachelor",
    "bachelor"), region = c("North", "South", "North", "West",
    "North", "West", "South", "South", "West", "South", "West",
    "South", "West", "East", "North", "West", "North", "North",
    "West", "North", "East", "West", "South", "North", "North",
    "East", "East", "North", "North", "West", "South", "West",
    "West", "East", "West", "North", "West", "North", "East",
    "North", "West", "South", "South", "East", "North", "West",
    "West", "East", "North", "East"), marital_status = c("divorced",
    "single", "divorced", "divorced", "divorced", "divorced",
    "divorced", "married", "divorced", "married", "divorced",
    "widowed", "married", "single", "widowed", "widowed", "single",
    "divorced", "widowed", "widowed", "single", "married", "single",
    "married", "widowed", "married", "single", "single", "widowed",
    "married", "widowed", "divorced", "single", "married", "single",
    "widowed", "widowed", "married", "widowed", "divorced", "married",
    "married", "divorced", "single", "married", "widowed", "divorced",
    "divorced", "single", "divorced")), row.names = c(NA, -50L
), class = c("tbl_df", "tbl", "data.frame"))

library(UtilsDataRSV)
see <- given_data |> view_cols()
```

```
[1] "id"
 [1] "id_11" "id_17" "id_28" "id_48" "id_9"  "id_12" "id_44" "id_2"  "id_24"
[10] "id_32" "id_27" "id_35" "id_22" "id_43" "id_36" "id_3"  "id_49" "id_37"
[19] "id_41" "id_20"
[1] "30 unique entries not displayed"
[1] "_____________________"
[1] "age"
[1] 54 28 34 44 79
[1] "_____________________"
[1] "gender"
[1] "female" "male"   "femal"
[1] "_____________________"
[1] "height"
[1] 186.9 165.4 170.2 192.1    NA
[1] "_____________________"
[1] "weight"
[1] 78.6 93.7 96.9 79.1 61.1
[1] "_____________________"
```

```
[1] "blood_type"
[1] "O"  "B"  "A"  "AB"
[1] "_____________________"
[1] "disease_status"
[1] "diseased" "healthy"  "Healthy"
[1] "_____________________"
[1] "cholesterol"
[1] 156 195 166 180 165
[1] "_____________________"
[1] "glucose"
[1] 120  89 116  90  NA
[1] "_____________________"
[1] "smoker"
[1] "yes" "no"
[1] "_____________________"
[1] "exercise"
[1] "regular"    "occasional" "none"
[1] "_____________________"
[1] "income"
[1] 41469 47553 58269 38468 82232
[1] "_____________________"
[1] "education"
[1] "highschool" "master"     "PhD"        "bachelor"
[1] "_____________________"
[1] "region"
[1] "North" "South" "West"  "East"
[1] "_____________________"
[1] "marital_status"
[1] "divorced" "single"   "married"  "widowed"
[1] "_____________________"

Warning: Not all unique entries displayed for these non-numeric cols: id
```

```
print('LIST OF ERRORS: ')
```

```
[1] "LIST OF ERRORS: "
```

```
print(' From the above we can see that the gender column has a typo: \'femal\' instead of \'f
```

```
[1] " From the above we can see that the gender column has a typo: 'femal' instead of 'female
```

```
print(' The height column has some missing entries.')
```

```
[1] " The height column has some missing entries."
```

```
print(' The disease_status column has a typo, \'Healthy\' and \'healthy\'.')
```

```
[1] " The disease_status column has a typo, 'Healthy' and 'healthy'."
```

```
print(' The glucose column has some missing entries.')
```

```
[1] " The glucose column has some missing entries."
```