What a desaster!

Claudius

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Packages used

```
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --
```

```
## v ggplot2 3.3.5     v purrr   0.3.4
## v tibble  3.1.6     v dplyr   1.0.8
## v tidyr   1.2.0     v stringr 1.4.0
## v readr   2.1.2     v forcats 0.5.1
```

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

```
library(DataScienceExercises)
library(knitr)
```

Exploring flight data

In this short text we explore the following data set on flights departing from New York.

```
base_data <- DataScienceExercises::nycflights21_small[1:200, ]
data.frame(head(DataScienceExercises::nycflights21_small, 50))
```

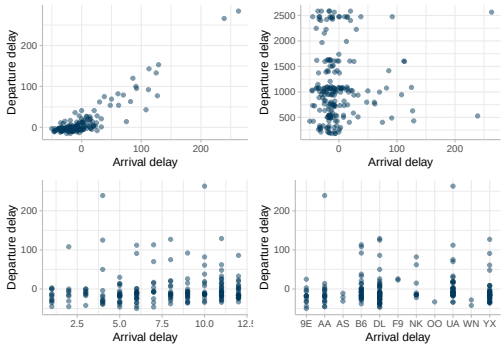
```
##    arr_delay dep_delay month carrier distance
## 1        -39        -4     4      DL     2248
## 2        -22        -4    12      AA     1389
## 3          0        -4     1      B6     1076
## 4         -8        -1     7      UA     1608
## 5         -7        -4     3      DL     1035
## 6        -17       -10    11      YX      335
## 7        -50        -3     6      9E      425
## 8        -29        -5     1      DL     1969
## 9        -46        -9     5      DL     1035
## 10       112        92     6      UA     1605
## 11        50        69     4      DL     1020
## 12        -3        13    12      B6     1417
## 13       -35        -9     1      YX      264
## 14        -7         6     3      B6     1065
## 15       -14        -4     8      DL      488
## 16       239       266     4      AA      529
## 17        -9         0    11      UA     1085
```

```
## 18       -17        -4    12      9E      288
## 19         0        12     3      B6     1089
## 20       -46       -11     7      DL     1020
## 21        -6        -1     9      9E      431
## 22       -14        -1    11      UA     2454
## 23        48        54    11      YX      799
## 24       -20        -4    11      YX      502
## 25        26        28    11      DL     1598
## 26       263       284    10      UA     2565
## 27       108        43     2      B6      944
## 28       -13       -10    12      YX     1107
## 29       -35        -1     5      AA     1372
## 30        -6        -7     9      YX      544
## 31        17        -5     7      UA      997
## 32       129       153    11      DL      431
## 33       -14        -5     3      NK      550
## 34       -11        -3     8      UA     2454
## 35        -5        -2     5      UA      997
## 36       -11         0    10      DL     1010
## 37         0        -8     9      YX      214
## 38        13        19     5      B6     1041
## 39        13         2    11      DL     1990
## 40       -21       -10    12      YX      288
## 41        -9        -5     9      YX      708
## 42       -19        -1     8      DL      502
## 43         8        -3    12      YX      541
## 44       -26        -4    11      DL     1010
## 45       -11         2     8      DL     2475
## 46       -20        -6    11      B6     1626
## 47       -24        -6     6      YX      636
## 48       -25        -7     6      9E      764
## 49        -6         9     6      YX      184
## 50       -13        -5     9      YX      184
```

To have a first look on the relationship of the variables, consider the following scatter plots:

```
arrival_dep <- ggplot(data = base_data) +
  geom_point(mapping = aes(x=arr_delay, y=dep_delay),
             alpha=0.5, color="#00395B") +
  ggplot2::theme_bw() +
  labs(x="Arrival delay", y="Departure delay") +
  theme(
    legend.position = "bottom",
    legend.title = ggplot2::element_blank(),
    panel.border = ggplot2::element_blank(),
    axis.line = ggplot2::element_line(colour = "grey"),
    axis.ticks = ggplot2::element_line(colour = "grey")
  )

arrival_dist <- ggplot(data = base_data) +
  geom_point(mapping = aes(x=arr_delay, y=distance),
             alpha=0.5, color="#00395B") +
  ggplot2::theme_bw() +
  labs(x="Arrival delay", y="Departure delay") +
  theme(
```

```
    legend.position = "bottom",
    legend.title = ggplot2::element_blank(),
    panel.border = ggplot2::element_blank(),
    axis.line = ggplot2::element_line(colour = "grey"),
    axis.ticks = ggplot2::element_line(colour = "grey")
  )

arrival_month <- ggplot(data = base_data) +
  geom_point(mapping = aes(y=arr_delay, x=month),
             alpha=0.5, color="#00395B") +
  ggplot2::theme_bw() +
  labs(x="Arrival delay", y="Departure delay") +
  theme(
    legend.position = "bottom",
    legend.title = ggplot2::element_blank(),
    panel.border = ggplot2::element_blank(),
    axis.line = ggplot2::element_line(colour = "grey"),
    axis.ticks = ggplot2::element_line(colour = "grey")
  )

arrival_carrier <- ggplot(data = base_data) +
  geom_point(mapping = aes(y=arr_delay, x=carrier),
             alpha=0.5, color="#00395B") +
  ggplot2::theme_bw() +
  labs(x="Arrival delay", y="Departure delay") +
  theme(
    legend.position = "bottom",
    legend.title = ggplot2::element_blank(),
    panel.border = ggplot2::element_blank(),
    axis.line = ggplot2::element_line(colour = "grey"),
    axis.ticks = ggplot2::element_line(colour = "grey")
  )

ggpubr::ggarrange(
  arrival_dep, arrival_dist,
  arrival_month, arrival_carrier,
  ncol = 2, nrow = 2)
```



This suggests that there is a strong correlation between departure and arrival delay. To compute the correlation we might use the following R code:

```
## [1] 0.9114122
```

There is indeed a very strong correlation. But is it significant? Lets check it using the Pearson correlation test:

```
cor.test(base_data$arr_delay, base_data$dep_delay, method = "pearson")
```

```
##
##  Pearson's product-moment correlation
##
## data:  base_data$arr_delay and base_data$dep_delay
## t = 31.166, df = 198, p-value < 2.2e-16
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.8845188 0.9322677
## sample estimates:
##       cor
## 0.9114122
```

Of course, these are just preliminary results, from a methodological point of view there is still much to do...