What a desaster!

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Packages used

```
library(tidyverse)
```

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

v ggplot2 3.3.6      v purrr   0.3.4
v tibble  3.1.8      v dplyr   1.0.10
v tidyr   1.2.1      v stringr 1.4.0
v readr   2.1.2      v forcats 0.5.2

-- 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))
```

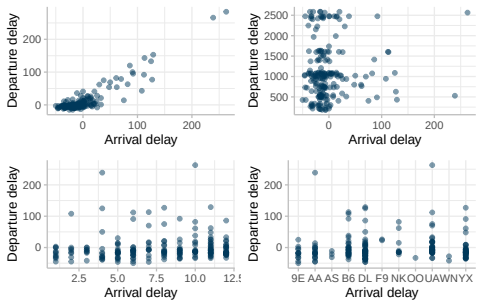
	arr_delay	dep_delay	month	carrier	distance
1	-39	-4	4	DL	2248
2	-22	-4	12	AA	1389
3	0	-4	1	B6	1076
4	-8	-1	7	UA	1608
5	-7	-4	3	DL	1035
6	-17	-10	11	YX	335
7	-50	-3	6	9E	425
8	-29	-5	1	DL	1969
9	-46	-9	5	DL	1035
10	112	92	6	UA	1605
11	50	69	4	DL	1020
12	-3	13	12	B6	1417
13	-35	-9	1	YX	264
14	-7	6	3	B6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