Assignment 4: Collaborating Together
Introduction to Applied Data Science
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Assignment 4: Collaborating Together

Part 1: Contributing to another student's Github repository

In this assignment, you will create a Github repository, containing this document and the .pdf output, which analyzes a dataset individually using some of the tools we have developed.

This time, make sure to not only put your name and student e-mail in your Rmarkdown header, but also your Github account, as I have done myself.

However, you will also pair up with a class mate and contribute to each others' Github repository. Each student is supposed to contribute to another student's work by writing a short interpretation of 1 or 2 sentences at the designated place (this place is marked with **designated place**) in the other student's assignment.

This interpretation will not be graded, but a Github shows the contributors to a certain repository. This way, we can see whether you have contributed to a repository of a class mate.

Question 1.1: Fill in the **github username** of the class mate to whose repository you have contributed.

[FilippoSallustio]

Part 2: Analyzing various linear models

In this part, we will summarize a dataset and create a couple of customized tables. Then, we will compare a couple of linear models to each other, and see which linear model fits the data the best, and yields the most interesting results.

We will use a dataset called `GrowthSW` from the `AER` package. This is a dataset containing 65 observations on 6 variables and investigates the determinants of economic growth. First, we will try to summarize the data using the `modelsummary` package.

```
library(AER)
data(GrowthSW)
```

One of the variables in the dataset is `revolutions`, the number of revolutions, insurrections and coup d'etats in country i from 1965 to 1995.

	No Revolutions					Revolutions				
	mean	median	sd	min	max	mean	median	sd	min	max
growth	2.46	2.29	1.28	0.42	6.65	1.68	1.92	2.11	−2.81	7.16
rgdp60	5283.32	5393.00	2439.39	1374.00	9895.00	1988.67	1259.00	1698.18	367.00	6823.00

Question 2.1: Using the function `datasummary`, summarize the mean, median, sd, min, and max of the variables `growth`, and `rgdp60` between two groups: countries with `revolutions` equal to 0, and countries with more than 0 revolutions. Call this variable `treat`. Make sure to also write the resulting data set to memory. Hint: you can check some examples here.

```
library(modelsummary); library(tidyverse)

new_data <- GrowthSW |>
  mutate(treat=if_else(GrowthSW$revolutions > 0, "Revolutions", "No Revolutions"))
new_data|>
  datasummary(formula = growth + rgdp60 ~ Factor(treat)*(mean + median + sd + min + max))
```

Designated place: type one or two sentences describing this table of a fellow student below. For example, comment on the mean and median growth of both groups. Then stage, commit and push it to their github repository.

Part 3: Make a table summarizing reressions using modelsummary and kable

In question 2, we have seen that growth rates differ markedly between countries that experienced at least one revolution/episode of political stability and countries that did not.

Question 3.1: Try to make this more precise this by performing a t-test on the variable growth according to the group variable you have created in the previous question.

```
t.test(new_data$growth ~ new_data$treat)
```

```
##
##  Welch Two Sample t-test
##
## data:  new_data$growth by new_data$treat
## t = 1.8531, df = 61.015, p-value = 0.06871
## alternative hypothesis: true difference in means between group No Revolutions and group Revolutions i
## 95 percent confidence interval:
##  -0.06182741  1.62566475
## sample estimates:
## mean in group No Revolutions    mean in group Revolutions
##                     2.459985                     1.678066
```

Question 3.2: What is the p-value of the test, and what does that mean? Write down your answer below. [the p-value of the test is = 0.06871, and this indicates that there is a statistical significant difference in growth between revolution and non revolutions]

We can also control for other factors by including them in a linear model, for example:

$$\text{growth}_i = \beta_0 + \beta_1 \cdot \text{treat}_i + \beta_2 \cdot \text{rgdp60}_i + \beta_3 \cdot \text{tradeshare}_i + \beta_4 \cdot \text{education}_i + \epsilon_i$$

Table 1: Regression table

	(1)	(2)	(3)	(4)
(Intercept)	2.460***	2.854***	0.839	−0.050
	(0.400)	(0.751)	(1.045)	(0.967)
treatRevolutions	−0.782	−1.028	−0.415	−0.069
	(0.491)	(0.633)	(0.647)	(0.589)
rgdp60		0.000	0.000	0.000*
		(0.000)	(0.000)	(0.000)
tradeshare			2.233*	1.813*
			(0.842)	(0.765)
education				0.564***
				(0.144)
Num.Obs.	65	65	65	65
R2	0.039	0.045	0.143	0.318

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Question 3.3: What do you think the purpose of including the variable `rgdp60` is? Look at `?GrowthSW` to find out what the variables mean. [The purpose of including rgdp60 is to examine and summarize relationship between economic growth and rgdp60 based off of the treat variable. Including rgdp60 in the analysis, the code is likely exploring whether there is any difference in the growth patterns based on the value of rgdp60 within each group.]

We now want to estimate a stepwise model. Stepwise means that we first estimate a univariate regression $\text{growth}_i = \beta_0 + \beta_1 \cdot \text{treat}_i + \epsilon_i$, and in each subsequent model, we add one control variable.

Question 3.4: Write four models, titled `model1`, `model2`, `model3`, `model4` (using the `lm` function) to memory. Hint: you can also use the `update` function to add variables to an already existing specification.

```
model1 <- lm(growth ~ treat, data = new_data)
model2 <- lm(growth ~ treat + rgdp60, data = new_data)
model3 <- lm(growth ~ treat + rgdp60 + tradeshare, data = new_data)
model4 <- update(model3, . ~ . + education)
```

Now, we put the models in a list, and see what `modelsummary` gives us:

```
library(modelsummary)
modelsummary(list(model1, model2, model3, model4),
             gof_map = c("nobs", "r.squared"),
             title = "Regression table", stars = T)
```

Question 3.5: Edit the code chunk above to remove many statistics from the table, but keep only the number of observations N, and the R^2 statistic.

Question 3.6: According to this analysis, what is the main driver of economic growth? Why? [Even though, In models (1) and (2), the coefficient for "rgdp60" is not statistically significant (p > 0.05), suggesting that it does not have a significant impact on economic growth. However, in model (3), the coefficient for "rgdp60" becomes statistically significant at the 0.05 level (p < 0.05). This indicates that "rgdp60" has a significant relationship with economic growth in this model. Model (4) does not include "rgdp60" as a predictor.

Based on this analysis, the variable "rgdp60" is identified as the main driver of economic growth. This variable represents a specific economic factor (possibly GDP in 1960) that has a statistically significant impact on economic growth when considering the other variables included in model (3). It is important to

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note that this conclusion is based solely on the information provided in the regression table, and further analysis and interpretation may be required to fully understand the relationship between the variables and economic growth.]

Question 3.7: In the code chunk below, edit the table such that the cells (including standard errors) corresponding to the variable `treat` have a red background and white text. Make sure to load the `kableExtra` library beforehand.

```
library(kableExtra)
table <- list(model1, model2, model3, model4) |>
  modelsummary(stars=T, gof_map = c("nobs", "r.squared"))
table |> row_spec(3:4, color = 'white') |> row_spec(3:4, background = 'red')
```

Question 3.8: Write a piece of code that exports this table (without the formatting) to a Word document.

```
library(flextable)
library(officer)

df <- as.data.frame(table)
output_file <- "C:/Users/Aless/OneDrive - Universiteit Utrecht/Desktop/UU/Applied Data Science/Assignme

ft <- flextable(df)

doc <- read_docx()
doc <- body_add_flextable(doc, value = ft)

print(doc, target = output_file)
```

The End