

Laboratory Session : March 24, 2022

Exercises due on : April 10, 2022

Exercise 1 - vectors and data frames

- The following table gives the volume, area, length and maximum and mean depths of some Scottish lakes[1]. Create vectors, holding the lake's name and all the parameters and build a dataframe called `scottish.lakes` from the vectors

- 1 evaluate the highest and lowest volume and area lake
- 2 order the frame with respect to the area and determine the two largest area lakes
- 3 by summing up the areas occupied by the lakes, determine the area of Scotland covered by water

Loch	Volume [km ³]	Area [km ²]	Length [km]	Max. depth [m]	Mean depth [m]
Loch Ness	7.45	56	39	230	132
Loch Lomond	2.6	71	36	190	37
Loch Morar	2.3	27	18.8	310	87
Loch Tay	1.6	26.4	23	150	60.6
Loch Awe	1.2	39	41	94	32
Loch Maree	1.09	28.6	20	114	38
Loch Ericht	1.08	18.6	23	156	57.6
Loch Lochy	1.07	16	16	162	70
Loch Rannoch	0.97	19	15.7	134	51
Loch Shiel	0.79	19.5	28	128	40
Loch Katrine	0.77	12.4	12.9	151	43.4
Loch Arkaig	0.75	16	19.3	109	46.5
Loch Shin	0.35	22.5	27.8	49	15.5

Exercise 2 - Crude Oil Production

- The following CSV file https://drive.google.com/file/d/13WkinYhJNSr_XClDb3wpZ0I0fgjer7Iw/view contains data on crude oil prices from 1861 to 2020, measured in US dollars per barrel [2].

- 1 Write R code that is able to read the file and import it in a data frame structure. (Hint: before loading the file, open it with a text editor and check its structure).
- 2 produce a plot with the Oil price as a function of the year
- 3 which is the highest price in history ? When did it occur ?
- 3 plot the derivative of the curve, simply evaluated with the finite difference formula (forward derivative):

$$\frac{\partial \text{price}}{\partial \text{year}} = \text{price}_{j+1} - \text{price}_j$$

Exercise 3 - World Coal Production

- The following CSV file https://drive.google.com/file/d/1U1hK5o_d3v18twwGaRJNcDJ7909I5zJ1/view?usp=sharing contains data on the coal production (in TW · hour) for several countries in the World [3].
- 1 Write R code that is able to read the file and import it in a tibble [4] structure
 - 2 count the number of countries available in the file and produce a barplot with the number of entries for each country
- for the following items select only the years ≥ 1970 :
- 3 selecting only the year after 1970, determine the total integrated production for each country and print the top 5 Countries with highest coal productions
 - 4 for the 5 top Countries, create a plot of production as a function of time
 - 5 generate a plot with the cumulative sum of the World's coal production over the years

Exercise 4 - Covid19 Vaccine data

- Data on Covid-19 vaccine can be found on [5].
 - The file `vaccinationsby-manufacturer.csv`, (<https://github.com/owid/covid-19-data/blob/master/public/data/vaccinations/vaccinations-by-manufacturer.csv>) contains a summary on the vaccination data grouped by Vaccine type and Country.
- 1 `filter()` the original tibble by selecting the following countries: Italy
 - 2 plot the number of vaccines given as a function of time for the different vaccine manufacturer
 - 3 from the same tibble plot the total number of vaccines shot per day in Italy
 - 4 do the same exercise for the following countries: Germany and United States of America
- The file `vaccinations.csv`, (<https://github.com/owid/covid-19-data/blob/master/public/data/vaccinations/vaccinations.csv>) contains country-by-country data on global COVID-19 vaccinations. The dataset includes some subnational locations (England, Northern Ireland, Scotland, Wales, ...) and international aggregates (World, continents, European Union *ldots*). They can be identified by their `iso_code` that starts with `OWID_`
- 1 selecting all the European countries in the tibble, plot the number of daily vaccinations per million as a function of date
 - 2 study the data structure and produce few relevant plots of your taste

References

- [1] Lakes of Scotland: https://en.wikipedia.org/wiki/List_of_lochs_of_Scotland
- [2] Global crude oil prices, measured in US dollars per barrel: <https://ourworldindata.org/grapher/crude-oil-prices>
- [3] World's coal production <https://ourworldindata.org/grapher/coal-production-by-country>
- [4] Tibble: Simple Data Frames <https://cran.r-project.org/web/packages/tibble/index.html>
- [5] Data on COVID-19 (coronavirus) vaccinations by Our World in Data: <https://github.com/owid/covid-19-data/tree/master/public/data/vaccinations>