Introduction to Spatial Data Programming
Execrise 2
Time series and function definition & Tables, conditionals and loops

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Question 1

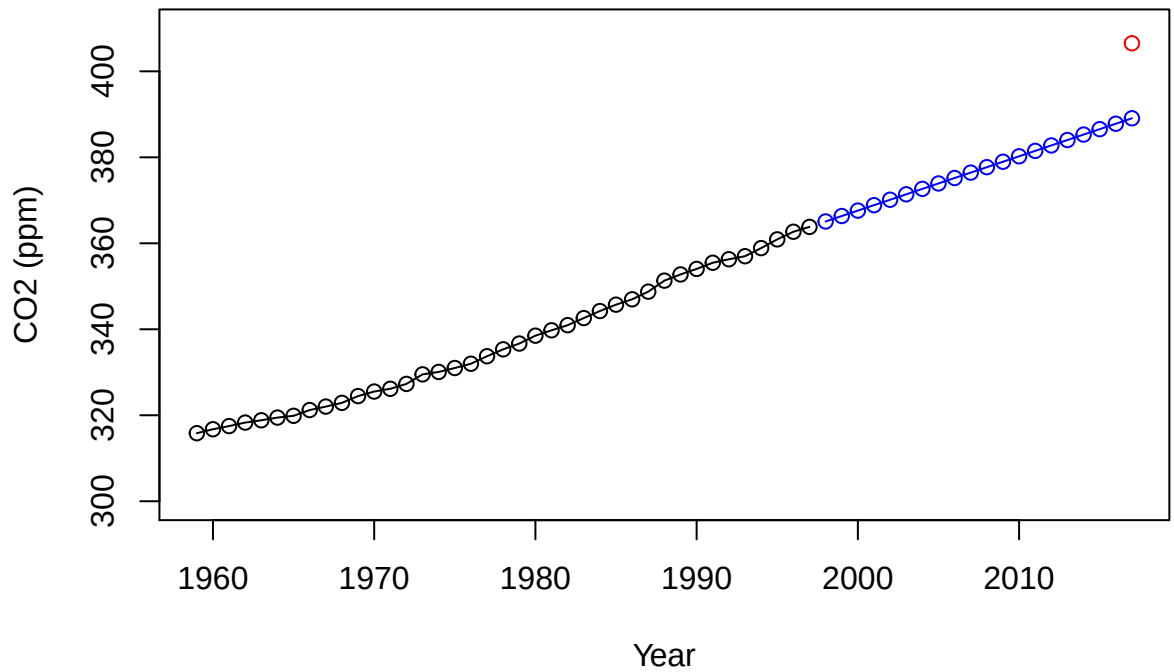
- Run the following four expressions to load two vectors named `year` and `co2` into memory

```
data(co2)
means = aggregate(co2, FUN = mean)
year = as.vector(time(means))
co2 = as.vector(means)
```

- The `co2` vector contains CO_2 measurements in the atmosphere, in *ppm* units, during the period 1959-1997. The `year` vector contains the corresponding years
- Assuming that the rate of CO_2 increase was constant and equal to the average rate during 1959-1997, calculate the predicted CO_2 concentration during each of the years 1998-2017
- Create a **plot** showing CO_2 concentration as function of time, with -
  - Observed values during 1959-1997, based on the `year` and `co2` vectors, in **black**
  - Predicted values during 1998-2017 in **blue**
- **Add** a point in **red** showing the true concentration in 2017, which was `406.53`

```
data(co2)
means = aggregate(co2, FUN = mean)
year = as.vector(time(means))
co2 = as.vector(means)

year_predicted = 1998:2017
mean_rate = mean(diff(co2))
co2_predicted = co2[year == 1997] + mean_rate*(1:length(year_predicted))
plot(
  year, co2,
  xlim = c(1959, 2017), ylim = c(300, 410),
  xlab = "Year",
  ylab = "CO2 (ppm)"
)
lines(year, co2)
points(year_predicted, co2_predicted, col = "blue")
lines(year_predicted, co2_predicted, col = "blue")
points(2017, 406.53, col = "red")
```



(50 points)

Question 2

- **Read** the `rainfall.csv` file into a `data.frame` object
- **Calculate** a new column named `rainy_months` with the number of months that had >20 mm of rainfall for each meteorological station
- Write an **expression** that prints station names where `rainy_months` value is `1`, meaning that there is exactly one month with >20 mm of rainfall at that station

```
rainfall = read.csv("rainfall.csv", stringsAsFactors = FALSE)
m = c("sep","oct","nov","dec","jan","feb","mar","apr","may")
f = function(x) sum(x > 20)
rainfall$rainy_months = apply(rainfall[, m], 1, f)
rainfall$name[rainfall$rainy_months == 1]
```

```
## [1] "Revivim"   "Sde Hayil" "Sde Boker" "Kalya"
```

(50 points)