Introduction to Time Series in R

Exercise 1. Exploration of a built-in `tsibble` object

Load the `tsibble` package (install it if necessary):

```
> install.packages("tsibble")
> library(tsibble)
> library(dplyr)
```

Work on the built-in dataset `PBS` (Pharmaceutical Benefit Scheme):

- Inspect the first rows of the dataset.
- Identify the `index` (time) and `key` (grouping variables) of the `tsibble`.
- Find the first and last time points in the dataset.
- Count the number of observations per key (e.g., per ATC1 code).

Useful resources:

- `tsibble` objects in `fpp3`
- `tsibble` package documentation

Exercise 2. Creating a `tsibble` from scratch

Create a small dataset of monthly sales for two products:

- Construct a `tibble` with columns: `month`, `product`, `sales`.
- Convert the `tibble` into a `tsibble`, specifying the `index` and `key`.
- Inspect your `tsibble`.
- Plot sales over time for each product using `ggplot2`.

Hint:

```
sales_tsibble <- sales_data %>%
  as_tsibble(index = month, key = product)
```

Exercise 3. Creating a `tsibble` from an external file: Smartphone Sales

In this exercise, you will work with a dataset containing monthly sales of two smartphone models.

- The file `smartphone_sales.csv` contains three columns: `month`, `model`, and `units_sold`.
- Read the CSV file into R using `readr::read_csv()`.
- Convert the dataset into a `tsibble`, specifying the `index` (`month`) and `key` (`model`).
- Inspect the tsibble to ensure the time index and keys are correctly set.
- Optional: Plot the monthly sales over time for each model using `ggplot2`.

Exercise 4. Time series visualisation. Part 1.

1. Use the help function to explore what the object `gafa_stock`, `PBS`, `vic_elec` and `pelt` represent.
   (a) Use autoplot() to plot some of the series in these data sets.
   (b) What is the time interval of each element?
2. Use filter() to find what days correspond to the peak closing price for each of the four stocks in gafa_stock.
3. The `USgas` package contains data on the demand for natural gas in the US.
   (a) Install the `USgas` package.
   (b) Create a tsibble from `us_total` with year as the index and state as the key.
   (c) Plot the annual natural gas consumption by state for the New England area (comprising the states of Maine, Vermont, New Hampshire, Massachusetts, Connecticut and Rhode Island).
   (d) Comment on your findings

Exercise 5. Time series visualisation. Part 2.

1. Create time plots of the following four time series: Bricks from `aus_production`, Lynx from `pelt`, Close from `gafa_stock`, Demand from `vic_elec`.
   (a) Use ? (or help()) to find out about the data in each series.
   (b) Modify the axis labels and titles if needed.
   (c) Can you identify any unusual observations?
2. What can you conclude? Provide detailed comment on each time series based on your plots.