Exercise: decomposition

Earlham College
BUS 323 - Fall 2025 - Labadie

In this activity, you will practice performing time series decomposition using datasets in the `fpp3` package and classical and STL decomposition. Please turn in your code with answers in comments, or a document with your answers and plots (Word doc or a PDF generated from Markdown, for example).

1. Consider the last five years of the Gas data from aus_production. Use the following code to get the sample: `gas <- tail(aus_production, 5*4) |> select(Gas)`.

   (a) Plot the time series. Can you identify seasonal fluctuations and/or a trend-cycle?

   (b) Use `classical_decomposition` with `type=multiplicative` to calculate the trend-cycle and seasonal indices.

   (c) Do the results support the graphical interpretation from part a?

   (d) Compute and plot the seasonally adjusted data.

   (e) Change one observation to be an outlier (e.g., add 300 to one observation), and recompute the seasonally adjusted data. What is the effect of the outlier?

   (f) Does it make any difference if the outlier is near the end rather than in the middle of the time series?

2. This exercise uses the `canadian_gas` data (monthly Canadian gas production in billions of cubic meters, January 1960 – February 2005).

   (a) Plot the data using `autoplot()`, `gg_subseries()` and `gg_season()` to look at the effect of the changing seasonality over time.

   (b) Do an STL decomposition of the data. You will need to choose a seasonal window to allow for the changing shape of the seasonal component.

   (c) How does the seasonal shape change over time? (Try plotting the seasonal component using `gg_season()`.)

   (d) Can you produce a plausible seasonally adjusted series?