

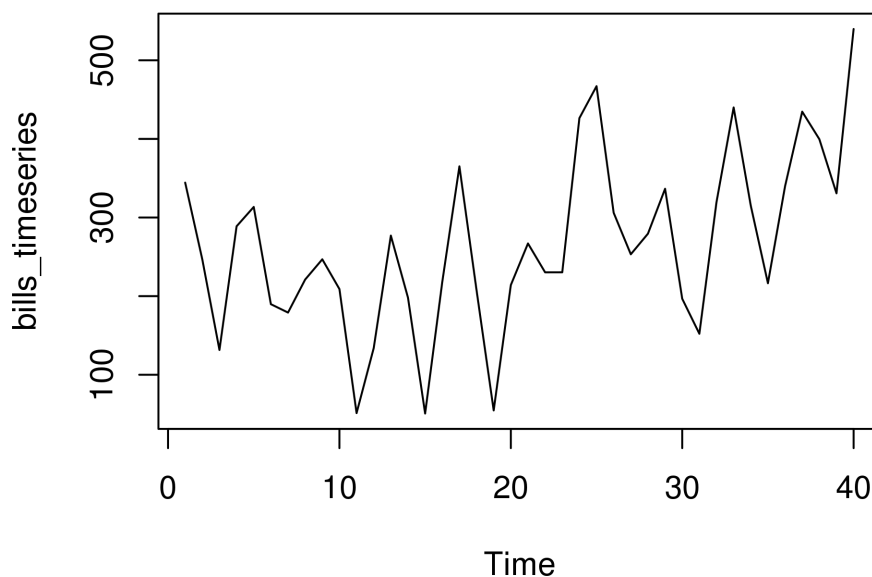
Homework Assignment 10

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November 14, 2015

Problem 1. Plot the energy bills versus time. What kind of trend appears to exist? What type of seasonal variation appears to exist? Is a transformation needed to obtain a series that displays constant variation?

Solution. See below for a plot of the bills time series data:



It is clear from the plot that there is a trend that appears to move upwards as time increases and a seasonal variation with period 4 lags present in the data so a transformation is needed to obtain residuals that represent a stationary time series. \square

Problem 2. Write algebraically a time series model with trend and seasonal component with definitions of the dummy variable.

Solution. As we have both a trend and seasonal component to our data, our model must incorporate these facts. Let $\{X_t\}$ represent the observations from our original time series. Then $X_t = m_t + s_t + Y_t$ represents our time series model where Y_t is a random noise component and $s_t = s_{t+d}$ for some positive integer d .

We can transform this process into a stationary process with repeated applications of the difference operator. Assuming the random noise component has zero mean, then the following transformation gives us a stationary process with mean c :

$$(1 - B)(1 - B^4)X_t = c + (1 - B)(1 - B^4)Y_t$$

□