We shall fit a regression of the form,

$$y_t = \beta_0 + \beta_1 t + \beta_2 Q_2 + \beta_3 Q_3 + \beta_4 Q_4 + \epsilon_t$$

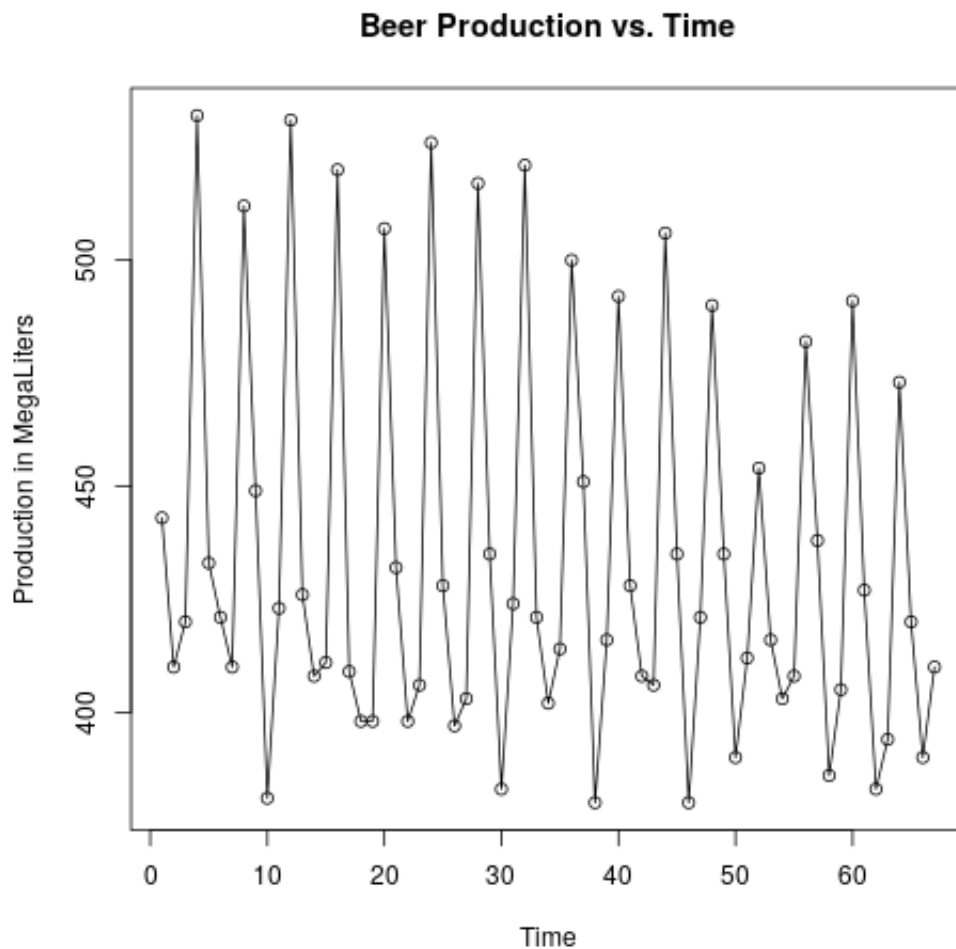With Q_i dummy variables for the ith quarter of a given year.

1. First, we define the dummy variables as follows.

$$Q_2 = \begin{cases} 1 & t \in \text{Quarter 2} \\ 0 & t \notin \text{Quarter 2} \end{cases}$$

$$Q_3 = \begin{cases} 1 & t \in \text{Quarter 3} \\ 0 & t \notin \text{Quarter 3} \end{cases}$$

$$Q_4 = \begin{cases} 1 & t \in \text{Quarter 4} \\ 0 & t \notin \text{Quarter 4} \end{cases}$$

2. Next, we plot the data to analyze the overall data trends to see if we need to scale for constant seasonal variation.

Beer Production vs. Time

We see here that the overall trend of the data is negative, but there is no major increase or decrease in seasonal variation over the experimental region. As such, we expect β_1 to have a negative value, and we will not log or scale the y variable at all for linearity.