The demand for microchip, as we can see, is a time-series data. Hence, we will use time series forecasting analysis to study the patterns of demand data. We will explore a few mathematical and computational analysis techniques to forecast and compare to choose the best one.

First of all, from its shape, the demand data resembles the additive trend – as it can be broken down to a seasonal trend and an upward trend – which can be summarized by this equation. To find the upward trend, linear regression is used. After that, we rearrange the upward trend to make it horizontal, from there, fit a sinusoidal curve.

This sinusoidal curve fitting gives an R-squared value of -1.3171.

Leveraging on linear regression mentioned, we assume that 52 weeks are variables which affect the demand as the cycle repeats year by year. Solving the multilinear regression system of 52 variables and 260 equations gives us the model. Yet, multilinear regression also fails in this case.

Apart from the mathematical models, a computational model named Holt Exponential Smoothing is used too. We forecast the next value based on the weighted average of all previous values. The HES model fits well the data, yet, when we test the model for forecasting with our train data, the inaccuracy is significant.

Acknowledging the failure of this model, we upgrade this method to Holt-Winter Seasonal Method, which is an improvement of HES. Yet similarly to HES, the model fits the data well, but fails in forecasting too.

We also try another model named Seasonal Auto-Regressive Integrated Moving Average, a popular time series forecasting model which analyses 3 parts: automatic regression, integration and moving averages. For SARIMA, the model gives a relatively better prediction.

Overall, we compare the R-squared value and correlation index to actual data of the 5 models, the sinusoidal curve is the most accurate although it is the less likely to be used in real life to forecast data since it could not deal with noise. Yet, we will stick to it due to minimal accuracy.