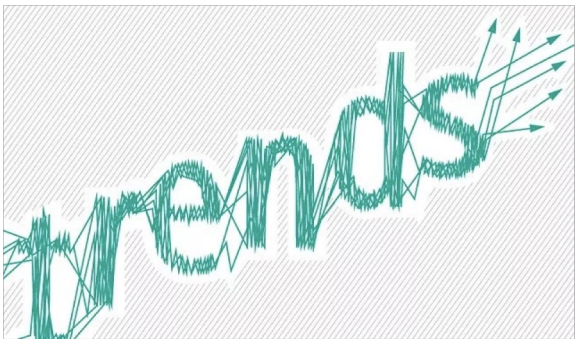
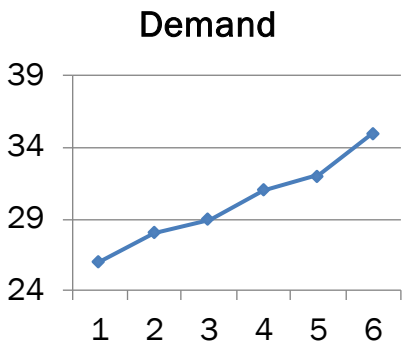


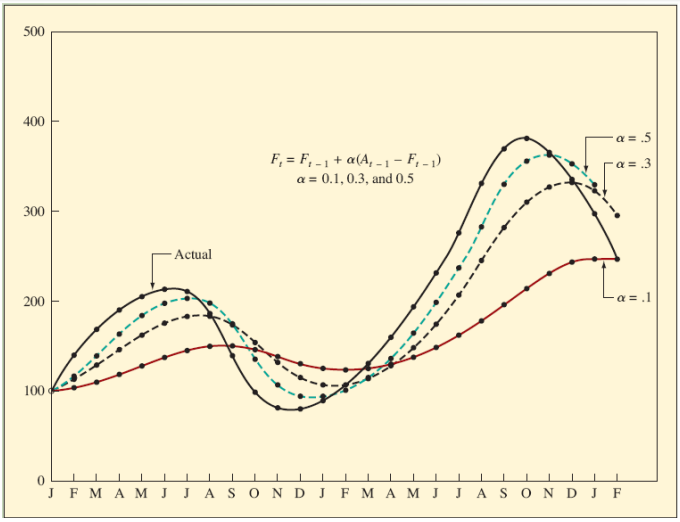
WHEN THERE IS A TREND

When there is a trend

- Period 1 – 26
- Period 2 - 28
- Period 3 - 29
- Period 4 - 31
- Period 5 - 32
- Period 6 - 35



Exponential Forecasts versus Actual Demand over Time Showing the Forecast Lag



Trend Effects in Exponential Smoothing

- An trend in data causes the exponential forecast to always lag the actual data
- Can be corrected somewhat by adding in a trend adjustment
- To correct the trend, we need two smoothing constants
  - Smoothing constant alpha (α)
  - Trend smoothing constant delta (δ)

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Trend Effects Equations

$$\text{FIT}_t = F_t + T_t$$
$$F_t = FIT_{t-1} + \alpha\left(A_{t-1} - FIT_{t-1}\right)$$
$$T_t = T_{t-1} + \delta\left(F_t - FIT_{t-1}\right)$$

F_t = The exponentially smoothed forecast for period t

T_t = The exponentially smoothed trend for period t

FIT_t = The forecast including trend for period t

FIT_{t-1} = The forecast including trend made for the prior period

A_{t-1} = The actual demand for the prior period

α = Smoothing constant

δ = Smoothing constant

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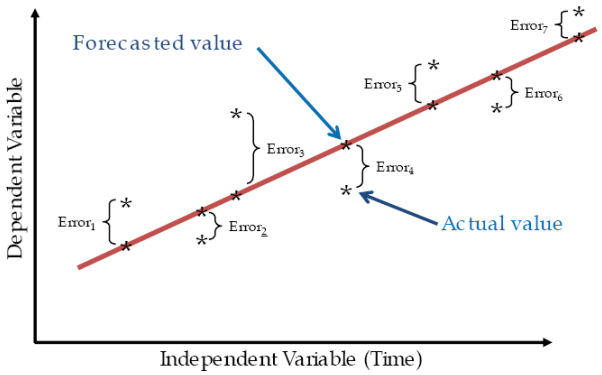
Linear Regression



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Estimating Trend

Method of Least Squares

- Treat the time periods as independent variable and the actual demand as dependant variable.
- Linear regression of the form Y = a + bX could be constructed to predict the demand Y for any value of X

X_i = Time periods
Y_i = Actual demand during period X_i
a = Intercept (at period 0)
b = Slope of the line
n = Number of periods

The coefficients of the regression equation are as follows:

$$b = \frac{\sum_i X_i Y_i - n\bar{X}\bar{Y}}{\sum_i X_i^2 - n\bar{X}^2} \qquad a = \bar{Y} - b\bar{X} \qquad \bar{X} = \frac{\sum X}{n} \qquad \bar{Y} = \frac{\sum Y}{n}$$

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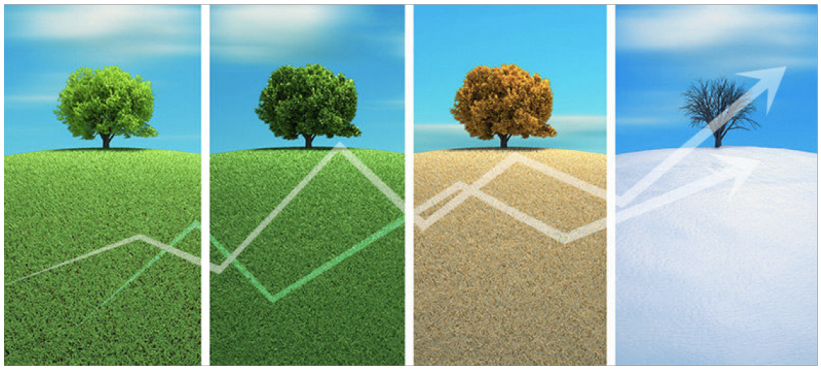

WHEN THERE IS SEASONALITY

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When there is seasonality

- Need to de-seasonalize data before using any standard forecasting techniques
  - Use average demand for entire series
  - Use average demand for same period across seasons
  - Use moving average based on length of season