

## Calculations done for the assessment in developing the plot

**ema = talib.EMA(df['Close'], timeperiod=period).**

This command calculates the EMA of the 'Close' price data for a given period of time.

$$\text{EMA} = (\text{Price} * K) + (\text{Previous EMA} * (1 - K))$$

Where:

Price: The current closing price

K: The smoothing factor, which is calculated as  $2/(\text{period} + 1)$

Previous EMA: The EMA calculated for the previous period

**bb = BollingerBands(df['Close'], window=bollinger\_period, window\_dev=bollinger\_deviation)**

This command calculates the Bollinger bands for the given period of time and deviation. These are plotted two standard deviations away from a SMA of the security's price over a given period of time.

The function argument window\_dev which sets the number of standard deviations to be added and subtracted from the moving average to create the upper and lower Bollinger bands.

**df['Signal'] = df['MACD'].ewm(span=9, adjust=False).mean()**

The calculation of the Signal Line for the Moving Average Convergence Divergence (MACD) indicator is performed and is calculated as Exponential Moving Average (EMA) of the MACD line.

The EMA of the MACD line is calculated by taking a weighted average of the MACD line values over a specified period of time. In this case, the span parameter is set to 9, which means that the EMA is calculated over the past 9 periods of the MACD line.

The formula for EMA is as follows:

$$\text{EMA}(t) = (V(t) * (2/(n-1))) + \text{EMA}(t-1) * (1 - (2/(n-1)))$$

where:

$V(t)$  is the current value of the MACD line at time  $t$

$n$  is the number of periods over which the EMA is calculated

$EMA(t-1)$  is the EMA value for the previous period

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df['EMA'] = df['Close'].ewm(span=period).mean()
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delta = df['Close'].diff()
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gain = delta.where(delta > 0, 0)
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loss = -delta.where(delta < 0, 0)
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avg_gain = gain.rolling(period).mean()
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avg_loss = loss.rolling(period).mean()
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rs = avg_gain / avg_loss
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df['RSI'] = 100 - (100 / (1 + rs))
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First, the EMA is calculated using the ewm function. The span parameter is used to set the number of periods to be considered while calculating the EMA. The mean function is used to calculate the mean of the selected periods.

Next, the difference between the current close price and the previous close price is calculated using the diff function. This is stored in the delta variable.

The where function is used to set negative delta values to 0 and store it in the gain variable. Similarly, negative values of delta are stored in the loss variable.

The rolling function is used to calculate the average gain and loss over a given period. The period parameter sets the number of periods to be considered while calculating the average.

The Relative Strength (RS) is calculated as the ratio of average gain to average loss.

Finally, the RSI is calculated using the RS value. The RSI value is given by the formula,  $RSI = 100 - (100 / (1 + RS))$ . The resulting RSI values are stored in the df['RSI'] column.