**Time series work flow:**

**A)** Determine if the series is stationary. To do so you can use the Dickey-Fuller test. If not stationary then you should check for long-term trends and seasonality. Long-term trend is usually detectable by just looking at the time series plot. The trend also shows in the PACF plot where you don’t see the correlations jump up and down around zero. Seasonality is best seen in the ACF plot where you can see periodic jumps (*e.g.* every 4 lags). Remember that a time series can have multiple seasonal trends (*e.g.* price of some good going up every week but also every quarter).

**B)** Determine the model parameters:

Scenario 1:

*No long-term trend, no seasonality (stationary series):*

Look at the PACF plots. Count the number of bars where the correlation is significant (outside of the confidence intervals). That is the order of the autoregressive term (p).

Look at the ACF plot. Count the number of bars where the correlation is significant. That is the order of the moving average term (q).

Train an ARMA(p,q) model.

Scenario 2:

*Long-term trend, no seasonality:*

Keep differencing the series and perform a Dickey-Fuller test each time and check for stationarity. Once stationary, stop differencing and count the number of differences you did. That is the order of integration (d). Look at the PACF and ACF of the stationary series to determine (p) and (q) just like you did in scenario 1.

Train an ARIMA(p,d,q) model.

Scenario 3:

*No long-term trend, seasonality:*

Keep doing seasonal differencing (look up how to do this) and perform a Dickey-Fuller test each time and check for stationarity. Once stationary, stop differencing and count the number of differences you did. That is the order of seasonal differencing (D). Look at the PACF and ACF of the stationary series to determine terms the order of seasonal autoregressive (P) and the order of seasonal moving average terms (Q) respectively.

Train an SARIMA(0,0,0)(P,D,Q)S where S is the seasonality period (lag).

Scenario 4:

*Long-term trend and seasonality:*

This gets a little complicated. Perform one seasonal differencing first then do a Dickey-Fuller. The seasonal differencing may remove the long-term trend as well. If it doesn’t, do an ordinary differencing and check again. General rule of thumb is that you shouldn’t do more than two seasonal and ordinary differencing *combined*. At this point you have (d) and (D). Then look at the PACF plot. The number of significant bars at early lags will give you the order of autoregressive terms (p). The number of significant bars at seasonal locations will give you the order of seasonal autoregressive terms (P).

Look at the ACF plot next. The number of significant bars at early lags will give you the order of moving average (q). The number of significant bars at seasonal locations will give you the order of seasonal moving average (Q).

Train an SARIMA(p,d,q)(P,D,Q)S model.

*These hyperparameters are a good starting point for a little grid searching.*