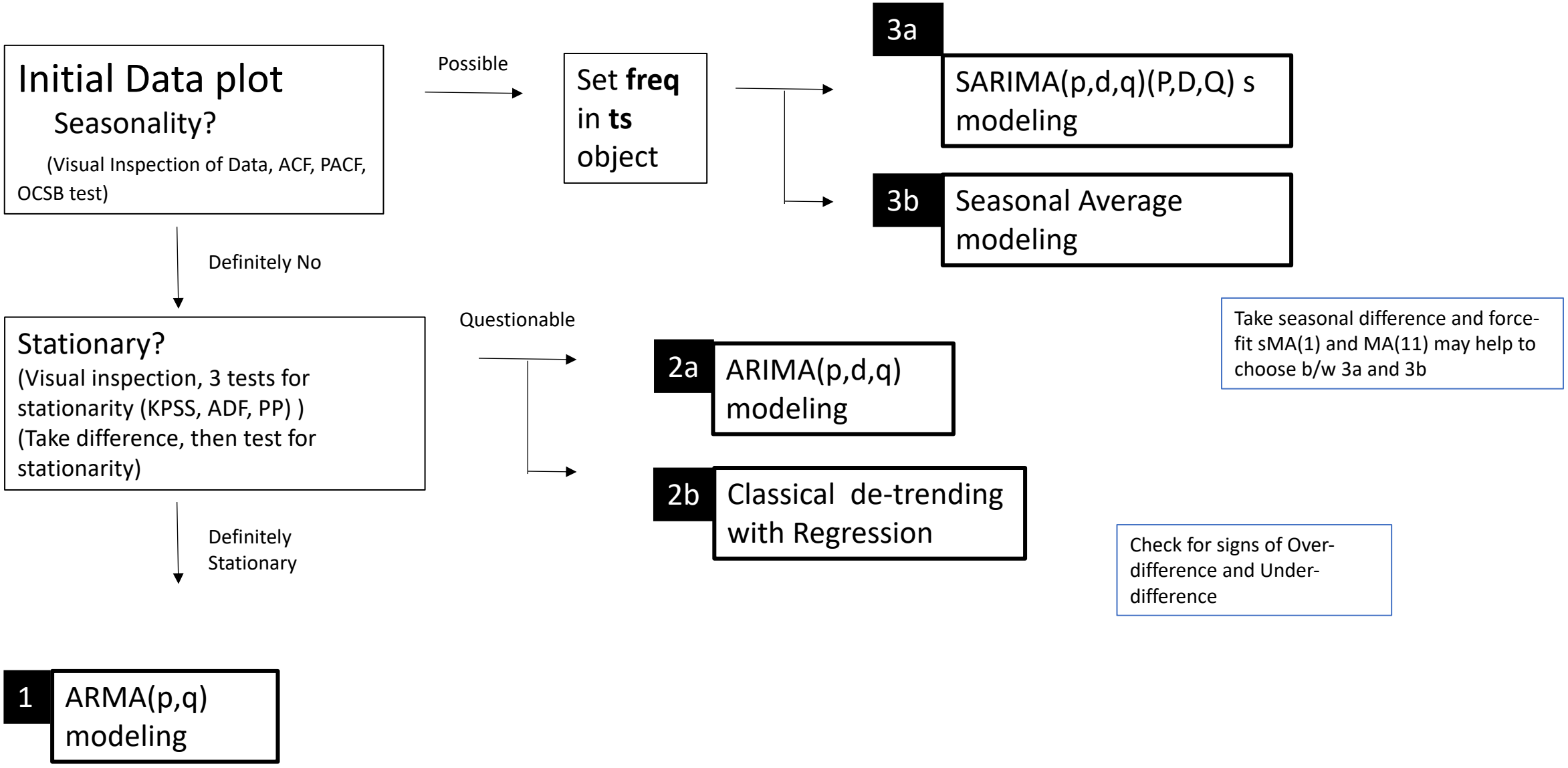
Time Series Modeling Flow Chart



1 ARMA(p,q) modeling

- d=0 is fixed and not questioned.
- Let **auto.arima()** with **stepwise=FALSE** option to pick the best (p,q) by lowest AICc
- Check proposed model for parameter significance
  - CI contains 0 ---> parameter estimate not significantly different from 0
  - If p=3 and AR3 is insignificant, then then use p=2.
  - If p=3 and AR2 is insignificant, then keep p=3. Supress only AR2 to be 0 (optional)
- Force fit the model with increased q and p
  - Make sure the last term added comes back non-significant.

1 ARMA(p,q) modeling

- Residual Analysis
  - B-L test checks correlation for residuals. P-value above .05 -> can’t reject the null hyp. of uncorrelation.
  - B-L test must be above .05 for all choices of H.
  - If B-L test reject for one of choices of H --> Model fit not adequate
  - M-L test checks correlation for square of residuals.
  - J-B test checks for normality of residuals.
    - P-value less than .05 -> residual is not normally distributed
    - Rejection of normality is not critical for ARIMA modeling.

2a ARIMA(p,d,q) modeling

- Value of d is open
- Find when non-stationarity turns into stationarity
  - Stationarity.tests(D1) d=0
  - Stationarity.tests(diff(D1)) d=1
  - Stationarity.tests(diff(diff(D1))) d=2
- If transition from non-stationarity to stationarity is instant and clear, then choose the first value of d with stationarity.
- If transition is not instant, then narrow down candidate for d down to 2 values.

2a ARIMA(p,d,q) modeling

- Perform ARMA(p,q) modeling to each candidate of d.
- Signs to watch out for
  - If p=1, see if AR1 parameter is significantly different from +-1. If not, it indicates non-stationarity (d needs to be increased)
  - If q=1, see if MA1 parameter is significantly different form +-1. If not, it indicates over-difference (d needs to be decreased)
  - It's ok to force p=1 or q=1 just to check for these points. In this case, other parameter (p or q) should be as high as there are significant estimates.
- In the end, pick the model that has less warning signs.
- AICc, AIC, BIC can not be used to compare models with different d.

3a SARIMA(p,d,q)x(P,D,Q) s modeling

- Value of d and D are open
- Find when non-stationarity with seasonality turns into stationarity w/o seasonality
  - Stationarity.tests(D1) d=0
  - Stationarity.tests(diff(D1, 12)) d=0, D=1
  - Stationarity.tests(diff(diff(D1, 12))) d=1, D=1
- Seasonality can be seen in ACF plot
- Narrow down your candidate of d,D to down to 1 or 2 sets.
- Note that stationary series can still have seasonality.
- Rest is same as ARIMA modeling.

2b Classical De-trending Method

3b Seasonal Average Method

Terminology: ".. AR1 is Significant"

AR1 term is significant. = Parameter estimate for phi1 is statistically different from 0 = 95% CI for phi1 does not include 0 = Hypothesis test with H0: phi1 = 0 rejects H0. (i.e. p-value less than .05)

- If you simply say "significant", it implies that you are comparing to 0
- If you are comparing something other than 0, (e.g. +-1) Then it must be stated. (e.g. Significantly different from 1)
- Term "significant" must be associated with low p-value (Reject H0)