Time Series Final Exam: In Class Portion **Solution**

**Questions 1 – 4 (3 pts each)**

Simply circle the option(s) that are correct. More than one option may be appropriate. If you think none are appropriate then circle NONE at the end of the question.

1. An AR(1) model can generate

i. a frequency of 0 alone

ii. a frequency of .5 alone

iii. a frequency between 0 and .5

iv. both a frequency of 0 and .5

v. a frequency between 0 and .5 and a frequency of 0.

NONE

2. An AR(2) model can generate

i. a frequency of 0 alone

ii. a frequency of .5 alone

iii. a frequency between 0 and .5

iv. both a frequency of 0 and .5

v. a frequency between 0 and .5 and a frequency of 0.

vi. NONE

3. What type of models will produce forecasts that will converge directly to the sample mean in a fashion similar to what is displayed below?



i. AR(1) positive phi

ii. AR(1) negative phi

iii. AR(2) complex conjugate roots.

iv. AR(4) with two sets of complex conjugate roots

v. ARIMA(0,1,0) models

vi. signal + noise models

NONE

4. What type of models will simply forecast the last value of the series into the future?

i. AR(1) positive phi

ii. AR(1) negative phi

iii. AR(2) complex conjugate roots.

iv. AR(4) with two sets of complex conjugate roots

v. ARIMA(0,1,0) models

vi. signal + noise models

NONE

5. Consider the time series below of the monthly high temperatures in Dallas, Texas from 2010 to 2019:



Is this data from a stationary or non-stationary process? Explain. (3 pts)

**Condition 1**: The DFW Monthly Mean Max temps 2010-2019 (DFW\_Data) shows evidence being pseudo cyclical, which makes sense as it is temperature, so the mean is likely dependent on the time.

**Condition 2:** It is not certain in the data that the variance depends on time and it is reasonable that the temperatures fluctuate around a mean temperature similarly time period and is fairly consistent cycle pattern.

**Condition 3:** Although an autocorrelation plot is not shared, based on its appearance, there is no indication that the covariance depends on where the series is in time.

**Since condition one is very likely violated, the time series is deemed to be from a non-statioonary process.**

6. (3pts) Which estimates can yield non-stationary models? Circle all that apply:

i. Yule Walker

ii. Burg

iii. Maximum Likelihood

iv. All can yield non-stationary models.

7. (3pts) Dickey Fuller tests were shown to have an inflated (high) type II error rates.

a. Write down the null and alternative hypothesis of the Dickey-Fuller Test.

H0: Model has a unit root (+1)

b. Explain what a type II error is in the context of this test and thus what the concern of an inflated type II error rate is here.

Type II error is the error that occurs when we fail to reject a null hypothesis that is actually false. *i.e. incorrectly conclude there was a unit root.*

8. (3pts) True or False:

All stationary and invertible ARMA models can be written as an infinite order AR process.

Simply write “TRUE” or “FALSE” TRUE

9. (3pts) TRUE or FALSE:

There are many invertible models that have the same acf (correlation structure).

Simply write “TRUE” or “FALSE” FALSE

10. (3pts) Given the following model and white noise variance estimate, show your calculation of the margin of error (probability interval half width) for a 95% probability interval of a forecast horizon of 3 (l = 3). .

psi.weights.wge(phi = (0.8),lag.max = 3)

[1] 0.800 0.640 0.512

MOE = 1.96\*sqrt(4)\*sqrt(1^2 + 0.80^2 + 0.64^2) = ± 5.61

11. (2pts): True or False: We should always choose the model with the smallest ASE? FALSE

12. And now … it is time for ….. **MATCHING!!!** Match the realization in the first column with the ACF in the second column by filling in the numbers below (representing the first column) with the corresponding letter (representing the second column). (2 pts each)

Matched below (not in the plot).

|  |  |
| --- | --- |
| 1. | a. |
| 2. | b. |
| 3. | c. |
| 4. | d. |
| 5. | e. |

1. \_\_d\_ 2. \_\_e\_\_ 3. \_\_a\_\_\_ 4. \_\_c\_\_\_\_ 5. \_\_\_b\_\_\_\_

13. One more round….. **MATCHING!!!** Match the realization or acf in the first column with the spectral density in the second column by filling in the numbers below (representing the first column) with the corresponding letter (representing the second column). (2 pts each) (One from column 2 won’t be used.)

Matched below (not in the plot).

|  |  |
| --- | --- |
| 1. | a. |
| 2. | b. |
| 3. | c. |
| 4. | d. |
|  | e. |

1. \_\_d\_\_\_ 2. \_\_\_\_e\_\_\_ 3. \_\_a\_\_\_\_ 4. \_\_c\_\_\_