MG2MDCSTA100 – Time Series Methods and their Applications
PRACTICAL EXAMINATION

Duration: 1Hour   Maximum: 35 Marks

*From the following eight questions, students must answer any **five** questions. Each question carries **7** marks.*

[Solve the questions using R Studio in the computer lab. The R code and outputs (except graphs) must be written in the answer paper. Ensure that the graphs generated are evaluated by the invigilator before leaving the lab. Document your analysis and findings.]

1. Create a time series object starting from Jan 2020 with monthly frequency and plot all the time series plots for the following time series data.

   [Analyse][CO1, CO4]

   1.06,   2.63,   1.50,   0.01,   -0.43,   -0.38,   0.93,   1.54,   -2.83,,   -2.26,

   -2.43,   -0.11,   -0.88,   -0.30,   -3.70,   -1.46,   0.12,   1.25,   0.60,   0.22,

   1.54,   4.46,   3.72,   8.78,   2.30,   2.58,   4.15,   0.73,   -2.63,   4.83

2. Create a time series object starting from April 2020 with monthly frequency and plot all the time series plots for the following time series data.

   [Analyse][CO1, CO4]

   0.76,   0.74,   0.77,   0.50,   -0.31,   1.63,   1.31,   -1.31,   0.05,   -0.45,

   -1.29,   -0.86,   -1.46,   -1.46,   -1.35,   -2.36,   -0.34 ,   -0.02,   -1.15,   0.68,

   0.76,   0.09,   0.94,   1.35,   1.50

3. Create a time series object starting from June 2020 with monthly frequency and plot all the time series plots for the following time series data.

   [Analyse][CO1, CO4]

   5.89,   3.32,   -0.33,   3.51,   3.64,   4.70,   2.59,   6.28,   8.03,   8.18,

   6.41,   3.70,   1.23,   -0.84,   -0.18,   -1.60,   0.15,   1.25,   3.71,   3.23,

   4.81,   1.59,   2.55,   2.51,   2.01,   5.05,   5.91

4. Create a time series object starting from Jan 2021 with monthly frequency and plot all the time series plots for the following time series data.

   [Analyse][CO1, CO4]

   -2.43,   1.09,   -6.26,   -12.41,   -8.40,   -5.17,   4.40,   2.70,   0.78,   3.90,

   3.26,   10.81,   7.19,   -1.63,   2.29,   1.89,   -6.35,   -13.31,   -11.94,   -9.61,

   -4.85,   1.82,   -1.01,   -3.14,   -2.93

5. Create a time series object starting from Jan 2000 with monthly frequency and plot all the time series plots for the following time series data.

[Analyse][CO1, CO4]

48.37,   50.79,   51.83,   50.64,   48.93,   49.98,   50.41,   50.55,   51.61,
51.43,   48.39,   48.05,   50.78,   50.68,   49.25,   49.44,   49.97,   49.44,
49.42,   50.46,   52.09,   50.45,   48.22,   47.64,   51.32,   51.75,   50.64,
48.31

6. Plot all the time series plots for the **AirPassengers** data (a built-in time series data set on monthly airline passenger totals from 1949 to 1960) in R.

[Analyse][CO1, CO4]

7. Create a time series object and fit an AR model for the following time series data.

[Skill][CO1, CO2, CO4]

1.06,   2.63,   1.50,   0.01,   -0.43,   -0.38,   0.93,   1.54,   -2.83, ,   -2.26,
-2.43,   -0.11,   -0.88,   -0.30,   -3.70,   -1.46,   0.12,   1.25,   0.60,   0.22,
1.54,   4.46,   3.72,   8.78,   2.30,   2.58,   4.15,   0.73,   -2.63,   4.83

8. Create a time series object and fit an AR model for the following time series data.

[Skill][CO1, CO2, CO4]

0.76,   0.74,   0.77,   0.50,   -0.31,   1.63,   1.31,   -1.31,   0.05,   -0.45,
-1.29,   -0.86,   -1.46,   -1.46,   -1.35, -2.36,   -0.34 ,   -0.02,   -1.15,   0.68,
0.76,   0.09,   0.94,   1.35,   1.50

9. Create a time series object and fit an AR model for the following time series data.

[Skill][CO1, CO2, CO4]

5.89,   3.32,   -0.33,   3.51,   3.64,   4.70,   2.59,   6.28,   8.03,   8.18,
6.41,   3.70,   1.23,   -0.84,   -0.18,   -1.60,   0.15,   1.25,   3.71,   3.23,
4.81,   1.59,   2.55,   2.51,   2.01,   5.05,   5.91

10. Create a time series object and fit an AR model for the following time series data.

[Skill][CO1, CO2, CO4]

-2.43,   1.09,   -6.26,   -12.41,   -8.40,   -5.17,   4.40,   2.70,   0.78,   3.90,
3.26,   10.81,   7.19,   -1.63,   2.29,   1.89,   -6.35,   -13.31,   -11.94,   -9.61,
-4.85,   1.82,   -1.01,   -3.14,   -2.93

11. Create a time series object and fit an AR model for the following time series data.

[Skill][CO1, CO2, CO4]

48.37, 50.79, 51.83, 50.64, 48.93, 49.98, 50.41, 50.55, 51.61,

51.43, 48.39, 48.05, 50.78, 50.68, 49.25, 49.44, 49.97, 49.44,

49.42, 50.46, 52.09, 50.45, 48.22, 47.64, 51.32, 51.75, 50.64,

48.31

12. Fit an AR model for the **AirPassengers** data (a built-in time series data set on monthly airline passenger totals from 1949 to 1960) in R.

[Skill][CO1, CO2, CO4]

13. Fit an AR model for the **sunspot.year** data (a built-in time series data set on yearly sunspot counts from 1749 to 1983) in R. [Skill][CO1, CO2, CO4]

14. Fit an AR model for the **Nile** data (a built-in time series data set on annual river flow data from 1871 to 1970) in R. [Skill][CO1, CO2, CO4]

15. Fit an AR model for the **LakeHuron** data (a built-in time series data set on annual water levels of Lake Huron from 1875 to 1972) in R. [Skill][CO1, CO2, CO4]

16. Simulate 30 values of the specified time series model and plot all the time series plots. Also note down the first 5 and last 5 values generated.

[Interest][CO1, CO3, CO4]

- AR(1) model using $\varphi_1 = 0.70$ and seed value 13

- AR(2) model using $\varphi_1 = 0.50$, $\varphi_2 = 0.33$, intercept 55 and seed value 7

17. Simulate 30 values of the specified time series model and plot all the time series plots. Also note down the first 5 and last 5 values generated.

[Interest][CO1, CO3, CO4]

- AR(1) model using $\varphi_1 = -0.20$, intercept 75 and seed value 99

- AR(2) model using $\varphi_1 = 0.60$, $\varphi_2 = 0.20$ and seed value 345

18. Simulate 30 values of the specified time series model and plot all the time series plots. Also note down the first 5 and last 5 values generated.

[Interest][CO1, CO3, CO4]

- AR(1) model using $\varphi_1 = 0.80$, intercept 50 and seed value 8

- AR(2) model using $\varphi_1 = 1.50$, $\varphi_2 = -0.75$ and seed value 888

19. Simulate 30 values of the specified time series model and plot all the time series plots. Also note down the first 5 and last 5 values generated.

[Interest][CO1, CO3, CO4]

- AR(1) model using $\varphi_1 = 0.70$ and seed value 13

- AR(2) model using $\varphi_1 = 0.60$, $\varphi_2 = 0.20$, intercept 55 and seed value 345

20. Simulate 30 values of the specified time series model and plot all the time series plots. Also note down the first 5 and last 5 values generated.

[Interest][CO1, CO3, CO4]

- AR(1) model using $\varphi_1 = -0.20$ and seed value 99

- AR(2) model using $\varphi_1 = 1.50$, $\varphi_2 = $ -0.75, intercept 50 and seed value 888

21. Simulate 30 values of the specified time series model and plot all the time series plots. Also note down the first 5 and last 5 values generated.

<div align="right">[Interest][CO1, CO3, CO4]</div>

- AR(1) model using $\varphi_1 = 0.80$, intercept 60 and seed value 8
- AR(2) model using $\varphi_1 = 0.50$, $\varphi_2 = 0.33$ and seed value 7

22. Simulate 30 values of the specified time series model and plot all the time series plots. Also note down the first 5 and last 5 values generated.

<div align="right">[Interest][CO1, CO3, CO4]</div>

- AR(1) model using $\varphi_1 = 0.70$, intercept 55 and seed value 13
- AR(2) model using $\varphi_1 = 1.50$, $\varphi_2 = $ -0.75 and seed value 888

23. Simulate 30 values of the specified time series model and plot all the time series plots. Also note down the first 5 and last 5 values generated.

<div align="right">[Interest][CO1, CO3, CO4]</div>

- AR(1) model using $\varphi_1 = $ -0.20 and seed value 99
- AR(2) model using $\varphi_1 = 0.50$, $\varphi_2 = 0.33$, intercept 45 and seed value 7

24. Simulate 30 values of the specified time series model and plot all the time series plots. Also note down the first 5 and last 5 values generated.

<div align="right">[Interest][CO1, CO3, CO4]</div>

- AR(1) model using $\varphi_1 = 0.80$ and seed value 8
- AR(2) model using $\varphi_1 = 0.60$, $\varphi_2 = 0.20$, intercept 40 and seed value 345

25. Simulate 30 values of the specified time series model and plot all the time series plots. Also note down the first 5 and last 5 values generated.

<div align="right">[Interest][CO1, CO3, CO4]</div>

- AR(1) model using $\varphi_1 = 0.70$, intercept 50 and seed value 13
- AR(2) model using $\varphi_1 = 0.50$, $\varphi_2 = 0.33$ and seed value 7

26. Simulate 30 values of the specified time series model and plot all the time series plots. Also note down the first 5 and last 5 values generated.

<div align="right">[Interest][CO1, CO3, CO4]</div>

- AR(1) model using $\varphi_1 = $ -0.20 and seed value 99
- AR(2) model using $\varphi_1 = 0.60$, $\varphi_2 = 0.20$, intercept 50 and seed value 345

27. Simulate 30 values of the specified time series model and plot all the time series plots. Also note down the first 5 and last 5 values generated.

<div align="right">[Interest][CO1, CO3, CO4]</div>

- AR(1) model using $\varphi_1 = 0.80$ and seed value 8
- AR(2) model using $\varphi_1 = 1.50$, $\varphi_2 = $ -0.75, intercept 100 and seed value 888

28. Simulate 30 values of the specified time series model and plot all the time series plots. Also note down the first 5 and last 5 values generated.

<div align="right">[Interest][CO1, CO3, CO4]</div>

- AR(1) model using $\varphi_1 = 0.70$, intercept 125 and seed value 13
- AR(2) model using $\varphi_1 = 0.60$, $\varphi_2 = 0.20$ and seed value 345

29. Simulate 30 values of the specified time series model and plot all the time series plots. Also note down the first 5 and last 5 values generated.

[Interest][CO1, CO3, CO4]

- AR(1) model using $\varphi_1 = $ -0.20, intercept 55 and seed value 99
- AR(2) model using $\varphi_1 = 1.50$, $\varphi_2 = $ -0.75 and seed value 888

30. Simulate 30 values of the specified time series model and plot all the time series plots. Also note down the first 5 and last 5 values generated.

[Interest][CO1, CO3, CO4]

- AR(1) model using $\varphi_1 = 0.80$ and seed value 8
- AR(2) model using $\varphi_1 = 0.50$, $\varphi_2 = 0.33$, intercept 75 and seed value 7

31. Simulate 30 values of the specified time series model and plot all the time series plots. Also note down the first 5 and last 5 values generated.

[Interest][CO1, CO3, CO4]

- AR(1) model using $\varphi_1 = 0.70$ and seed value 13
- AR(2) model using $\varphi_1 = 1.50$, $\varphi_2 = $ -0.75, intercept 25 and seed value 888

32. Simulate 30 values of the specified time series model and plot all the time series plots. Also note down the first 5 and last 5 values generated.

[Interest][CO1, CO3, CO4]

- AR(1) model using $\varphi_1 = $ -0.20, intercept 10 and seed value 99
- AR(2) model using $\varphi_1 = 0.50$, $\varphi_2 = 0.33$ and seed value 7

33. Simulate 30 values of the specified time series model and plot all the time series plots. Also note down the first 5 and last 5 values generated.

[Interest][CO1, CO3, CO4]

- AR(1) model using $\varphi_1 = 0.80$, intercept 50 and seed value 8
- AR(2) model using $\varphi_1 = 0.60$, $\varphi_2 = 0.20$ and seed value 345

34. Simulate 15 white noise values using seed values 1 and 100 and plot them. Also note down all the 15 values generated. [Skill][CO2, CO4]

35. Simulate 15 white noise values using seed values 234 and 143 and plot them. Also note down all the 15 values generated. [Skill][CO2, CO4]

36. Simulate 15 white noise values using seed values 888 and 88 and plot them. Also note down all the 15 values generated. [Skill][CO2, CO4]

37. Simulate 15 white noise values using seed values 7 and 18 and plot them. Also note down all the 15 values generated. [Skill][CO2, CO4]

38. Simulate 15 white noise values using seed values 45 and 99 and plot them. Also note down all the 15 values generated. [Skill][CO2, CO4]

39. Simulate 15 white noise values using seed values 16325 and 88 and plot them. Also note down all the 15 values generated. [Skill][CO2, CO4]

40. Simulate 15 white noise values using seed values 888 and 5433 and plot them. Also note down all the 15 values generated. [Skill][CO2, CO4]

(5 x 6 = 30)