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PO Belur Math, Howrah, West Bengal 711 202
School of Mathematical Sciences
Department of Computer Science

MSc BDA : Batch 2019-21, Semester III, MidSem Exam
DA311: Time Series
Dr. Sudipta Das

Student Name (in block letters):

Date: 09 Nov 2020

Student Roll No:

Max Marks: 50

Signature:

Time: 1hrs

Answers must be properly justified to deserve full credits.

1. (1 point) In general, adjacent observations in time series data are independent and identically distributed (IID)
 - (a) True
 - (b) **False**

2. (1 point) $\nabla_d = (1 - B)^d$
 - (a) True
 - (b) **False**

3. (1 point) A set of observations exhibiting a strong cyclic component will pass the difference-sign test for randomness
 - (a) **True**
 - (b) False

4. (1 point) Random walk is not a stationary process
 - (a) **True**
 - (b) False

5. (1 point) An weak stationary process is always a strict stationary process
 - (a) True
 - (b) **False**

6. (2 points) Increasing the number of periods in a moving average will accomplish greater smoothing, but at the expense of
- (a) manager understanding
 - (b) **responsiveness to changes**
 - (c) accuracy
 - (d) stability
7. (2 points) Which is/are true for a seasonal component of a time series
- (a) **Periods are equal and should be less than an year**
 - (b) Periods can be unequal, however, should be less than an year
 - (c) Periods are equal and can be of any length
 - (d) **Amplitudes are same**
8. (2 points) In moving average method we cannot find trend values of some
- (a) Starting Periods
 - (b) Middle Period
 - (c) End Periods
 - (d) **Starting and End Periods**
9. (2 points) Autocovariance measures
- (a) Linear dependence between multiple points on the different series observed at different times
 - (b) Any dependence between two points on the same series observed at different times
 - (c) Linear dependence between two points on different series observed at same time
 - (d) **Linear dependence between two points on the same series observed at different times**
10. (2 points) Which of the following is/are true for a white noise?
- (a) Mean is 0
 - (b) Zero autocovariances
 - (c) **Zero autocovariances except at lag zero**
 - (d) An i.i.d. process
11. (2 points) Second differencing in time series can help to eliminate
- (a) Linear Trend
 - (b) **Quadratic Trend**
 - (c) Seasonality
 - (d) Noise

12. (2 points) Suppose that we have observations from an MA(1) process with $\theta = -0.8$ and $Z_t \sim WN(0, 1)$. Which of the following is true? (x versus y means x is in horizontal axis and y is in vertical axis)
- (a) The scatter plot of Y_t versus Y_{t-1} will display a negative linear trend and the scatter plot of Y_t versus Y_{t-2} will display a negative linear trend
 - (b) The scatter plot of Y_t versus Y_{t-1} will display a positive linear trend and the scatter plot of Y_t versus Y_{t-2} will display a positive linear trend
 - (c) **The scatter plot of Y_t versus Y_{t-1} will display a negative linear trend and the scatter plot of Y_t versus Y_{t-2} will display a random scatter of points**
 - (d) The scatter plot of Y_t versus Y_{t-1} will display a positive linear trend and the scatter plot of Y_t versus Y_{t-2} will display a random scatter of points
13. (2 points) Which statement about an AR(2) process is always true
- (a) **The process is invertible**
 - (b) **The process is stationary**
 - (c) The theoretical ACF is zero at lag k , for all $k > 2$
 - (d) The theoretical PACF decays exponentially or according to a sinusoidal pattern as the lag gets large.
14. (2 points) The partial autocorrelation function is necessary for distinguishing between
- (a) **AR and MA models**
 - (b) **AR and ARMA models**
 - (c) MA and ARMA models
 - (d) Different models from within the ARMA family
15. (2 points) For a MA(3) process
- (a) **ACF = 1 at lag 0**
 - (b) ACF = 0 at lag 2
 - (c) ACF = 0 at lag 3
 - (d) **ACF = 0 at lag 4**
16. (2 points) Which of the following is necessary condition for an weakly stationary time series
- (a) **Mean is constant**
 - (b) **Autocovariance function depends on s and t only through their difference $|s - t|$ (where t and s are moments in time)**
 - (c) **The time series under considerations is a finite variance process**
 - (d) Time series is Gaussian
17. (2 points) Which of the following is true for an autocorrelation function $\rho(\cdot)$, of a stationary process
- (a) $\rho(0) = 1$ **Correct**
 - (b) $\rho(t + h, t) = \rho(t)$ **Not correct**
 - (c) $-1 \leq \rho(h) \leq 1$ **Correct**
 - (d) $\rho(h)$ is an even function **Correct**

18. (2 points) If T is the number of turning point of a rapidly fluctuating sequence (compared with an i.i.d. sequence) of length 98, then it is of high chance that T will be
- (a) lesser than 48
 - (b) **greater than 64**
 - (c) equals to 48
 - (d) greater than 98

19. (2 points) Consider the following $AR(1)$ model

$$Y_t = 0.2 + 0.4Y_{t-1} + Z_t,$$

where $Z_t \sim WN(0, 1)$. The mean of the process Y_t is

- (a) 0
 - (b) **0.33**
 - (c) 1.00
 - (d) 1.04
20. (2 points) Consider the following $AR(1)$ model

$$Y_t = 0.2 + 0.4Y_{t-1} + Z_t,$$

where $Z_t \sim WN(0, 1)$. The MSE of one-step ahead prediction by the Durbin-Levinson algorithm is

- (a) 0.40
 - (b) **1.00**
 - (c) 1.04
 - (d) 1.19
21. (2 points) Given an actual value of 102 at time t , a previous forecast value of 99, and an alpha of 0.4, the exponential smoothing forecast for the next period would be
- (a) 97.4
 - (b) **100.2**
 - (c) 100.8
 - (d) 101.0

22. (2 points) Consider the following $MA(1)$ model

$$Y_t = 0.2Z_{t-1} + Z_t,$$

where $Z_t \sim WN(0, 2)$. The ACVF of the process at lag 1 is

- (a) **0.40**
- (b) 1.00
- (c) 1.4
- (d) 1.19

23. (3 points) The following ARMA process

$$X_t + 0.3X_{t-1} - 0.88X_{t-2} = Z_t - 0.4Z_{t-1} + 0.04Z_{t-2},$$

where $\{Z_t\} \sim WN(0, 1)$, is

- (a) causal
- (b) **non-causal**
- (c) **invertible**
- (d) non-invertible

24. (3 points) Consider the following $MA(1)$ model

$$Y_t = 0.8Z_{t-1} + Z_t,$$

where $Z_t \sim WN(0, 2)$. The PACF of the process at lag 2 is (approximately)

- (a) -0.39
- (b) **-0.31**
- (c) 0
- (d) 0.39

25. (5 points) Consider the following set of data:

23.32, 32.33, 32.88, 28.98, 34.16, 26.33, 29.88, 32.69, 18.98, 21.23, 26.66, 29.89

What is the lag-one sample autocorrelation of the time series?(approximately)

- (a) 0.20
- (b) **0.12**
- (c) 0.13
- (d) 0.07

This exam has total 25 questions, for a total of 50 points and 0 bonus points.

Best of luck!!