1M3N20229 (Pages : 2) Reg. No:..........................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester M.Sc Degree Examination, November 2020

MST3C11 – Applied Regression Analysis

(2019 Admission onwards)

Time: 3 hours Max. weightage : 30

PART A

Answer any four (2 weightage each)

1. State the important properties of least square estimates in estimation of linear regression models.
2. Explain the effect of outliers in the linear regression model.
3. Define residuals and describe the role of residuals in detecting normality
4. Distinguish between coefficient of determination R^2 and adjusted R^2.
5. Describe the concept of orthogonal polynomials.
6. Explain the term odds ratio .
7. In a Gauss-Markov model show that BLUE of a linear parametric function is unique.

(4×2 = 8 weightage)

PART B

Answer any four (3 weightage each)

8. What is multicollinearity ? Explain the consequences of presence of multicollinearity.
9. Let $Y = X\beta + \epsilon$, be a general linear model with $\epsilon(0, \sigma^2)$ and X be a matrix of full rank. Obtain the maximum likelihood estimate of β.
10. Show that the least square estimator $\hat{\beta}$ is independent of the error variance σ^2
11. What is autocorrelation? How do we detect it?
12. Distinguish between generalized least squares estimate and ordinary least squares estimate.
13. Find out the maximum likelihood estimates of β and σ^2 in general linear regression model.
14. Describe Logistic regression model.

(4×3 = 12 weightage)

PART C

Answer any two (5 weightage each)

15. a)Define a multiple linear regression model. Derive the least square estimator of the regression coefficient vector and show that it is BLUE.

    b) Find out the Crammer-Rao lower bound for the variance of unbiased estimators of β and σ^2 in general linear regression model.

16. a)State the assumptions in the multiple linear regression models. How do we detect the departures from underlying assumptions using residual analysis?

    b) What are the methods for identifying non-constant variance? Explain the remedies.

17. a)Define stepwise regression and Mallow's C_p statistic and state its importance in regression analysis .

    b) Describe nonparametric Regression.

18. a) Explain the non linear regression model. Explain the parameter estimation procedure.

    b) Describe the Poisson regression model. Explain how to estimate the parameters of this model.

(2×5 = 10 weightage)

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Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester M.Sc Degree Examination, November 2020

MST3C12 – Stochastic Processes

(2019 Admission onwards)

Time: 3 hours Max. weightage : 30

PART A

Answer any four (2 weightages each)

1. Prove that Markov chain is completely determined by the one-step TPM and the initial distribution.
2. Show that state i is recurrent if $\sum_{n=1}^{\infty} p_{ii}^{(n)} = \infty$ and is transient if $\sum_{n=1}^{\infty} p_{ii}^{(n)} < \infty$.
3. Explain Inspection Paradox in the context of a renewal process.
4. Bring out the relation between Poisson process and Binomial distribution.
5. Derive the Chapman-Kolmogorov equation.
6. Explain Stationary distribution with the help of an example.
7. Derive Poisson Process.

(4x2=8 weightages)

PART B

Answer any four (3 weightages each)

8. (a) Prove that the random process X(t) =A Cos(wt+θ) is wide sense stationary if it is assumed that **A** and **w** are constants and θ is uniformly distributed variable on the interval $(0,2\pi)$.

   (b) Show that inter arrival times are exponentially distributed.
9. (a) Define renewal reward process.

   (b)Show that the number of renewals by time t is greater than or equal to n if and only if the n^{th} renewal occurs on or before time t.
10. (a) Stochastic process having independent increment is a Markov process. Is the converse true, justify?

    (b)Explain Brownian motion process?
11. (a)Explain Stopping Time

    (b)Distinguish between open and closed systems.

12. (a)Define linear death process.

(b)Derive the steady state probabilities of M/M/1 model.

13. (a)Show that the renewal function $m(t) = \sum_{n=1}^{\infty} F_n(t), \forall t,$ where $F_n(t) = P(S_n \leq t), n \geq 1, \forall t.$

(b)Write down the steady state equations of Erlang's Loss system.

14. (a) Let $\{X_n, n = 1, 2, \ldots\}$ be a four step Markov chain with one step TPM

$$\begin{bmatrix} 0.5 & 0 & 0.5 & 0 \\ 0 & 0.5 & 0 & 0.5 \\ 0.5 & 0 & 0.5 & 0 \\ 0 & 0.5 & 0 & 0.5 \end{bmatrix}.$$ Find the periodicities of the states.

(b) What do you mean by queue? Briefly explain Kendall's Notation

(4x3=12 weightages)

PART C

Answer any two (5 weightages each)

15. (a) Derive Pollock-Kinchins formulae.

(b) Show that the renewal function satisfies renewal equation.

16. (a) State and prove elementary renewal theorem.

(b) Define Stochastic processes and its various states with the help of examples.

17. (a) Establish the relation between probability generating functions of off spring random variable and n^{th} generation size in Galton –Watson branching Process.

(b) Derive its mean and variance.

18. (a) Explain the transient behaviour of M/M/S model.

(b) Derive the limiting probabilities of a Birth-Death process.

(2 x 5 = 10 weightages)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester M.Sc Degree Examination, November 2020

MST3E02 – Time Series Analysis

(2019 Admission onwards)

Time: 3 hours Max. weightage : 30

Part A

(Answer any Four the questions. Weightage 2 for each question)

1. Explain the relationship between a time series and a stochastic process.
2. State different components of a time series.
3. Define Autoregressive process of order one.
4. Describe the stationary and invertibility conditions of a MA(1) model.
5. What is the importance of diagnostic checking in time series modelling?
6. Derive the expression for 2-step ahead forecast equation of an AR(1) model.
7. Give any two examples for non- linear models in time series analysis.

(4 x 2=8 weightage)

Part B

(Answer any Four questions. Weightage 3 for each question)

8. Distinguish between weak stationarity and strict stationarity of a time series.
9. Explain how will you estimate seasonality in given time series. How will you test for seasonality?
10. Show that the unconditional mean of a time series y_t that can be described by the AR(1) model $y_t - \mu = \varphi_1 \left(y_{t-1} - \mu \right) + \varepsilon_t$ is equal to μ when $|\varphi_1| < 1$.
11. Derive the stationarity conditions for an AR(2) process.
12. Explain forecasting of time series using minimum mean square error method.
13. State TRUE or FALSE with reason for the following statements:
    i) If $\{X_t\}$ is a weakly stationary time series, then X_5 and X_7 are identically distributed.
    ii) If $\{W_t\}$ is a white noise, then W_i and W_j are always independently distributed for $i \neq j$.
14. Define GARCH(1,1) model and describe any two properties of GARCH(1,1) model.

(4 x 3=12 weightage)

Part C

(Answer any TWO questions. Weightage 5 for each question)

15. Discuss the following: (i) Moving Average Smoothing (ii) Holt-Winter Smoothing
16. Explain the steps involved in ARIMA(p,d,q) model identification procedure.
17. Discuss the maximum likelihood estimation procedure for ARMA(1,1) model.
18. Briefly explain: (i) Herglotz Theorem (ii) Periodogram analysis (iii) correlogram analysis.

(2 x 5=10 weightage)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester M.Sc Degree Examination, November 2020

MST3E05 – Lifetime Data Analysis

(2019 Admission onwards)

Time: 3 hours Max. weightage : 30

Part A

Short Answer Type questions

(Answer any four questions. Weightage 2 for each question)

1. Define hazard rate. Show that the hazard rate determines the distribution uniquely.
2. Discuss type I censoring
3. What is the significance of p-p plots in Survival Analysis?
4. What is the Nelson- Aalen estimate of cumulative hazard function
5. What are threshold parameters? Explain.
6. Give the density function, hazard rate and survivor function of log-logistic distribution.
7. Justify Cox likelihood as a partial likelihood.

(4 x 2= 8 weightage)

Part B

Short Essay Type/ problem solving type questions

(Answer any four questions. Weightage 3 for each question)

8. What is mean residual life function? Obtain its relationship with hazard rate. Also show that the mean residual life function uniquely determines the distribution.
9. Discuss Kaplan Meier method for obtaining estimate of the survival function.
10. Explain the standard life table methods.
11. Discuss estimation of two parameter Weibull distribution, when some of the observations are censored.
12. Discuss estimation of μ and σ^2 of lognormal distribution for samples without censored observation
13. Explain how regression models can be used for comparing or testing the equality of two distributions.
14. Explain Gehan's generalized Wilcoxon test

(4 x 3= 12 weightage)

Part C

Long Essay Type questions

(Answer any two questions. Weightage 5 for each question)

15. Describe the general formulation of right censoring and also derive the likelihood function.

16. Discuss likelihood ratio test for comparing two survival distributions which follow exponential model with parameters λ_1 and λ_2 respectively

17. Explain exponential regression model and Weibull regression model. Show that it is a special case proportional hazards model.

18. Explain the linear rank tests for comparing different distributions.

(2 x 5= 10 weightage)