Register Number: ____________________
Date: ____________________

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU-27
BCA(DATA ANALYTICS) —II SEMESTER
SEMESTER EXAMINATION —APRIL 2022
(EXAM CONDUCTED IN JULY —AUGUST 2022)
BCADA 2221:ADVANCED STATISTICAL COMPUTING USING R

TIME: 2 hrs **MAXIMUM MARKS: 60**

This paper has 2 printed pages and 2 parts.

Part A

Answer ALL questions. More than one options may be correct. $(\mathbf{1 \times 10 = 10})$

1. Correlation ratio lies between 1 and -1.
   A. True B. False

2. If $R_{1.23} = 1$, the multiple linear regression of X_1 on X_2 and X_3 is consodered as perfect for prediction.
   A. True B. False

3. In the usual notations, $R^2_{1.23}$ ca be expressed as
   A. $1-(1-r^2_{12})(1-r^2_{13.2})$ B. $1-(1-r^2_{12})(1-r^2_{13.2})$ C. $(1-r^2_{12})(1-r^2_{13.2})$ D. $(1-r_{12})(1-r_{13.2})$

4. Let $E(T_1) = 0 = E(T_2)$, where T_1 and T_2 are the linear functions of the sample observations. If $V(T_1) \leq V(T_2)$ then:
   A. T_1 is an unbiased linear estimator. B. T_1 is the best linear unbiased estimator.
   C. T_1 is a consistent linear unbiased estimator. D. T_1 is a consistent best linear unbiased estimator.

5. χ^2 test can be used for
   A. Testing independence B. Goodness of fit C. Comparing means D. Comparing Variances.

6. Multiple Linear regression
   A. Can predict multiple values B. Has many predictor variables C. Neither D. Both

7. A large p-value
   A. Let's you reject the alternate hypothes B. Let's you accept the null hypothes C. Let's you accept the alternate hypothes D. Let's you reject the null hypothes

8. Power of a test is the
   A. Lower bound of probability of type I error B. 1 - probability of type two error C. Upper bound of probability of type one error D. None of the options are correct

9. Confidence interval for μ if σ^2 is unkown is
   A. $\left[\bar{X}_n - z_{\alpha/2}\frac{\sigma}{\sqrt{n}}, \bar{X}_n + z_{\alpha/2}\frac{\sigma}{\sqrt{n}}\right]$ B. $\left[\bar{X}_n - z_{\alpha/2}\frac{\hat{S}}{\sqrt{n}}, \bar{X}_n + z_{\alpha/2}\frac{\hat{S}}{\sqrt{n}}\right]$ C. $\left[\bar{X}_n - t_{n,\alpha/2}\frac{\sigma}{\sqrt{n}}, \bar{X}_n + t_{n,\alpha/2}\frac{\sigma}{\sqrt{n}}\right]$
   D. $\left[\bar{X}_n - t_{n-1,\alpha/2}\frac{\hat{S}}{\sqrt{n}}, \bar{X}_n + t_{n-1,\alpha/2}\frac{\hat{S}}{\sqrt{n}}\right]$

10. $\bar{X}$ (sample mean) is
    A. unbiased B. Sufficient for μ for normal distribution C. consistent D. None of the choices

Part B

Answer ANY SIX questions. **($6 \times 5 = 30$)**

11. Explain different kinds of sampling you know. What are the different sampling distributions you know?
12. Define and explain with example Consistency and Unbiasedness.
13. Explain two different kinds of errors with examples, with regards to hypothesis testing.
14. Define the multiple regression model. Explain all the notations. Give how the expressions for coefficients of partial regrssion.
15. Construct the confidence interval for population mean, when population variance is known.
16. Explain regression for categorical variables.
17. Explain Null and Alternate hypothesis. Explain how to accept or reject the null hypothesis.
18. Explain one application of the Chi-square test.

Part C

Answer ANY TWO questions. **($2 \times 10 = 20$)**

19. What is a statistical hypothesis? Define significance level and power of a test with reference to hypothesis testing. Can the two types of errors be minimized simultaneously? Why or why not? Exlpain how the critical region is determined.
20. Given a random sample of $X_1, \ldots X_n$ from a normal $N(\mu, \sigma^2)$ distribution, examine unbiasedness of
    (a) $\bar{X}$ for μ
    (b) $\frac{1}{n}\sum_{i=1}^{n}(X_i - \bar{X})$ for σ^2

    Explain how we can find the estimators for μ and σ^2 using method of moments.
21. (a) When the correlation ratio coefficient is equal to unity, show that the two correlation ratios are equal to unity. Is the converse true?
    (b) Define correlation ratio η_{XY} and prove that $1 \geq \eta_{XY}^2 \geq r^2$, where r is the coefficient of correlation between X and Y.
    (c) Interpret the following statements: A. $r = 0$ B. $r^2 = 1$ C. $\eta^2 = 1$ D. $\eta^2 = r^2$ E. $\eta = 0$