SLR-EW-12

Seat No.	

Set P

M.Sc. (Semester - II) (New) (CBCS) Examination: Oct/Nov-2023
BIOSTATISTICS
Statistical Inference-I(MSC22202)

Day & Date: Tuesday, 19-12-2023 Max. Marks: 80
Time: 11:00 AM To 02:00 PM

Instructions: 1) Q. Nos. 1 and 2 are compulsory.
2) Attempt any three questions from Q. No. 3 to Q. No. 7
3) Figure to right indicate full marks.

Q.1 A) Choose correct alternatives. **10**

1) Let $X_1, X_2, \ldots, X_n$ be iid from$B(1, \theta)$. Then $\bar{X}$ is _____.
   a) sufficient statistic b) unbiased estimator
   c) complete sufficient statistic d) all the above

2) A statistic which does not contain any information about the parameter is called _____.
   a) sufficient statistic b) minimal sufficient statistic
   c) ancillary statistic d) complete statistic

3) Cramer-Rao inequality gives _____.
   a) upper bound to the variance of unbiased estimator of $\Psi(\theta)$.
   b) lower bound to the variance of unbiased estimator of $\Psi(\theta)$.
   c) lower bound to the mean of unbiased estimator of $\Psi(\theta)$.
   d) None of these

4) Let $T(X)$ is a complete sufficient statistic and $A(X)$ is ancillary statistic, then which one of the following statements is correct?
   a) $T(X)$ and $A(X)$ are distributionally dependent
   b) $T(X)$ and $A(X)$ are functionally dependent
   c) $T(X)$ and $A(X)$ are statistically independent
   d) none of the above

5) The MLE of parameter θ is a statistic which _____.
   a) is sufficient for parameter for θ
   b) maximizes the likelihood function L
   c) is a solution of $\frac{\partial\, log}{\partial\theta} = 0$
   d) is always unbiased

6) If T is an unbiased estimator of θ then T^2 is _____.
   a) biased estimator for θ^2
   b) unbiased estimator for θ^2
   c) unbiased estimator for $(\theta^2 + 1)$
   d) biased estimator for $(\theta^2 + 1)$

7) Let $X_1, X_2, \ldots, X_n$ is a random sample of size n from $U(0, \theta)$ distribution then what is unbiased estimator of θ?
   a) $\bar{X}$ b) $\bar{X}/2$
   c) $2\bar{X}$ d) $\sqrt{\bar{X}}$

8) If a statistic T_n is such that $E(T_n) \to \theta$ and $Var\ (T_n) \to 0$ as $n \to \infty$ then for θ T_n will be _____.
   a) consistent b) efficient
   c) sufficient d) none of these

9) Let T_n be an unbiased and consistent estimator of θ. Then T_n^2 as an estimator of θ^2 is _____.
   a) unbiased and consistent b) unbiased and inconsistent
   c) biased and consistent d) biased and inconsistent

10) Mean squared error of an estimator T_n of θ is expressed as _____.
   a) $Var_\theta(T_n) + Bias$ b) $Var_\theta(T_n) + [Bias]^2$
   c) $[Var_\theta(T_n)]^2 + [Bias]^2$ d) $[Var_\theta(T_n) + Bias]^2$

B) Fill in the blanks. **06**

1) If $E_\theta(T) \neq \theta$ then T is _____ estimator of θ.
2) MLE of parameter θ of the distribution $f(x,\theta) = \frac{1}{2}e - |x - \theta|$ is _____.
3) Let X has $U\ (0,\theta)$ distribution then the MLE of θ is _____.
4) If T_n is consistent estimator of θ then a consistent estimator for $(a\theta^2 + b)$ is _____.
5) An estimator T_n of θ is said to be more efficient than any other estimator T_n^* of θ if and only if _____.
6) _____ statistic is independent of every complete sufficient statistic.

Q.2 Answer the following. **16**

a) Explain the following:
   1) Weak consistency
   2) Strong consistency

b) Let random variable X has $N(\theta, 1)$ distribution. Show that family of X is complete.

c) Define Fisher information in a single observation. Find the same for $B(n,\theta)$ distribution, when n is known.

d) Let $X_1, X_2, \ldots, X_n$ be $iid\ N(\theta, 1)$, computing the actual probability show that $\bar{X}_n$ is consistent estimator of θ.

Q.3 Answer the following.

a) Define sufficient statistic. State Neyman-Fisher factorization theorem. Examine whether one-to-one function of a sufficient statistic is also sufficient. **08**

b) Let X_1, X_2 are iid Poisson random variables with parameter λ. Let $T_1 = X_1 + X_1$ and $T_2 = X_1 + 2X_2$. Show that T_1 is sufficient statistic but T_2 is not sufficient. **08**

Q.4 Answer the following.

a) Define joint and marginal consistency for a vector parameter θ. Show that joint consistency is equivalent to marginal consistency. **08**

b) Let $X_1, X_2, \ldots, X_n$ be a random sample from $U(0,\theta)$. Find two consistent estimators of θ. **08**

Q.5 Answer the following.

a) State and prove Lehmann-Scheffe theorem. **08**

b) Derive UMVUE of $(1/\theta)$ based on a random sample from $U(0,\theta)$ distribution. **08**

Q.6 Answer the following.

a) State and prove Cramer-Rao inequality with necessary regularity conditions. **08**

b) Let $X_1, X_2, \ldots, X_n$ be iid Poisson (λ) random variables. Obtain Cramer-Rao lower bound for unbiased estimator of λ. **08**

Q.7 Answer the following.

a) Define maximum likelihood estimator (MLE). Describe the method of maximum likelihood estimation for estimating an unknown parameter. **08**

b) Let $X_1, X_2, \ldots, X_n$ *be* a random sample of size n from $N(\mu, \sigma^2)$ distribution. Find MLE of μ and σ^2. **08**

SLR-EW-19

Seat No.	

Set P

M.Sc. (Semester - IV) (New) (CBCS) Examination: Oct/Nov-2023
BIOSTATISTICS
Demography and Health Statistics (MSC22401)

Day & Date: Monday, 18-12-2023 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Question 1 and 2 are compulsory.
2) Attempt any three questions from Q. No. 3 to Q. No. 7.
3) Figures to the right indicate full marks.

Q.1 A) Choose the correct alternative: **10**

1) According to Barkely _____ is known as demography.
   a) the study of characteristics of human population
   b) the numerical portrayal of human population
   c) scientific study of human population, primarily with respect to there size, structure and development
   d) None of these

2) The difference between population at two census is known as _____.
   a) Population constant b) Population change
   c) Population increase d) Population decrease

3) Death rate of infants having age 0 to 4 weeks is known as _____.
   a) Infant mortality rate b) Neo natal mortality rate
   c) Post natal mortality rate d) crude death rate

4) Which of the following is not a component of population change?
   a) Fertility b) Mortality
   c) Migration d) None of these

5) In _____ method, the census was being conducted in one day.
   a) De Facto method of census
   b) De Jure method of census
   c) Regular method of census
   d) In Facto method of census

6) Mortality is related to _____.
   a) Deaths in human population
   b) Only infant deaths
   c) Deaths in old age population
   d) None of these

7) The First National Rural Health Mission was conducted during _____.
   a) 2007-12 b) 2002-09
   c) 2005-12 d) 2005-08

8) The NFHS – I was conducted during _____.
   a) 1992-93 b) 1993-94
   c) 1998-99 d) 1999-2000

9) Which of the following is/are postulates of Malthusian theory?
   a) The law of diminishing returns applies to agricultural yield
   b) Food is essential for man's existence
   c) There is a natural instinct to increase the population
   d) All the above

10) Which of the following is not a Socio-Economic theories of population?
   a) Leibenstein's Motivational theory of population growth
   b) Karl Marx theory of surplus population
   c) Dumont's theory of social capillarity
   d) Pearl and Reeds Logistic Curve Theory of Population

B) Fill in the blanks: **06**

1) Weight of infant at birth is a _____ cause of infant mortality.
2) Projection horizon means number of years between _____ and _____.
3) Geometric change is _____ method of population projection.
4) _____ is the secondary source of demographic data.
5) In the India census 2011 _____ households were enumerated.
6) The people migrated from TN to Maharashtra are _____ to the TN.

Q.2 Answer the following. **16**

a) Define crude death rate and write its merits and demerits.
b) Write a short note on fertility.
c) State the objectives of NFHS – I and II.
d) How Demography is related to Geography?

Q.3 Answer the following.

a) Discuss in detail, subject matter of demography. **08**
b) Discuss in detail the Migration as a component of population change. **08**

Q.4 Answer the following.

a) State and explain Malthusian theory of population. **08**
b) Discuss the Cohart-Component method of Population projection. **08**

Q.5 Answer the following.

a) What do you mean by population change? Discuss in detail. **08**
b) Explain Demography as a scientific discipline. **08**

Q.6 Answer the following.

a) State and explain the optimum theory of population. **08**
b) Discuss population policies in India. **08**

Q.7 Answer the following.

a) State and Explain any one Biological theory of population. **08**
b) Discuss in detail, history of census in India. **08**

SLR-EW-20

Seat No.	

Set P

M.Sc. (Semester - IV) (New) (CBCS) Examination: Oct/Nov-2023
BIOSTATISTICS
Clinical Trials (MSC22402)

Day & Date: Tuesday, 19-12-2023 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Q. Nos. 1 and. 2 are compulsory.
2) Attempt any three questions from Q. No. 3 to Q. No. 7
3) Figure to right indicate full marks.

Q.1 A) Fill in the blanks by choosing correct alternatives given below. **10**

1) The major purpose of Randomization in clinical trials is to _____
   a) Facilitate double blinding
   b) Help ensure that the study subjects are representative of general population
   c) Reduce selection bias in allocation of treatment
   d) None of these

2) The comparison of bioavailability between two dosage forms.
   a) Bioequivalence b) Biopharmaceutics
   c) Bioavailability d) Biological

3) Which of the following describes a meta-analysis?
   a) Analyse very large studies.
   b) Analysis of the methods of statistical analysis.
   c) Establish external validity.
   d) Detect trends across studies that may have used different procedures, numbers of participants, types of control procedures, and different forms of measurement

4) What is the purpose of Investigational New Drug (IND) Application?
   a) Permission to administer a new drug to humans
   b) Permission to administer a new drug to animals
   c) Permission to market a new drug
   d) Permission to manufacture the new drug

5) Which of the following statement is suitable for the term placebo in clinical trials?
   a) Substances that are different to drugs + contain pharmacologically active drug
   b) Substances that are similar to drugs + do not contain any pharmacologically active drug
   c) Substances that are similar to drugs + contain pharmacologically-active drug
   d) Substances that are different to drugs + do not contain any pharmacologically active drug

6) Bioavailability is defined as _____.
   a) Rate of drug absorption
   b) Rate of drug distribution
   c) Rate of drug elimination
   d) Rate and extent of absorption

7) In the Kruskal-Wallis test of 10 samples, the appropriate number of degrees of freedom is _____.
   a) 10 b) 9
   c) 8 d) 7

8) To avoid experimenter bias, when the experimenter nor the participant is aware of which group the participant is in, this is known as:
   a) Null hypothesis b) Random assignment
   c) Variable manipulation d) Double Blind

9) In single blind study _____ is blinded to the assignment of the patient to test group.
   a) patient b) investigator
   c) both a) and b) d) None of these

10) In a randomized double-blind trial to compare a new analgesic with ibuprofen, a standard treatment, for the control of pain in arthritis, the difference in pain scores between the two regimes was not significant. We can conclude that:
   a) the new drug is useless.
   b) there is no difference in analgesia between the two drugs.
   c) the trial has failed to demonstrate a difference in analgesia.
   d) the difference between the drugs is very small.

B) State whether the following statements are True or False: **06**

1) We can estimate carryover effect in 'Parallel Design'
2) Blinding is effective tool to prevent the assessment bias.
3) Phase IV clinical trials Conducted before FDA Approval to marketing the drug.
4) The placebo effect is the name of an effect that occurs when an experimental group gets better simply because they are being giving a pill and this leads them to expect to get better.
5) Bioavailability is defined as Rate and extent of absorption.
6) The aim of post marketing studies is not safety and comparisons with other medicines.

Q.2 Answer the following **16**

a) Explain difference between: Statistical significance and clinical significance.
b) Write note on: New Drug Application (NDA)
c) Write the short note on Washout period and Carryover effect in crossover design.
d) Explain the following terms related with Clinical Trials :
   i) Concept of Bias
   ii) Randomization

Q.3 Answer the following

a) Discuss the concept of bioequivalence study. **08**
b) Discuss the methods of bias reduction **08**

Q.4 Answer the following

a) Discuss the parallel design useful in clinical trials and its advantages over the crossover design. **08**

b) Explain the four phases involve in the development of clinical trials. **08**

Q.5 Answer the following

a) What is cross sectional design? Write advantages and disadvantages of cross- sectional design. **08**

b) Define Blinding. Explain the various types of blinding methods used in clinical trials. **08**

Q.6 Answer the following

a) Write down importance of clinical trials and ethics of clinical trials **08**

b) Write the note on: **08**

1) Abbreviated New Drug Application (ANDA)
2) Investigation New Drug Application (INDA)

Q.7 Answer the following

a) Explain Meta analysis. **08**

b) A pharmaceutical company is interested in conducting a clinical trial to compare two cholesterol lowering agents. Suppose that a difference of 8% in the percent change of LDL-cholesterol is considered a clinically meaningful difference and that standard deviation is assumed to be 15%. Find the required sample size for having an 80% power and $\alpha = 0{,}05$. **08**

SLR-EW-21

Seat No.	

Set P

M.Sc. (Semester - IV) (New) (CBCS) Examination: Oct/Nov-2023
BIOSTATISTICS
Survival Analysis (MSC22403)

Day & Date: Wednesday, 20-12-2023 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Q. Nos. 1 and 2 are compulsory.
2) Attempt any three questions from Q. No. 3 to Q. No. 7
3) Figure to right indicate full marks.

Q.1 A) Choose correct alternatives. **10**

1) System reliability of components kept in parallel _____ as number of components increases.
   a) increases b) decreases
   c) remains unchanged d) cannot be determined

2) A series system is a special case of $k - out - of - n$ system when _____.
   a) $k = n - 1$ b) $k = n$
   c) $k = 2$ d) $k = 1$

3) A life time distribution F having finite mean is said to be $NBUE$ for $t \geq 0$, if _____.
   a) $\mu_t \leq \mu_0$ b) $\mu_t \geq \mu_0$
   c) $\mu_t = \mu_0$ d) none of the above

4) The scaled TTT transform for exponential distribution with mean λ is_____.
   a) λt b) λ
   c) t/λ d) t

5) For which of the following family, each member has non-monotonic failure rate?
   a) Exponential b) Weibull
   c) Lognormal d) Gamma

6) In survival analysis, the outcome variable is _____.
   a) continuous b) discrete
   c) dichotomous d) None of the above

7) Which of the following is an example of right censored observation?
   a) patient decided to move elsewhere
   b) patient become non-cooperative
   c) person may not experience the event before the study ends
   d) all the above

8) The censoring time is identical for every censored observations in ____.
   a) right random censoring
   b) type I censoring
   c) type II censoring
   d) both type I and type II censoring

9) Nonparametric estimator of survival function under complete data is _____.
   a) unbiased estimator
   b) biased estimator
   c) unbiased and consistent estimator
   d) biased and consistent estimator

10) Green-Wood's formula is used for estimating approximate value of ____ of Kaplan- Meier estimator.
   a) mean b) variance
   c) confidence interval d) bias

B) Fill in the blanks. **06**

1) The survival function ranges between _____.
2) For a series system of two independent components each having reliability 0.6 then the reliability of system is _____.
3) As the number of components n increases, the reliability of series system _____.
4) To find exact confidence interval for mean of exponential distribution under no censoring, the pivotal quantity has _____ distribution.
5) To obtain confidence band for survival function _____ statistic is used.
6) If $\phi(x)$ is a structure function then dual of $\phi(x)$ is _____.

Q.2 Answer the following. **16**

a) Define irrelevant component. Give an illustration.
b) Define dual of a structure function. Show that dual of dual is primal.
c) Describe type-I censoring with illustration.
d) Explain the terms:
   i) Coherent structure ii) Failure rate function

Q.3 Answer the following.

a) Define reliability of a system. Obtain the reliability of parallel system of n independent components. **08**

b) Define star shaped function. Prove that $F \in IFRA$ if and only if - $\log R(t)$ is star shaped. **08**

Q.4 Answer the following.

a) Define IFR and IFRA class of distributions. If $F \in IFR$ then show that $F \in IFRA$. **08**

b) If failure time of item has Weibull distribution with distribution function **08**

$$F(t) = \begin{cases} 1 - e^{-(\lambda t)^{\alpha}}, t > 0 \\ 0, \ otherwise \end{cases}.$$

Examine whether it belongs to IFR or DFR.

Q.5 Answer the following.

a) Define mean time to failure (MTTF) and mean residual life (MRL) function. Obtain the same for exponential distribution. **08**

b) Discuss maximum likelihood estimation of parameters of a gamma distribution under complete data. **08**

Q.6 Answer the following.

a) Describe actuarial method of estimation of survival function with a suitable illustration. **08**

b) Obtain maximum likelihood estimate of mean of the exponential distribution under type II censoring. **08**

Q.7 Answer the following.

a) Define TTT transform and show that it is concave if F is IFR. **08**

b) Describe Gehan's test for two sample testing problem in presence of censoring. **08**

SLR-EW-23

Seat No.	

Set P

M.Sc. (Semester-IV) (New) (CBCS) Examination: Oct/Nov-2023
BIOSTATISTICS
Data Mining (MSC22408)

Day & Date: Thursday, 21-12-2023 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Question no. 1 and 2 are compulsory.
2) Attempt any three questions from Q. No. 3 to Q. No. 7.
3) Figure to right indicate full marks.

Q.1 A) Choose the correct alternative: **10**

1) In a feed- forward network, the connections between layers are _____ from input to output.
   a) Bidirectional b) Unidirectional
   c) Multidirectional d) None of these

2) The range of ReLU activation function is _____.
   a) $(0, \infty)$ b) $[0, \infty)$
   c) $(-\infty, \infty)$ d) None of these

3) The range of Tanh activation function is _____.
   a) $(1, \infty)$ b) $[-1,1]$
   c) $(-\infty, \infty)$ d) None of these

4) The use of posterior probabilities is done in _____ classifier.
   a) kNN classifier b) Decision tree
   c) Random forest d) None of these

5) Market-basket problem was formulated by _____.
   a) Agrawal et al. b) Toda et al.
   c) Steve et al. d) Simon et. Al

6) Cluster is _____.
   a) A group of similar observations
   b) A group of most heterogeneous observations
   c) A group of farthest observations
   d) A group of arbitrarily chosen observations

7) In k- nearest neighbor algorithm, k stands for _____.
   a) Number of neighbors that are investigated
   b) Number of Iterations
   c) Number of total records
   d) Random number

8) In data mining, SVM stands for _____.
   a) Simple Vector Mechanism
   b) Singular Vectoral Movement
   c) Support Vector Mechanism
   d) Support Vector Machine

9) kNN classifier can be used only when _____.
   a) Class label is categorical
   b) Class label is numeric
   c) Both (a) and (b)
   d) Neither (a) nor (b)

10) Each neuron is made up of a number of nerve fibers called _____.
   a) Molecules b) Dendrites
   c) Atoms d) Sigmoid

B) State whether following statements are true or false. **06**

1) In kNN classification, we use Baye's Rule.
2) ANN can be considered as a generalization of a regression model.
3) ANN is unsupervised learning tool.
4) Clustering is the only unsupervised learning method.
5) The distance between two clusters calculated using single linkage can't be greater than the same calculated using complete linkage.
6) Data used to verify performance of the built model is called _____.

Q.2 Answer the following **16**

a) Discuss sigmoid activation function in detail.
b) Discuss advantages of unsupervised learning.
c) Explain classification and regression in detail.
d) Explain in brief, how supervised learning works.

Q.3 Answer the following.

a) What is meant by supervised learning? Also explain kNN classifier in detail. **08**
b) Explain the concept of information gain with respect to Decision tree. How it is used in forming the tree? **08**

Q.4 Answer the following.

a) What is meant by unsupervised learning? Also explain market basket analysis in detail. **08**
b) Explain Bayes' classifier in detail. **08**

Q.5 Answer the following.

a) Explain logistic regression classifier in detail. **08**
b) Explain different method of linkages used in Clustering. **08**

Q.6 Answer the following.

a) Explain the class imbalance problem in detail. **08**
b) How Support Vector Machine is used as a classifier? **08**

Q.7 Answer the following.

a) Explain the algorithm for decision tree. **08**
b) Describe- **08**
   i) Accuracy of a model
   ii) Precision of a model