BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – M.Sc.(MLT)-2023
Course Name – Medical Bioinformatics & Biostatistics
Course Code - MMTC03002
(Semester III)

Full Marks : 60

Time : 2:30 Hours

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A
(Multiple Choice Type Question)

1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Which scoring matrix is commonly used in protein BLAST searches?

a) PAM250.

b) BLOSUM62.

c) PAM30.

d) BLOSUM1180.

(ii) Summarize the main purpose of BLASTp.

a) Compare nucleotide sequences with nucleotide databases.

b) Translate nucleotide sequences.

c) Calculate sequence length.

d) Compare protein sequences with protein databases.

(iii) Explain the role of hydrogen bonds in the structure of proteins.

a) They stabilize primary structure.

b) They form covalent bonds between amino acids.

c) They stabilize secondary structures like alpha helices and beta sheets.

d) They have no effect on protein structure.

(iv) Use your understanding of transcription to evaluate how the presence of a silencer region affects gene expression.

a) It promotes gene expression.

b) It has no effect on gene expression.

c) It can repress transcription of nearby genes.

d) It increases the stability of mRNA.

(v) Which of the following is an example of qualitative data?

a) Blood pressure (120/80 mmHg).

b) Blood glucose level (90 mg/dL).

c) Patient descriptions of symptoms.

d) Vital signs measurements.

(vi) Which of the following scenarios is an example of using primary data for research purposes?

a) A researcher using national cancer statistics from a database.

b) A healthcare team collecting blood samples during a clinical trial.

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c) A doctor reviewing a patient's past health records for a case study.

d) A public health agency referencing older epidemiological data for a report.

(vii) You want to write a research proposal. Select the items you should incorporate into the proposal.

a) Work plan.

b) Methodology.

c) Timeline of study.

d) All of these.

(viii) You are willing to use Census report for your research study. Identify the type of data you are using.

a) Primary data.

b) Secondary data.

c) Tertiary data.

d) Quarternary data.

(ix) Write the correct statement for null hypothesis.

a) It proposes that no statistical significance is there between two sets of data.

b) It proposes that there is statistical significance between two sets of data.

c) It is always be rejected.

d) It is always be accepted.

(x) Write the correct statement about standard deviaion.

a) It is the mean value of data set.

b) It is the dispersion of data around the mean.

c) It is the likelyhood of differences between sample mean and population mean.

d) It is the error in calculating the data.

(xi) Examine the reason why low E-values in a BLAST result are important.

a) They indicate random alignment.

b) They signify biologically significant alignments.

c) They are used to measure query length.

d) They help in annotating genome sequences.

(xii) Determine how quaternary structure differs from tertiary structure.

a) Tertiary structure refers to individual polypeptides, quaternary structure refers to multiple polypeptide subunits.

b) Tertiary structure involves peptide bonds, quaternary structure involves covalent bonds.

c) Both involve the primary structure of proteins.

d) Quaternary structure is more stable than tertiary structure.

(xiii) Evaluate which data scale is appropriate for measuring temperature in Celsius.

a) Nominal scale.

b) Ordinal scale.

c) Interval scale.

d) Ratio scale.

(xiv) Evaluate why case-control studies are considered efficient for studying rare diseases.

a) They require a large population and are costly.

b) They randomly assign participants to the control group.

c) Case-control studies rely on prospective data collection.

d) They start with outcomes and work backward, making them efficient for studying rare diseases.

(xv) Evaluate the importance of the p-value in hypothesis testing.

a) The p-value indicates the probability of committing a Type-2 error.

b) A p-value above 0.05 proves the null hypothesis.

c) A p-value below 0.05 always leads to a Type-1 error.

d) The p-value helps determine the likelihood of observing the data if the null hypothesis is true.

Group-B

(Short Answer Type Questions)   3 x 5=15

2. Compare and contrast the secondary structures of proteins, focusing on the α-helix and β-sheet.   (3)

3. Distinguish between nominal scale and ordinal scale.   (3)

4. Apply the concept of case-control studies to assess the association between smoking and lung cancer. (3)
5. The marks obtained by 7 students in your class are 67, 62, 81, 28, 91, 38 and 74. Calculate the mean of the marks. (3)
6. Analyze the role of E-value in blast result (3)

OR

Explain BLOSUM and its role in BLAST. (3)

Group-C
(Long Answer Type Questions)
5 x 6=30

7. A pharmaceutical company is testing a new drug to lower blood pressure. They administer the new drug to a sample of 30 patients and measure their blood pressure before and after treatment. The average pre-treatment blood pressure was 150 mmHg with a standard deviation of 10 mmHg, and the average post-treatment blood pressure was 140 mmHg with a standard deviation of 8 mmHg. Using a significance level of 0.05, determine if the new drug significantly lowers blood pressure. t value for degree of freedom of 29 is 2.045 at 95% confidence interval. (5)
8. Differentiate between case control study and cohort study. (5)
9. Describe different branches of bioinformatics. (5)
10. Describe the bonds responsible for the stabilization of different protein structures. (5)
11. A study was conducted to analyze the distribution of different types of cancer diagnoses in a cancer treatment center over a year. The following data was collected: (5)

   Breast Cancer: 120 cases
   Lung Cancer: 90 cases
   Prostate Cancer: 60 cases
   Colorectal Cancer: 50 cases
   Skin Cancer: 30 cases
   Other: 50 cases
   Compose a pie chart using the data.

12. The latent period of influenza virus was observed in 6 patients were 3, 7, 4, 5, 6 and 5 days. Calculate the standard deviation of latent period of influenza virus. (5)

OR

There were 3 students who got 0-20 marks, 4 students who got 20-40 marks and 3 students who got 40-60 marks. Calculate the standard deviation of marks of the students. (5)

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