7. (a) Find the inverse of $A = \begin{pmatrix} 1 & 1 & 2 \\ 1 & 2 & 1 \\ 2 & 1 & 1 \end{pmatrix}$ 5

(b) Prove that 5

$$\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a-b-c)^2$$

OR

8. (a) Solve the following system of equations: 5

$3x + 4y = 2$

$9x - 16y - 1 = 0$

(b) A box contains 25 tickets with numbers 1, 2, ..., 25. One ticket is drawn at random. Find the probability that the number on the ticket is divisible by 2 or 3. 5

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Post Graduate Diploma in Bioinformatics
Odd Semester Exam, 2025

Bioinformatics & Computational Biology Centre

Course No.: PGDBI-T3
(Biostatistics & Basic Mathematics)

Full Marks: 70
Pass Marks: 30

Time: 3 hours

The figures in the right margin indicate full marks for the question.
Answer All questions

PART-I
(Marks : 20)

1. Choose the correct answer: 1x10=10

i. Which of the following statements about correlation is correct?

a) A correlation of 0 means there is a strong relationship.

b) Correlation coefficients range from -1 to +1.

c) A positive correlation always implies causation.

d) Correlation and regression are the same.

ii. What is the purpose of regression analysis?

a) To calculate the mean of a dataset

b) To establish a cause-effect relationship

c) To predict the value of a dependent variable based on an independent variable

d) To rank variables in order of importance

iii. If a sample mean is used to estimate a population mean, this process is called:

a) Data mining

b) Inferential statistics

c) Regression

d) Correlation analysis

iv. What is a Type I error?

a) Accepting the null hypothesis when it is false

b) Rejecting the null hypothesis when it is true

c) Failing to reject the null hypothesis when it is false

d) Accepting the alternative hypothesis when it is false

v. The level of significance (alpha, α) is:

a) The probability of a Type II error

b) The confidence level of a test

c) The probability of rejecting a true null hypothesis

d) The power of a test

j) Find the middle terms in the expansion of $(x^2 + \frac{1}{2y})^9$.

PART-II
(Marks-50)

Answer any five questions, Question no. 7 is compulsory **5x10=50**

1. What is correlation coefficient? Discuss the properties of correlation coefficient. Describe the applications of correlation analysis in Bioinformatics with examples. 2+3+5=10

2. Differentiate between quantitative data and qualitative data used in biological science with suitable examples. 10

3. What is dispersion? Describe various measures of dispersion with formulae that are widely used in Bioinformatics. 2+8=10

4. Discuss type I and type II errors in the context of acceptance and rejection of null hypothesis using suitable examples and figures. 10

5. Write short notes on (any two): 5x2=10

   a) Method of least squares

   b) Chi-square test and its applications

   c) Paired ‘t’ test and its applications

6. What is regression analysis of bivariate data? If X and Y are two variables, write the regression equation of X on Y and Y on X with meaning of each term. 3+7=10

vi. Which of the following indicates a statistically significant result at the 5% level?

a) p-value = 0.08

b) p-value = 0.05

c) p-value = 0.06

d) p-value = 0.10

vii. Increasing the sample size generally:

a) Increases the p-value

b) Increases the chance of a Type II error

c) Decreases the standard error

d) Increases the significance level

viii. The constant term in the expansion of $\left(\frac{3x^2}{2} - \frac{1}{3x}\right)^9, x \neq 0$ is

a) $\frac{5}{18}$ b) $\frac{7}{18}$

c) $\frac{5}{17}$ d) $\frac{7}{17}$

ix. Write the expression of $\frac{2}{5-3\,i}$ in the form $\boldsymbol{a + i\,b}$

a) $\frac{5}{8} - i\,\frac{3}{8}$ b) $\frac{5}{8} + i\,\frac{3}{8}$

c) $\frac{5}{17} + i\,\frac{3}{17}$ d) $\frac{5}{17} - i\,\frac{3}{17}$

x. Find the matrix product AB, if it is defined

$A = \begin{pmatrix} 1 & 3 & -3 \\ 3 & 0 & 5 \end{pmatrix}$ and $B = \begin{pmatrix} 3 & 0 \\ -3 & 1 \\ 0 & 5 \end{pmatrix}$

a) $\begin{pmatrix} -12 & -6 \\ 25 & 9 \end{pmatrix}$ b) $\begin{pmatrix} 3 & 9 & 0 \\ 0 & 0 & 25 \end{pmatrix}$

c) AB undefined d) $\begin{pmatrix} -6 & -12 \\ 9 & 25 \end{pmatrix}$

2. Answer the following questions 1x10=10

a) What is a population in statistics?

b) What is standard deviation?

c) What type of correlation exists if both variables increase together?

d) In regression, what does the slope represent? Write the general form of a simple linear regression equation.

e) What does β represent in hypothesis testing?

f) What is null hypothesis and alternative hypothesis?

g) Name any one test of significance for comparing means.

h) Find the argument of $-1 + i$

i) Two dice are thrown together. Find the probability that the sum is 9 or 10.