(b) To create Scatter and Bar Plot in R (including the name of the package).

(c) One-way ANOVA and two-way ANOVA.

(d) Chi-square test of independence after uploading the data present in a .csv file.

(e) Paired T-Test, Independent-Samples T-Test where y1 and y2 are numeric, Independent-Samples T-Test with equal variances not assumed.

(f) For apply(), lapply() and sapply() function in R.

(g) Three different functions to merge and Join Data in R.

6. A class of 10 students was surveyed and their heights were recorded :

150 cm, 150 cm, 142 cm, 154 cm, 168 cm, 153 cm, 151 cm, 153 cm, 142 cm and 151 cm

(a) How would the values be stored in a variable?

(b) How do you recall a single value from the vector?

(c) Use the function for calculating the *(i)* five-number summary, *(ii)* variance, *(iii)* standard deviation and *(iv)* histogram. 2+2+6=10

★★★

M. Sc. Biotechnology Examination, 2024

(1st Year, 1st Semester)

Biostatistics and Computational Biology

Paper : PG/134T

Time : 2 *Hours* *Full Marks* : 40

GROUP—A

Answer *any* **three** questions : 10×3=30

1. A drug research experimental unit tests two newly developed drugs to reduce blood pressure levels. The drugs are administered to two different sets of animals. In group one, 350 of 600 animals were tested to respond to drug one; in group two, 260 of 500 were tested to react to drug two. The research unit wants to test whether there is a difference between the efficacy of the two drugs.

(a) Explain how the data for this hypothesis test is appropriate for a Z test.

(b) Test the hypothesis that the gram-negative bacterial strains are more sensitive to the tested antibiotic using the level of significance of *(i)* 0·01 ($Z_{0·01}$ = 2·33) and *(ii)* 0·05 ($Z_{0·05}$ = 1·64).

(c) Considering the hypothesis test results, decide which Type I or Type II errors are possible and describe this error. [2+(4+2)+2]=10

2. The survey on random people from two districts of West Bengal, Kolkata and North 24 Parganas, asked about their willingness to take the vaccine. The results of the study are displayed in the contingency table below.

	Willingness to take the vaccine	
Residence	**YES**	**NO**
Kolkata	127	81
North 24 Parganas	248	344

(a) Explain how the data for this hypothesis test is appropriate for a chi-square test concerning independence.

(b) A 0·05 significance level is chosen for a hypothesis test to see if there is any evidence of a relationship between locations of residence and whether or not willing to take the vaccine ($\chi^2_{1;0\cdot05} = 3\cdot841$).

(c) Considering the hypothesis test results, decide which Type I or Type II errors are possible and why.

(1+8+1)=10

3. Genetic theory states that children having one parent of blood type *A* and the other of blood type *B* will always be of one of three types, *A*, *AB* and *B* and the proportion of three types will on an average be as 1 : 2 : 1. A report states that out of 300 children having one *A* parent and *B* parent, 30 percent were found to be type *A*, 45 percent type *AB* and the remainder type *B*.

(a) Explain how the data for this hypothesis test is appropriate for a chi-square test concerning independence.

(b) A 0·05 significance level is chosen for a hypothesis test to see if there is any evidence of a relationship between locations of residence and whether or not willing to take the vaccine ($\chi^2_{2;0\cdot05} = 5\cdot991$).

(c) Considering the hypothesis test results, decide which Type I or Type II errors are possible and why.

(1+8+1)=10

4. The per acre production data for three varieties of wheat, each grown on 4 plots are given below :

Plot of land	**Per acre production data**		
	Variety of wheat		
	A	*B*	*C*
1	**6**	**5**	**5**
2	**7**	**5**	**4**
3	**3**	**3**	**3**
4	**8**	**7**	**4**

Measure whether the white variety production differences are significant at a 5% significance level (F(2, 9) at 5% = 4·26).

10

GROUP—B

Answer *any* **one** question : 10

5. Write the correct syntax for the following (*any* **five**) :

2×5=10

(a) Construction of correlation matrix of many variables in R (including the name of the package).