

# Question Paper

Exam Date & Time: 27-Dec-2023 (02:00 PM - 05:00 PM)



## MANIPAL ACADEMY OF HIGHER EDUCATION

FIRST SEMESTER MSc. (BY RESEARCH IN LIFE SCIENCES) DEGREE EXAMINATION - DEC 2023 / JAN 2024  
SUBJECT: MLS-505 - BIostatISTICS  
(OBE-2023 REGULATION - REGULARS)

Marks: 60

Duration: 180 mins.

Answer all the questions.

Illustrate where necessary.

- 1A) Define the following terms used in statistical inference: (3)  
i) Type I error  
ii) Margin of error  
iii) Power of the test

- 1B) A farmer wants to test the effectiveness of a pest control method in allowing strawberry blooms to yield marketable strawberries. Out of a random sample of 100 blooms, 77 yield marketable strawberries. Construct a 99% confidence interval for the proportion of marketable strawberries grown with this pest control method. (4)

- 1C) In a study of maturation of egg cells in the frog *Xenopus laevis*, oocytes from each of four females were divided into two batches; one batch was exposed to progesterone and the other was not. After two minutes, each batch was assayed for its Cyclic adenosine monophosphate (cAMP) content, with the results given in the following table. (5)  
Use an appropriate parametric test to investigate the effect of progesterone on cAMP. If the level of significance is 0.10, report the findings. [Critical value is 2.3534]

FROG	cAMP (pmol/oocyte)		
	CONTROL	PROGESTERONE	<i>d</i>
1	6.01	5.23	0.78
2	2.28	1.21	1.07
3	1.51	1.40	0.11
4	2.12	1.38	0.74
Mean	2.98	2.31	0.68
SD	2.05	1.95	0.40

- 2A) In a study of the relationship between measles vaccination and Guillain-Barré syndrome (GBS), researchers used a Poisson distribution in the examination of the occurrence of GBS during latent periods after vaccinations. They found that during latent period, the rate of GBS was 2 cases per day. Find the probability on a given day there was (4)  
i) No cases of GBS  
ii) At least two cases of GBS
- 2B) A study was conducted to evaluate the efficacy and safety of a pH-sensitive, polymer coated oral presentation of mesalamine in patients with mildly to moderately active ulcerative colitis. (4)

Outcome	Treatment Group		
	Placebo	Mesalamine, 1.6 g / d	Mesalamine, 2.4 g / d
In remission	2	6	6
Improved	8	13	15
Maintained	12	11	14
Worsened	22	14	8

The above table shows the results of treatment at the end of six weeks by treatment received. What is the probability that

- A randomly selected patient will be in remission?
- A patient placed in placebo will be in remission?
- A randomly selected patient will be in remission and one who received placebo?
- A patient selected at random will be one who received a dose of 2.4g/d or was listed as improved or both?

2C) List any four properties of normal distribution. (4)

3A) Illustrate correlation with the help of scatter diagrams. (6)

3B) **Write short notes on:** (6)

- Kruskal Wallis test
- Shapiro-Wilk test

4A) Define coefficient of variation. Mean and standard deviation of pulse rate for a group of individuals is 76 and 3 beats/minute respectively. The mean and standard deviation of their height is 64 and 2 inches respectively. Which of the two characteristics is more consistent? (6)

4B) In a study of the lizard *Sceloporus occidentalis*, biologists measured the distance (m) run in two minutes for each of 14 animals. The results (listed in increasing order) were as follows: (6)

18.4 22.2 24.5 26.4 27.5 28.7 30.6  
32.9 32.9 34.0 34.8 37.5 42.1 45.5

Compute quartile deviation.

5A) Give the formula and list the factors that contribute to the computation of sample size for estimating unknown population mean. (3)

5B) A study was planned to find whether there is any difference in the average RBC Cholinesterase values (measured in micro mol/min/ml) between alcoholic and non-alcoholic adult males. What should be the minimum sample size required in each group to detect a clinically significant difference of 3 micro mol/min/ml at 90% power and 5% level of significance? Assume the pooled standard deviation of RBC Cholinesterase values is 5 micro mol/min/ml. ( $Z_{1-\alpha/2} = 1.96$ ,  $Z_{1-\beta} = 1.28$ ) (3)

5C) Swaziland has the highest HIV prevalence in the world: 25% of this country's population is infected with HIV. The ELISA test is one of the most accurate tests for HIV. For those who carry HIV, the ELISA test is 99% accurate. For those who do not carry HIV, the test is 92% accurate. If an individual from Swaziland has tested positive, what is the probability that he carries HIV? (3)

5D) Identify the type of variable (Nominal/Ordinal/Discrete/Continuous) (3)

- Optical density of a solution
- Blood type of a person (A, B, AB, O)
- Number of petals in a flower

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