

UNIVERSITY EXAMINATIONS

FIRST SEMESTER 2025/2026 ACADEMIC YEAR

**THIRD YEAR EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE (GENERAL), BACHELOR OF
EDUCATION (SCIENCE) AND BMED**

BOTA 311: BIOSTATISTICS

STREAM: R

TIME: 2 HRS

DAY: MONDAY [8.30 – 10.30 A.M]

DATE: 26/01/2026

THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

PLEASE DO NOT OPEN UNTIL THE INVIGILATOR SAYS SO.

INSTRUCTIONS TO CANDIDATES

Answer **ALL** questions in section **A** and any **TWO** questions from section **B**.

SECTION A: (40 MARKS) ANSWER ALL QUESTIONS**QUESTION ONE**

The data below represent the number of fruits sampled from 10 trees in a garden:

41	33	30	16	25
36	19	17	44	42

Use the data to calculate the following:

- a) Mean **(1 Mark)**
- b) Standard deviation **(3 Marks)**
- c) If the value 44 is replaced by 55, recalculate the standard deviation and state the direction of change. **(2 Marks)**

QUESTION TWO

Scores made on a certain aptitude test by students are approximately normally distributed with a mean of 500 and a variance of 10,000.

- a) What proportion of those taking the test scored below 200? **(2 Marks)**
- b) A person is about to take the test. What is the probability that he or she will make a score of 650 or more? **(2 Marks)**
- c) What proportion of scores fall between 350 and 675? **(2 Marks)**

QUESTION THREE

Cortisol level determinations were made on two samples of women at childbirth. Group 1 subjects underwent emergency cesarean section following induced labor. Group 2 subjects delivered by either cesarean section or the vaginal route following spontaneous labor. The sample sizes, mean cortisol levels, and standard deviations were as follows:

Sample	n	$\bar{x}$	s
1	10	435	65
2	12	645	80

Using the above sample data, test the null hypothesis that the cortisol level is the same for delivery through the cesarean section and the vaginal route. Use 5% level of significance and assume that the cortisol levels are normally distributed in each case. **(6 Marks)**

QUESTION FOUR

Define the following terms:

- a) Experiment (1 Mark)
- b) Frequency distribution (1 Mark)
- c) Probability (1 Mark)
- d) Tabulation (1 Mark)

QUESTION FIVE

A study of diabetic edema featured seven subjects whose foveal thickness (μm) were measured in pre- and post-unilateral vitrectomy surgery. The results are shown in the table below:

Subject	Pre-op Foveal Thickness	Post-op Foveal Thickness
1	690	200
2	840	280
3	470	230
4	690	200
5	730	560
6	500	210
7	440	200

Use the Wilcoxon signed-rank test to determine whether one should conclude that the surgery is effective in reducing foveal thickness. Let $\alpha = 0.05$. Determine the p -value for this test.

(7 Marks)

QUESTION SIX

Identify five types of sampling techniques.

(5 Marks)

QUESTION SEVEN

The table below displays data on five personality types with three groups of subjects, ATPD, PS, and BSAD:

Personality type	ATPD (1)	PS (2)	BSAD (3)	Total
Obsessoid (O)	9	2	6	17
Asthenic/low self-confident (A)	20	17	15	52
Asthenic/high self-confident (S)	5	3	8	16
Nervous/tense (N)	4	7	4	15
Undeterminable (U)	4	13	9	26
Total	42	42	42	126

Find the following probabilities if subjects are chosen at random:

- a) $P(O)$ (2 Marks)
- b) $P(A \cup 2)$ (2 Marks)
- c) $P(2|A)$ (2 Marks)

SECTION B: 30 marks. Answer any two questions

QUESTION EIGHT

The data below show the number of babies born during a year in 36 local hospitals:

32	26	40	28	53	54	29	42	42	54	53	56
39	56	53	36	49	53	30	53	21	34	28	50
52	57	43	46	54	31	22	31	24	24	57	29

Use the data to prepare:

- a) A frequency distribution, showing, classes, class boundaries, midpoints, and frequencies (9 Marks)
- b) A histogram (6 Marks)

QUESTION NINE

The following data gives the crop yield in 12 plots of land. The plots were treated with three different types of fertilizers, A, B, and C:

A	B	C
25	20	24
22	17	26
24	17	30
21	19	20

Is there any significant difference in the average yields of land under the three varieties of fertilizers?

Let $\alpha = 0.05$.

(15 Marks)

QUESTION TEN

The phenological behavior of a plant was determined using an index that incorporated several measurements. The following data represents an index (Y) for estimating phenology of a plant that was subjected to heat stress (X) over time.

X	18	13	18	15	10	12	8	4	7	3
Y	23	20	18	16	14	11	10	7	6	4

- a) Construct a scatter diagram for these data. **(6 Marks)**
- b) Find the least-squares line relating the index of phenology to heat stress **(3 Marks)**
- c) Determine the correlation coefficient (r) and explain the strength and direction of relationship between the index of phenology and heat stress. **(6 Marks)**