GWANDA STATE UNIVERSITY

FACULTY OF COMPUTATIONAL SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

Applied Statistics

CMS 1202

Semester Two 2025/2026 : Main Examination

This examination paper consists of 4 printed pages, inclusive of this cover page.

Date:	**June 2026**
Total:	**100 Marks**
Time:	**3 hours**
Examiner's Name:	**Mr. E. Utete.**

INSTRUCTIONS

Candidates should attempt **ALL** questions from **Section A** which carries **40 marks**. Answer **ANY THREE** questions from **Section B** each question carries **20 marks**. **Section B** carries **60 marks**.

- All answers and all rough work must be written in the answer booklet(s) provided.
- A line should be drawn through any rough work to indicate to the examiner that it is not part of the work to be graded.
- Black and blue pen only must be used for written answers and pencil for all drawings and sketches.

ADDITIONAL MATERIALS

- Calculator (non-programmable).
- Pens and Pencils.
- List Of Formulae and Statistical Tables.

SECTION A: Answer ALL questions [40].

A1. The following data represents the ages (in years) of 8 individuals:

$$22, 25, 27, 30, 32, 35, 40, 42$$

(a) Calculate the mean and median of the dataset. **(3 Marks)**

(b) Construct a box plot for the data and identify any outliers. **(4 Marks)**

A2. (a) Define the following terms and give an example of each:

(i) Population and Sample **(2 Marks)**

(ii) Parameter and Statistic **(2 Marks)**

(b) A dataset has a mean of 50 and a standard deviation of 5. If every value in the dataset is multiplied by 2 and then increased by 10, what are the new mean and standard deviation? **(4 Marks)**

A3. A random variable X follows a binomial distribution with parameters $n = 12$ and $p = 0.3$.

(a) Calculate $P(X = 4)$. **(3 Marks)**

(b) Calculate $P(X \geq 2)$. **(3 Marks)**

(c) Find the expected value and variance of X. **(2 Marks)**

A4. The number of customers arriving at a bank follows a Poisson distribution with a mean of 8 customers per hour.

(a) What is the probability that exactly 5 customers arrive in a given hour? **(3 Marks)**

(b) What is the probability that at most 2 customers arrive in a 30-minute period? **(4 Marks)**

A5. Ten samples were taken from a plating bath used in an electronics manufacturing process, and the bath pH was determined. The sample pH values are:

$$7.91,\ 7.85,\ 6.82,\ 8.01,\ 7.46,\ 6.95,\ 7.05,\ 7.35,\ 7.25,\ 7.42$$

Manufacturing engineering believes that the pH has a mean value of 7.0.

(a) State the null and alternative hypotheses to test whether the population mean pH differs from 7.0. **(2 Marks)**

(b) Calculate the sample standard deviation for the pH data. **(4 Marks)**

(c) Compute the t-test statistic for this hypothesis test. **(4 Marks)**

SECTION B: Answer ANY three questions [60].

B6. The female students in an undergraduate statistics class at GSU self-reported their heights to the nearest inch. The data are

62, 64, 66, 67, 65, 68, 61, 65, 67, 65, 64, 63, 67, 68, 64, 66, 68, 69, 65, 67, 62, 66, 68, 67, 66, 65, 69, 65, 70, 65, 67, 68, 65, 63, 64, 67, 67

(a) Construct a stem-and-leaf diagram for the height data and comment on any important features that you notice. **(8 Marks)**

(b) Calculate the median and Interquartile range of height of this group. **(7 Marks)**

(c) Define an outlier and use the data above to determine if there is an outlier. **(5 Marks)**

B7. A company wants to compare the lifetimes of two brands of lightbulbs. The following data (in hours) were recorded:

Brand A	1200	1350	1100	1400	1250	1300	1150	1250	1200	1300
Brand B	1150	1250	1050	1300	1200	1150	1250	1100	1150	1200

(a) State the null and alternative hypotheses for comparing the medians of the two brands. **(2 Marks)**

(b) What conditions would make a parametric test inappropriate here? **(3 Marks)**

(c) To perform a Wilcoxon Rank-Sum Test (Mann-Whitney U test) at $\alpha = 0.05$ significance level.

(i) Combine and rank the data. **(6 Marks)**

(ii) Calculate the test statistic. **(4 Marks)**

(iii) Determine the critical value and state your conclusion. **(5 Marks)**

B8. A company's quarterly sales (in thousands of dollars) for the past 3 years are as follows:

Year	$Q1$	$Q2$	$Q3$	$Q4$
1	50	55	60	65
2	62	68	72	78
3	75	82	88	95

(a) Plot the time series data and describe the main components you observe. **(4 Marks)**

(b) Calculate a 4-quarter centered moving average for this data. Show all steps. **(6 Marks)**

(c) Plot the moving average on the same graph as the original data. What does it reveal about the data? **(4 Marks)**

(d) Fit a linear trend line to the data and forecast sales for Q1 of Year 4. **(6 Marks)**

B9. A random sample of 75 students was taken to determine if there is a relationship between study time and exam performance.
The observed frequencies are:

	Exam Performance			
Study Time	Distinction	Pass	Fail	Total
High	20	20	5	45
Low	5	15	10	30
Total	25	35	15	75

(a) State the null and alternative hypotheses for a test of independence. **(2 Marks)**

(b) Calculate the expected frequencies for each cell under the null hypothesis. **(4 Marks)**

(c) Calculate the chi-square test statistic for independence. **(6 Marks)**

(d) Using a 5% significance level, determine the critical value and state your conclusion. **(4 Marks)**

(e) What is the p-value for this test? **(4 Marks)**

End of Examination Paper