Topic	Description
Module	Mobile Robotics
Module Code	MRV
Semester	SS 2025
Lecturer	Daniel T. McGuiness, Ph.D
ECTS	5
SWS	4
Lecture Type	ILV
Teaching UE	60
Coursework Name	A Assignment
Work	Individual
Suggested Private Study	20 hours
Submission Format	Submission via SAKAI
Submission Deadline	29th Jun 23:59
Late Submission	Not accepted
Resubmitting Opportunity	No re submission opportunity

> No lecture time is exclusively devoted to the aforementioned assignment.

- Please make sure your calculations are legible and easy to follows.
- If no clear indication of derivation is given, no points will be awarded.
- There is no need for text in this assignment.
- You will only be awarded grades on your derivation and solution to the questions given in this assignment.

A portion of the mark for every assignment will be, where applicable, based on style. Style, in this context, refers to organisation, flow, sentence and paragraph structure, typographical accuracy, grammar, spelling, clarity of expression and use of correct IEEE style for citations and references. Students will find *The Elements of Style (3rd ed.)* (1979) by Strunk & White, published by Macmillan, useful with an alternative recommendation being *Economist Style Guide (12th ed.)* by Ann Wroe.

Question	Maximum Point	Result
Sensor Readings	50	
Setting the Precision	30	
Accuracy of the Voltmeter	20	
Sum	100	

[Q1] Sensor Readings — 50

During a survey analysis of the environment, you are trying to determine the variability of a sensor reading to better estimate the position of the robot using Kalman Filter. Using $\alpha = 0.05$, you are analysing the received data and assume the data is adequately described by a normal distribution. The raw data is as follows:

4.080	3.410	2.980	4.620	1.930
6.730	6.050	6.700	5.330	6.400
3.580	5.950	5.730	5.650	5.090
5.100	4.610	6.990	4.230	3.630
4.060	4.600	5.800	5.170	5.010
4.080	4.830	3.950	6.010	5.900
2.600	4.610	4.110	5.840	5.640
6.150	6.540	4.720	4.960	6.190
5.630	4.630	3.930	4.060	3.980
5.670	6.000	5.980	5.200	3.390

Table 1: Collected raw data from the sensor.

Is the data normally distributed?

[Q2] Setting the Precision — 30

A firm manufactures battery packs for mobile robots which contains 5000 g of li-ion cells and the company interested to know whether the mean weight differs significantly from 5000 g at the 5% level, in which case the manufacturing machine has to be adjusted.

Set up a hypothesis and an alternative and perform the test, assuming normality and using a sample of 50 manufactured batteries with mean 4990 g and standard deviation 20 g.

[Q3] Accuracy of the Voltmeter — 20

If simultaneous measurements of electric voltage by two different types of voltmeter produce the differences (in volts) 0.4, 0.6, 0.2, 0.0, 1.0, 1.4, 0.4, 1.6, can we assert at the 5% level that there is no significant difference in the calibration of the two types of instruments? Assume normality.