



Level 4 Cert in Statistics for Data Science (949) 156 Credits

Unit: Measures of Variation	Guided Learning Hours: 260
Exam Paper No.: 5	Number of Credits: 26
Prerequisites: Mathematical terms and Excel knowledge.	Corequisites: A pass or higher in Certificate in Excel or equivalence.
Aim: Variation describe how different data values in a dataset are from each other. It helps understand how spread out that is; highlighting how consistent or unpredictable the data is. To measure data variation, a number of methods are used; range, interquartile range, mean absolute deviation etc. Learners will learn how to compute measures of variation using both manual calculations and Excel. It is important to understand that for range, there is no distinguishing for sample range and population range. However, for standard deviation and variance, there are different notations depending on whether it is population or sample. Learners are encouraged to research on difference between sample and population. Apart from just calculating averages in a given dataset, learners learn about the uncertainty in the average value. Causes of uncertainty can be categorised as (i) Random errors cause unpredictable, fluctuating measurements and can be reduced by repeated measurements. (ii) Systematic errors introduce consistent, directional bias from faulty instruments or experimental flaws and require different methods to correct. Coefficient of Variation (Coefficient of Variance); a metric that relates to ratio of standard deviation of the mean is also covered, including mean, median and mode of grouped data and average deviation.	
Required Materials: Recommended Learning Resources.	Supplementary Materials: Lecture notes and tutor extra reading recommendations.
Special Requirements: The unit requires a combination of lectures, demonstrations, discussions, and hands-on labs.	
Intended Learning Outcomes: - Understand how measures of variation (or dispersion) is used to describe how spread out or clustered a set of data is around its central average and the five primary measures of variation (Range, Interquartile Range (IQR), Variance, Standard Deviation and Mean Absolute Deviation (MAD)). - Understand how standard deviation as a statistical measurement shows how dispersed or spread out data points are from the average (mean). - Understand how variance quantifies the degree of data dispersion or volatility, measuring the spread of a data distribution. - Understand how grouped data is formed by aggregating individual observations of a variable into groups, enabling frequency distribution of these groups to summarise or analyse the data. - Understand how Mean Absolute Deviation (MAD) as a statistical measure	Assessment Criteria: 1.1 Be able to describe the different measures of variation statistical tools. 1.2 Describe the difference between sample and population. 1.3 Describe Sample Standard Deviation (STDEV.S). 1.4 Describe Population Standard Deviation (STDEV.P). 1.5 Define average uncertainty. 2.1 Define low standard deviation and high standard deviation. 2.2 Demonstrate calculating Standard Deviation. 2.3 Describe Coefficient of Variation (Coefficient of Variance). 2.4 Be able to calculate Coefficient for a Sample. 2.5 Be able to calculate Coefficient for a Population. 3.1 Define variance. 3.2 Demonstrate calculating population variance. 3.3 Demonstrate calculating sample variance. 3.4 Describe what high variance indicates. 3.5 What is the difference between standard deviation and variance. 4.1 Demonstrate how to calculate the mean of a group frequency table. 4.2 Be able to calculate standard deviation of grouped data. 4.3 Describe sample and standard deviation formulas. 4.4 Demonstrate calculating the standard deviation of grouped data. 4.5 Be able to calculate the mode of grouped data. 5.1 Describe Mean Absolute Deviation (MAD).

describes the average distance between each data point and the mean of the dataset.	5.2	Demonstrate how to calculate Mean Absolute Deviation (MAD).
	5.3	Be able to describe meaning of Mean Absolute Deviation (MAD) result calculation.
	5.4	Describe the Mean Absolute Deviation (MAD) formula.
	5.5	What is the difference between Average Deviation and Mean Absolute Deviation (MAD).
Methods of Evaluation: A 2-hour written examination paper with Section A and Section B. Section A has 40 multiple choice questions. Section B has three essay questions, each carrying 20 marks. Candidates are required to answer all questions. Candidates also undertake project/coursework in Measures of Variation with a weighting of 100%.		

Recommended Learning Resources: Measures of Variation

Text Books	- Statistical Engineering: An Algorithm for Reducing Variation in Manufacturing Processes by Stefan H. Steiner & R. Jock Mackay. ISBN-10 : 0873896467 - Statistics for the Rest of Us: Mastering the Art of Understanding Data Without Math Skills (Advanced Thinking Skills) by Albert Rutherford. ISBN-13 : 979-8391345831 - Standard Deviation by Jamie Singleton. ISBN-10 : 0615274005
Study Manuals 	BCE produced study packs
CD ROM 	Power-point slides
Software 	Excel