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Allison L. Lewis* (lewisa11@up.edu), **Steven J. Miller** (Steven.Miller@williams.edu) and **Victoria Cuff** (vcuff@clemsun.edu). *Theory and Applications of Benford's Law of Leading Digits*. Preliminary report.

Benford's Law of Leading Digits contributes to the analysis of a variety of real-life data sets, providing us with a method to detect abnormalities in data resulting from rounding errors, data collection methods, or even nefarious activities such as fraud. We perform an in-depth analysis on several diverse, natural data sets, including data from Climatedge, results from the 2009 Iranian elections, and streamflow statistics, analyzing the conformity of each data set to Benford's Law and other digit distributions. We develop a set of general techniques that can be applied to large data sets in a Benford analysis, and discuss the issues encountered due to a lack of significant digits, the sensitivity of the chi-square analysis, and simply non-Benford behavior. Exploring the theoretical implications of Benford's Law, we expand upon previous results from Miller and Nigrini (regarding the Exponential distribution) and generalize to the Weibull distribution, investigating how the variation of its parameters affects its conformity to the expected leading digit probabilities. The major goal of this study is to determine which data sets should be governed by Benford's Law, based on factors such as size and the presence of data entries spanning multiple orders of magnitude. (Received September 21, 2010)