Math 216 Midterm Exam 1 – Study Guide

The first midterm will cover Chapters 1 and 2 in your textbook, as well as additional data visualization techniques discussed in class. You are encouraged to bring a calculator (scientific or graphing) to the test, but you will not be allowed to use a laptop during the test. You may bring one 3"x5" index card with notes (front and back) for use during the test.

You should be able to do each of the tasks listed below and understand the concepts associated with each task. See the end of this document for a list of suggested practice problems from the textbook.

Section 1.2

- Determine whether a given variable is numerical or categorical.
- Determine whether a given numerical variable is discrete or continuous.
- Determine from a scatterplot if two variables are positively associated, negatively associated, or not associated.

Section 1.3

- Calculate the mean and standard deviation of a small data set.
- Calculate the first quartile, median, and third quartile of a data set.
- Identify outliers in a data set using the interquartile range method.
- Determine from a histogram if a data set is left skewed, right skewed, or symmetric.
- Determine from a histogram if the mean of a data set is likely less than, equal to, or greater than the median.
- Compare multiple data sets using histograms.
- Match a data set's histogram with its boxplot.
- Classify a summary statistic (mean, median, etc.) as robust or not.
- Compare data sets using summary statistics (mean, standard deviation, etc.).

Section 1.4

- Interpret a bar, segmented bar, or mosaic plot.
- Discuss why pie charts are inferior. (Just kidding.)
- Compare multiple data sets using boxplots.

Data Visualization

- Interpret bubble charts, heatmaps, and treemaps.

Section 1.5

- Identify more or less effective sampling techniques.
- Discuss potential problems with particular sampling techniques.
- Identify potential lurking variables in observational studies.

Section 1.7

- Discuss how a given experiment does or does not fulfill the principles of controlling, randomization, replication, and blocking.

Section 2.1

- Identify common misconceptions about probability (base rate fallacy, representativeness heuristic, conjunction fallacy) in examples of probability estimations.
- Discuss ways in which an example could be thought of as following the empirical or subjective notions of probability.
- Use a Venn diagram, along with the General Addition and Complement Rules, to calculate probabilities.
- Translate a narrative example of probabilities to event/set notation, and vice versa.
- Determine if two events described as unions, intersections, or complements of other events are equal.
- Shade a Venn diagram to represent a particular event described as unions, intersections, or complements of other events.
- Distinguish between the common notion of independence (that one event does not cause the other) and the mathematical notion.
- Calculate probabilities involving independent events using the Product Rule.

Section 2.2

- Use a simple (continuous or discrete) probability density function to calculate probabilities.

Section 2.3

- Calculate conditional probabilities given sufficient information about an example.
- Calculate probabilities using conditional probabilities and/or the General Multiplication Rule.
- Use conditional probabilities to determine if two events are independent.
- Model a probabilities problem using a tree diagram and use that tree diagram to calculate probabilities. (Optionally, use Bayes' Theorem to solve these kinds of problems.)

Section 2.4

- Calculate probabilities involving sampling with or without replacement from small populations.

Section 2.5

- Determine the probability distribution for a given random variable given sufficient information on that random variable.
- Find the expected value, variance, and standard deviation for a random variable given its probability distribution.

- Find the expected value, variance, and standard deviation for a linear combination of random variables given the expected value and variance of the component random variables.

End-of-Chapter Exercises

- Section 1.2 – 1.3, 1.5, 1.9
- Section 1.3 – 1.13, 1.15, 1.19, 1.23, 1.25, 1.27, 1.29, 1.31
- Section 1.4 – 1.35
- Section 1.5 – 1.37
- Section 1.6 – 1.39, 1.41, 1.45
- Section 1.7 – 1.49
- Section 2.1 – 2.1, 2.3, 2.5, 2.7, 2.9
- Section 2.2 – 2.15
- Section 2.3 – 2.19, 2.21, 2.23, 2.27, 2.29
- Section 2.4 – 2.31, 2.33
- Section 2.5 – 2.39, 2.41, 2.45, 2.47