MATH 241

Learning Objectives and Prerequisites

At the end of MATH 241, students should:

Explore and Understand Data

- Articulate the different definitions of statistics
- Identify different types of variables
- Summarize and display a single categorical variable, explore and analyze the relationship between two categorical variables
- Understand and calculate measures of central tendency and spread
- Understand and compare groups with histograms, boxplots, scatterplots, and other graphical representations of data
- Explore and understand the normal model, standardize with *z*-scores, find normal percentiles

Explore Relationships between Variables

- Understand the differences between correlation and causation and apply these concepts to real-world contexts, calculate the correlation coefficient
- Analyze scatterplots and identify associations among variables
- Calculate least squares lines and explain their significance, understand "regression to the mean" and explain how it applies in real-world contexts, identify assumptions and limitations of this regression
- Examine and calculate residuals, determine when extrapolation from the data is warranted, determine when the use of summary values are appropriate

Gather Data

- Understand randomness and conduct simulations
- Understand sampling and explain when different sampling methods are appropriate
- Create valid surveys, analyze other surveys for validity
- Understand and explain different kinds of studies, including observational studies, randomized comparative experiments, control treatments, and confounding conditions

Randomness and Probability

- Understand and calculate basic, simple probabilities, calculate conditional probabilities, determine when events are dependent or independent
- Create and analyze tables, Venn diagrams, and trees to calculate and interpret probabilities
- Calculate expected values
- Explore and apply probability models, including combining random variables, the binomial model and the normal model

Inferential Statistics

- Explain sampling distribution models and how to apply the models, sampling distribution of a proportion, normal model assumptions and conditions, apply the Central Limit Theorem
- Apply confidence intervals for proportions, calculate and interpret confidence intervals
- Apply hypothesis testing about proportions, calculate and explain p-values, apply hypothesis testing to data
- Determine inferences about means, apply the *t*-test, interpret confidence intervals, apply hypothesis testing for means, determine appropriate sample sizes for the tests

Comparing Groups

- Calculate and explain the standard deviation of a difference, explain assumptions and conditions for comparing proportions, calculate and apply confidence intervals for the difference between proportions, apply the two-sample *z*-test, calculate confidence intervals for the difference between two means, apply the two sample *t*-test
- Analyze paired data, explaining assumptions and conditions, calculate confidence intervals for matched pairs
- Apply goodness of fit tests, apply the chi-square test of homogeneity and explain the results, calculate the residuals and apply the results to the context
- Apply inferences to regression, explain assumptions and conditions, analyze the inferences, calculate and apply standard errors for predicted values

Apply understanding of statistics to a student-created project

Technology Tools Used

- Demonstrate proficient use of email, MyStatLab, and Blackboard technologies
- Demonstrate proficient use of a scientific calculator and Excel spreadsheets

Prerequisite Knowledge and Skills Needed

- Completion of MATH 035 with a C or better (see objectives for this course)
- Appropriate score on math placement test (currently a 12 or above on the MapleTA)