

**NOVA COLLEGE-WIDE COURSE CONTENT SUMMARY  
MTH 157 - ELEMENTARY STATISTICS (4 CR.)**

**Course Description**

Presents elementary statistical methods and concepts including descriptive statistics, estimation, hypothesis testing, linear regression, and categorical data analysis. Credit will not be awarded for both MTH 157 and MTH 240 or MTH 241. Lecture 4 hours per week.

**General Course Purpose**

The purpose of this course is to provide students with the abilities to understand the results of statistical studies and to perform descriptive and inferential statistics in their fields of interest.

**Course Prerequisites/Corequisites**

Prerequisites: Competency in Math Essentials Units MTE 1-5 as demonstrated through the placement and diagnostic tests, or by completion through unit 5 in an MTT course. A student who provides official evidence of a minimum mathematics score of 520 on the SAT or a minimum score of 22 on the ACT taken within the last two years may register for these courses without taking the math placement test

**Course Objectives**

Upon completion of this course, the student should be able to:

- A. define and use the following terms:
  - 1. population
  - 2. frame
  - 3. population parameters
  - 4. sample
  - 5. statistic
  - 6. inferential statistics
  - 7. descriptive statistics
- B. discuss the importance of and uses of descriptive and inferential statistics
- C. define and use the following terms:
  - 1. scientific method
  - 2. compounding variable
  - 3. units
  - 4. response variable
  - 5. explanatory variable
  - 6. level
  - 7. discrete data
  - 8. continuous data
  - 9. level of measurement
  - 10. nominal
  - 11. ordinal
  - 12. interval
  - 13. ratio data
  - 14. qualitative data
  - 15. quantitative data
  - 16. time series data
  - 17. stationary process
  - 18. non-stationary process
- D. identify whether a variable is explanatory or response
- E. determine if a study is controlled or observational
- F. identify the level of measurement of data as either qualitative or quantitative
- G. identify the level of measurement of data as nominal, ordinal, interval or ratio scale
- H. define and use the following terms:
  - 1. frequency distribution
  - 2. bar chart

3. relative frequency
  4. cumulative frequency
  5. histogram
  6. stem and leaf display
  7. ordered array
  8. time sequence plot
- I. evaluate the quality of graphs
- J. construct a bar graph, stacked bar graph, pie chart, frequency distribution, relative frequency distribution, cumulative frequency distribution, stem and leaf display, histogram and line graph
- K. follow the guidelines for constructing a bar chart that is aesthetically pleasing and informative
- L. follow the guidelines for determining the number of classes and class width of a frequency distribution
- M. write a paragraph explaining the information provided by a visual display of data
- N. define the use of the following terms:
1. arithmetic mean
  2. sample mean
  3. population mean
  4. outliers
  5. resistant statistical measure
  6. nonresistant statistical measure
  7. median
  8. trimmed mean
  9. mode
  10. moving average
  11. variance
  12. standard deviation
  13. mean absolute deviation
  14. range
  15. percentile rank
  16. quartile rank
  17. inter-quartile range
  18. box plot
  19. Z-score
  20. grouped data
  21. proportion measure
- O. find and interpret the four measures of central tendency -mean, median, mode, and trimmed mean
- P. determine which measure of central tendency is most appropriate for a given set of data
- Q. find and interpret a moving average
- R. find and interpret the three measures of variation - variance, standard deviation and range
- S. find and interpret the two measures of relative position - percentiles and quartiles
- T. find and interpret the interquartile range, and use this to identify outliers
- U. construct and interpret a box plot
- V. find the Z-scores for a set of data, and use the Empirical Rule to interpret the meaning
- W. find and interpret the mean and variance of grouped data
- X. find and interpret the proportion of a group that has a given characteristic
- Y. construct and interpret scatterplots
- Z. find and interpret the correlation coefficient
- AA. discuss the dangers of misinterpreting the correlation coefficient
- BB. use the least squares method to find regression equation and compute the error for each data point
- CC. find the average value of a model's error and the variance of the errors
- DD. define the use of the following terms:
1. simple event
  2. sample space
  3. event
  4. relative frequency
  5. probability that an event will occur
- EE. determine the probability that an event will occur
- FF. when given the value of a probability, interpret the meaning

- GG. use the table for the standard normal distribution to determine probabilities and percent of area
- HH. find and use the Z-transformation
- II. define and use the following terms:
  1. null hypothesis
  2. alternative hypothesis
  3. test statistic
  4. rejection region
  5. Type I error
  6. Type II error
  7. P-value
- JJ. formulate the null hypothesis and alternative hypothesis for a given situation
- KK. determine the critical values of test statistics both in one-sided and two-sided situations
- LL. use the nine step model for the following:
  1. testing a hypothesis about the mean (large sample)
  2. testing a hypothesis about the mean (small sample)
  3. testing a hypothesis about a population proportion
  4. testing a hypothesis about a population variance
  5. comparing two population means (large sample)
  6. comparing two population means (small sample)
  7. pair difference experimental design
- MM. compute and interpret the P-value for several test statistics
- NN. use the table for critical values of the t-distribution
- OO. use the table for critical value of Chi-Square distribution
- PP. find the expected value of an event
- QQ. compute and interpret the Chi-Square test for goodness of fit
- RR. compute and interpret the Chi-Square test for association between two qualitative variables

### **Major Topics to be Included**

- A. Introduction to Statistics
  1. What is statistics?
  2. Uses and misuses
  3. Role of statistics in research
- B. Descriptive statistics
  1. Organizing and Displaying Data
    - a. frequency distribution
    - b. relative frequency distributions
    - c. cumulative frequency distributions
    - d. stem and leaf displays
    - e. bar graphs and stacked bar graphs
    - f. pie charts
    - g. histograms and line graphs
  2. Measures of central tendency
    - a. mean, trimmed mean, median, mode and moving average
    - b. interpretation
  3. Measures of Variation
    - a. range
    - b. variance and standard deviation
    - c. percentiles and quartiles
    - d. interquartile range
    - e. interpretations
  4. Standard scores
- C. Probability
  1. Definition
  2. Sample space
  3. Events and their probabilities
- D. Normal curves
  1. Standard normal curve
  2. Computations with normal curves
- E. Hypothesis Testing
  1. Formulation

- a. stating null and alternative hypotheses
  - b. significance level
  - c. regions of acceptance and rejection
  - d. Type I and Type II errors
  - e. P-values - compute and interpret
  - f. conclusion and interpretation of results
2. For a population mean
    - a. large sample (z - test)
    - b. small sample (t -test)
  3. For a population proportion
  4. For a population variance
  5. For the difference in two population means
    - a. independent samples (z or t-test)
    - b. dependent samples (z or t-test)
  6. Chi-square Goodness of Fit Test
  7. Chi-square Test of Association
- F. Linear Regression and Correlation
1. Scatter plots
  2. Method of least squares
    - a. finding equation of regression line
    - b. computing residuals
    - c. average value of a model's error and the variance of the errors
  3. Pearson Correlation Coefficient
    - a. calculation
    - b. interpretation