DUBLIN, VIRGINIA
COURSE PLAN

Course Number and Title: MTH 155 Statistical Reasoning (3 cr.)

Prepared by: Math Faculty — Fall 2025 (Date)

Approved by: S. Tolbert-Hungoz (Dean) — Fall 2025 (Date)

Course Description

Presents elementary statistical methods and concepts including visual data presentation, descriptive statistics, probability, estimation, hypothesis testing, correlation and linear regression. Emphasis is placed on the development of statistical thinking, simulation, and the use of statistical software. Credit will not be awarded for both MTH 155: Statistical Reasoning and MTH 245: Statistics I or equivalent. This is a Passport and UCGS transfer course.

Lecture 3 hours, Total 3 hours per week.

3 credits

Introduction

Statistical Reasoning is a first course in statistics for students whose college and career paths require knowledge of the fundamentals of the collection, analysis, and interpretation of data. Emphasis is placed on the development of statistical thinking, simulation, and the use of statistical software. Students should develop an appreciation of the need for data to make good decisions and an understanding of the dangers inherent in basing decisions on anecdotal evidence rather than data. To that end, students will use appropriate data-collection methods and statistical techniques to support reasonable conclusions through the following content learning outcomes: Data Exploration, Statistical Design, Probability and Simulation, and Statistical Inference.

Course Objectives

- Communication
    - Interpret and communicate quantitative information and mathematical and statistical concepts using language appropriate to the context and intended audience.

        - Use appropriate statistical language in oral, written, and graphical terms.
        - Read and interpret graphs and descriptive statistics.
- Problem Solving
    - Make sense of problems, develop strategies to find solutions, and persevere in solving them.
    - Understand what statistical question is being addressed, use appropriate strategies to answer the question of interest, and state conclusions using appropriate statistical language.
- Reasoning
    - Reason, model, and draw conclusions or make decisions with quantitative information.
        - Use probability, graphical, and numerical summaries of data, confidence intervals, and hypothesis testing methods to make decisions.
        - Support conclusions by providing appropriate statistical justifications.
- Evaluation
    - Critique and evaluate quantitative arguments that utilize mathematical, statistical, and quantitative information.
        - Identify errors such as inappropriate sampling methods, sources of bias, and potentially confounding variables, in both observational and experimental studies.
        - Identify mathematical or statistical errors, inconsistencies, or missing information in arguments.
- Technology
    - Use appropriate technology in a given context.
        - Use some form of spreadsheet application to organize information and make repeated calculations using simple formulas and statistical functions.
        - Use technology to calculate descriptive statistics and test hypotheses.
- Graphical and Numerical Data Analysis
    - Identify the difference between quantitative and qualitative data
    - Identify the difference between discrete and continuous quantitative data
    - Construct and interpret graphical displays of data, including (but not limited to) box plots, line charts, histograms, and bar charts
    - Construct and interpret frequency tables
    - Compute measures of center (mean, median, mode), measures of variation, (range, interquartile range, standard deviation), and measures of position (percentiles, quartiles, standard scores)
- Sampling and Experimental Design
    - Recognize a representative sample and describe its importance
    - Identify methods of sampling

    - Explain the differences between observational studies and experiments
    - Recognize and explain the key concepts in experiments, including the selection of treatment and control groups, the placebo effect, and blinding
- Probability Concepts
    - Describe the difference between relative frequency and theoretical probabilities and use each method to calculate probabilities of events
    - Calculate probabilities of composite events using the complement rule, the addition rule, and the multiplication rule.
    - Use the normal distribution to calculate probabilities
    - Identify when the use of the normal distribution is appropriate.
    - Recognize or restate the Central Limit Theorem and use it as appropriate.
- Statistical Inference
    - Explain the difference between point and interval estimates.
    - Construct and interpret confidence intervals for population means and proportions.
    - Interpret the confidence level associated with an interval estimate.
    - Conduct hypothesis tests for population means and proportions.
    - Interpret the meaning of both rejecting and failing to reject the null hypothesis.
    - Use a p-value to reach a conclusion in a hypothesis test.
    - Identify the difference between practical significance and statistical significance.
- Correlation and Regression
    - Analyze scatterplots for patterns, linearity, and influential points
    - Determine the equation of a least-squares regression line and interpret its slope and intercept.
    - Calculate and interpret the correlation coefficient and the coefficient of determination.
- Categorical Data Analysis
    - Conduct a chi-squared test for independence between rows and columns of a two-way contingency table.

General Education Student Learning Outcomes Included in Course

General education at NRCC provides the educational foundation necessary to promote intellectual and personal development. Upon completing the associate degree, graduates will demonstrate competency in student learning outcomes in 1) civic engagement, 2) critical thinking, 3) professional readiness, 4) quantitative literacy, 5) scientific literacy, and 6)written communication.

This course includes the following general education student learning outcomes:

- Solve application problems by interpreting the materials presented, including determining the nature and extent of the information needed, and present the answer in standard English
- Estimate and consider answers to mathematical problems in order to determine reasonableness.
- Distinguish between population and sample, parameters and statistics.
- Distinguish between types of data (numerical, categorical, nominal ordinal, interval, ratio).
- Distinguish between types of statistical studies.
- Determine the type of sampling that is used in a study and whether biases might result.
- Simulate different types of sampling techniques.
- Construct frequency distributions, histograms, bar charts, pie charts, stem plots, and box plots.
- Read statistical graphs and use the graphs to analyze the data.

- Calculate the mean, median, mode, range, quartiles, variance and standard deviation for a set of data.
- Construct tables for two variable data, time plots, and scatter plots.
- Calculate correlations and regression equations.
- Use regression equations for prediction.
- Construct and use discrete probability distributions.
- Calculate the expected value of a discrete probability distribution.
- Find probabilities and proportions using the standard normal distribution and the Empirical Rule.
- Calculate z-scores and percentiles.
- Use the Central Limit Theorem and the probability distribution of sample statistics to find probabilities.
- Estimate population means, and proportions using the z-distribution
- Write a complete, concise interpretation for a confidence interval using standard English
- Test hypotheses about means and proportions.
- Calculate and interpret P-values.
- Conduct a chi-squared test for independence between rows and columns of a two-way contingency table
- Test hypotheses about regression equations
- Determine the equation of a least-squares regression line and interpret its slope and intercept
- Calculate and interpret the correlation coefficient and the coefficient of determination
- Use a computer application such as Microsoft Excel to do statistical calculations and construct statistical graphs
- Write a complete, concise conclusion for a hypothesis test for a given significance level using standard English

Instructional Methods

The instructional procedures will include lectures, discussions, in class work, homework, labs, reviews and tests

Instructional Materials

- **Textbook:** Introductory Statistics, OpenStax College, ISBN: 978-1-938168-20-8
- **Software:** MyOpenMath

  Microsoft Excel which is available on all NRCC computers and students have free access.

- **Calculator:** Not required.
- **Other:** Note paper, graph paper, pencils etc. Submitted work should be neat, legible and preferably written in pencil.

Course Content

- Populations, parameters, samples and statistics
- Statistical graphs
- Probability and probability distributions
- Sampling distributions
- Estimation of parameters
- Hypothesis tests for parameters
- Correlation and Regression

Grading/Evaluation

Students are evaluated on the following and other work as considered appropriate by the instructor:

- *class attendance, participation, and discussion*
- *assignments*
- *labs*
- *quizzes*
- *tests*
- *final exam*

See the course syllabus for details on how grades for this course will be calculated using percentages or points.

Grading scale:

90 - 100 = A
80 - 89 = B
70 - 79 = C
60 - 69 = D
Below 60 = F

Attendance

Regular attendance at classes is required. When absence from a class becomes necessary, it is the responsibility of the student to inform the instructor prior to the absence whenever possible. The student is responsible for the completion of all study missed during an absence. Any instruction missed and not completed will affect the grade of the student regardless of the reason for the absence.

Cheating/Plagiarism Policy

It is expected that all work completed in this course is the result of effort by the student registered in the course. The giving or receiving of any help from another student or unauthorized individual or source (including internet sites and AI) on any graded portion of the course is considered cheating and will not be tolerated. This includes plagiarism, which is defined as “To present another's words or ideas as one's own or without attribution” (American Heritage Dictionary, 2019). Remember that plagiarism includes using words or ideas from Internet sites, as well as copying from print sources. Any student found cheating will receive a 0 on that portion and possibly an F for the course. The dean will also be notified for records.

AI Usage

Different instructors will have different expectations around students’ usage of artificial intelligence (AI) tools depending upon the goals and learning outcomes of a course. Students should refer to the class syllabus/addendum for more specific guidelines. It is important to understand that using unauthorized AI tools to complete course work may result in an academic honesty violation. Students should always ask their instructor for guidance if they have any questions about the appropriateness of using a tool.

Withdrawal Policy

Student Initiated Withdrawal Policy

A student may drop or withdraw from a class without academic penalty during the first 60 percent of a session. For purposes of enrollment reporting, the following procedures apply:

If a student withdraws from a class prior to the termination of the add/drop period for the session, the student will be removed from the class roll and no grade will be awarded.

After the add/drop period, but prior to completion of 60 percent of a session, a student who withdraws from a class will be assigned a grade of "W." A grade of "W" implies that the student was making satisfactory progress in the class at the time of withdrawal, that the withdrawal was officially made before the deadline published in the college calendar, or that the student was administratively transferred to a different program.
After that time, if a student withdraws from a class, a grade of "F" or "U" will be assigned. Exceptions to this policy may be made under documented mitigating circumstances if the student was passing the course at the last date of attendance.

A retroactive grade of "W" may be awarded only if the student would have been eligible under the previously stated policy to receive a "W" on the last date of class attendance. The last date of attendance for a distance education course will be the last date that work was submitted.

Students requesting a late withdrawal due to documented mitigating circumstances should contact the Coordinator of Admissions and Records.

No-Show Policy

A student must either attend face-to-face courses or demonstrate participation in online courses by the last date to drop for a refund. A student who does not meet this deadline will be reported to the Admissions and Records Office and will be withdrawn as a no-show student. No refund will be applicable, and the student will not be allowed to attend/participate in the class or submit assignments. Failure to attend or participate in a course will adversely impact a student's financial aid award.

Instructor Initiated Withdrawal

A student who adds a class or registers after the first day of class is counted absent from all class meetings missed. Each instructor is responsible for keeping a record of student attendance (face-to-face classes) or performance/participation (online classes) in each class throughout the semester.

When a student's absences equal twice the number of weekly meetings of a class (equivalent amount of time for summer session), the student may be dropped for unsatisfactory attendance in the class by the instructor.

Since attendance is not a valid measurement for online courses, a student may be withdrawn due to non-performance. A student should refer to his/her online course plan for the instructor's policy.

In accordance with the No-Show Policy, a student who has not attended class or requested/accessed online learning materials by the last day to drop the class and

receive a refund must be withdrawn by the instructor during the following week. No refund will be applicable.

When an instructor withdraws a student for unsatisfactory attendance (face-to-face class) or non-performance (online class), the last date of attendance/participation will be documented. Withdrawal must be completed within five days of a student's meeting the withdrawal criteria. A grade of "W" will be recorded during the first sixty percent (60%) period of a course. A student withdrawn after the sixty percent (60%) period will receive a grade of "F" or "U" except under documented mitigating circumstances when a letter of appeal has been submitted by the student. A copy of this documentation must be placed in the student's academic file.

The student will be notified of the withdrawal by the Admissions and Records Office. An appeal of reinstatement into the class may be approved only by the instructor.

Non-Discrimination Statement

This College promotes and maintains educational opportunities without regard to race, color, national origin, religion, disability, sex, sexual orientation, gender identity, ethnicity, marital status, pregnancy, childbirth or related medical conditions including lactation, age (except when age is a bona fide occupational qualification), veteran status, or other non-merit factors.

Disability Statement

If you are a student with a disability and in need of accommodations for this course, please contact the Center for Disability Services (CDS) for assistance. CDS is located within the Advising Center in Rooker Hall. For more information about disabilities services, see Center for Disability Services Policies and Procedures.

Academic Success Center (Tutoring Center)

Free tutoring is available to all NRCC students in any subject area. In-person, one-on- one, and group tutoring sessions are available both in Dublin (Godbey 131) and at the mall site (room 202). Online tutoring sessions are also available to accommodate students who are unable to attend an in-person tutoring session. In addition, the Academic Success Center offers several online tutorials which are posted in Canvas on the NRCC Tutoring Services tab. For more information about the Academic Success Center at NRCC, please visit https://www.nr.edu/asc/ or call 1-540-674-3664.

General Health Guidelines and Student Expectations

In guarding against the transmission of infectious illnesses, it is imperative that we follow specific health-related best practices.

As a condition for attending class or otherwise using NRCC facilities, I, as a student, agree to the following conditions:

I will follow all CDC, state, and local guidelines pertaining to diseases and health conditions. More information can be found at the links below.

a. CDC Diseases and Conditions: https://www.cdc.gov/nchs/fastats/diseases-and-conditions.htm
b. Virginia Department of Health: https://www.vdh.virginia.gov/
c. New River Health District: https://www.nrvroadtowellness.com/

In the event of health threats or changes in guidelines, I understand in-person classes may be moved online, fully or partially, and I will need to be prepared to access technology and the internet with as little as 24 hours' notice.

By continuing my enrollment in class(es), **I agree to meet each of the expectations outlined above.**

New River Community College encourages all students to fully vaccinate against transmissible illnesses. Information about vaccinations can be found on the Virginia Department of Health website at www.vdh.virginia.gov.

Required Safety Training

Virginia law, effective August 1, 2024, requires campus safety and emergency preparedness training for all students enrolled in on-campus classes at public colleges and universities. The training must focus on an active shooter event and be completed by the last day of their first term in college.

To comply with this legislation, students will view a college-provided awareness and training video during the first two weeks of class for this course.

Evacuation Procedure

Please note the evacuation route posted at the classroom doorway. **Two routes are marked in case one route might be blocked.**