Mountain Empire Community College
Southwest Virginia Community College
Virginia Highlands Community College
Wytheville Community College

# PROBABILTY & STATISTICS
MTH 154 | Quantitative Reasoning Course Syllabus

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Office Hours: by appointment

**Course Description Summary:**  Presents topics in proportional reasoning, modeling, financial literacy, and discrete mathematics (e.g., logic and set theory). Focuses on the process of taking a real-world situation, identifying the mathematical foundation needed to address the problem, solving the problem and applying what is learned to the original situation. (Quantitative Reasoning is a Passport and UCGS transfer course.)

**Prerequisites:**   Algebra II

**Required Text and Materials:**
   *Using & Understanding Mathematics: A Quantitative Reasoning Approach*
      By Jeffrey Bennett and William L. Biggs (seventh Edition)
   *Introduction to the Practice of Statistics* (eighth edition)
      by David S. Moore, George P. McCabe, and Bruce Craig
   *Using R for Introductory Statistics* (second edition)
      by John Verzani
   *OpenIntro Statistics* (fourth edition) (*on-line textbook*)
   Scientific calculator or better;
   Wacom Intuos tablet and pen;
*Students must also have access to a desktop/laptop type computer, with high speed internet connection, outside of daily class time.*

**Dual Enrollment Credit:**
   Quantitative Reasoning (MTH 154) 3 credit hours
College credit is issued through one of four community colleges based on the location of the high school the student attends:  *Virginia Highlands Community College*, *Mountain Empire Community College*, *Southwest Virginia Community College*, or *Wytheville Community College*.

**Course Objectives:**  This course is designed to introduce students to fundamental techniques of data analysis, developing mathematical models, and incorporating statistical analysis to make informed conclusions using real world data.  As part of the course, students will learn mathematical tools and skills, such as modeling, to help them develop conceptual understanding by making connections between concepts and applying previously learned material to new contexts.  Students will also develop an understanding of financial tools for use as a decision making guide.  The course will help to prepare students for success in future courses, gain skills for the workplace, and participate as productive citizens in society.

**Instructional Methods:**  The course is taught in a "real time"/synchronous lecture/problem Q&A session format via the Internet.  Students are required to view online video series, which complements as well as re-enforces textbook material.  Furthermore, students may be required to view R software tutorial videos and/or Python tutorial videos and/or Excel tutorial videos and complete related labs.

To facilitate a student's successful understanding of the concepts and methods required for analysis, additional study aids, the review of which is optional, will be available to the student outside of the class.  These may include, but are not limited to

- On-line instructor authored example problem videos of problems from the textbook and other sources, that have not been worked in class;
- Workbooks, that "walk" a student through problem solution strategies for example problems;
- Supplemental technical documents and handouts;
- Numerous web sites with additional topic perspectives

Some course material will be made available through the Governor's School Probability and Statistics web site. Most supplemental course material will be made available through a secondary web site: the HGS Virtual School/Canvas course web pages.

**Evaluation Methods:**   Grades will be based upon:

- Class participation and attendance;
- Homework assignments;
- R and/or Python and/or Excel and/or Latex software assignments;
- Pop quizzes and in-class work;
- On-line labs and on-line exercises.
- Exams;
- Analysis projects; and
- Comprehensive mid-term(s) and final exam(s).

Typically grades are determined weighted:

- Problem solving skills:        15-25%
- Mid-Term and other Exams:  45-70%
- Comprehensive exams          10-25% of academic period grade
- Class participation:              up to 15%

Grade weight given to assignments (e.g., analysis projects, on-line exercises) will be announced at the time of their assignment.

A grade assignment scale in accordance with the *Governor's School Student Handbook* (i.e., 90-100: A, 80-89: B, 70-79: C, etc.), both numerical and letter, is used.  Averaged grades reported for any one grading period may be scaled upward at the discretion of the instructor.  Grades for any semester and/or academic year period, which may also be scaled upward when reported, are determined using actual grades earned by the student. There is no "extra credit."

**Attendance:**  Students are required to attend all classes and to be "in class" at the scheduled daily start time. Regarding the physical location of a student when attending the class, the attendance policies and expectations of the student's home school are to be followed. While in class, students are expected to be attentive and prepared to talk if called upon.  Students observed conducting any activity not in keeping with the current class discussion or explicitly permitted by the instructor during that day's class will be immediately dismissed from class for the day, not permitted to return, and receive a grade of zero "for the day".  [The grade of zero will be averaged with the student's assignment grades as if an additional 60 point homework assignment were given with a grade of zero for the phantom homework assignment.]

It is not the responsibility of the instructor to remember a student's schedule.

Students can be excused from class and/or class obligations by the Governor's School Probability and Statistics instructor.  Local school officials cannot excuse a student from any Governor's School assessment or course work requirement or due date.

**Scheduled Exams:** Exam times and dates are announced well in advance both in class as well as in the Outlook calendar for the class. Students may access the Outlook calendar through their Governor's School email account. Students must contact the instructor well in advance of any exam date which may be missed due to a scheduled absence.  An alternate exam time and/or date, which must be before the announced scheduled time, will be scheduled at the discretion of the instructor. No "make-up" exam after a scheduled exam date will be given.  Students failing to obtain an alternate date prior to their absence will receive a grade of zero for the missed exam.

In exceptional cases, and at the discretion of the instructor, other assessment grades may be averaged and the average grade so calculated subsequently used to replace a missed assessment.

**Assignment Submission:**  All assignments must be submitted to the instructor no later than the announced and/or posted due date and time.  **No late submissions will be accepted.**  The time stamp placed on the email by the Governor's School's email server at the time of delivery to the instructor's email address shall be solely used to determine if a student's work has been submitted on or before the due date and time.

An excused absence does not relieve the student from their obligation to submit work by the announced due date.  Also, short-term technical failures at any location do not provide justification for the acceptance of late submissions.  (For exceptional cases the course instructor will consider the waiver of the due date and time provided the instructor is consulted as soon as possible. What constitutes an "exceptional case" is determined solely by the instructor.)

Course work is submitted via the internet. (Any mailed work-to-be-graded submissions must be postmarked no later than the due date.  It is always the student's responsibility to see that mailed course work is mailed at a time and place to ensure that this requirement is met.  Contact the instructor for permission to submit work via USPS.)

To develop professional work practices and to facilitate grading of work and its return, all hand written assignment work – homework and/or exams - must meet the guidelines listed in the *Assignment Submission Guide,* which is posted on the Governor's School's [Probability and Statistics](#) course web site and on the course Canvas site.  Work not meeting <u>all</u> of the requirements detailed in the *Assignment Submission Guide* will not be graded, resulting in a recorded grade of zero (0) for the work.

Graded work is returned to the student in the PDF file format as an attachment to an email, which is sent to the student's Governor's School email account.

**Course Objectives Overview:**

Topics to be covered include …

- Communication
    - Interpret and communicate quantitative information and mathematical and statistical concepts using language appropriate to the context and intended audience.
        - Use appropriate mathematical language in oral, written and graphical forms.
        - Read and interpret real world advertisements, consumer information, government forms and news articles containing quantitative information.
        - Use quantitative information from multiple sources to make or critique an argument.

- Problem Solving
  - Share strategies to find solutions to life application problems to make sense of the mathematical content and persevere in solving them.
    - Apply strategies for solving open-ended questions requiring analysis and synthesis of multiple calculations, data summaries, and/or models.
    - Apply problem solving strategies to applications requiring multiple levels of engagement.
- Reasoning
  - Reason, model, and draw conclusions or make decisions with quantitative information.
    - Draw conclusions or make decisions in quantitatively based situations that are dependent upon multiple factors. Students will analyze how different situations would affect the decisions.
    - Present written or verbal justifications of decisions that include appropriate discussion of the mathematics involved.
    - Recognize when additional information is needed.
    - Recognize the appropriate ways to simplify a problem or its assumptions.
- Evaluation
  - Critique and evaluate quantitative arguments that utilize mathematical, statistical, and quantitative information.
    - Evaluate the validity and possible biases in arguments presented in real world contexts based on multiple sources of quantitative information - for example; advertising, internet postings, consumer information, and political arguments.
- Technology
  - Use appropriate technology in a given context.
    - Use a spreadsheet (i.e., data frame) to organize quantitative information and make repeated calculations using simple formulas.
    - Search for and apply internet-based tools appropriate for a given context.
- Financial Literacy
  - Simple Interest
    - Define interest and its related terminology.
    - Develop simple interest formula.
    - Use simple interest formulas to analyze financial issues
  - Compound Interest
    - Compare and contrast compound interest and simple interest.
    - Explore the mechanics of the compound interest formula addressing items such as why the exponent and $(1+r/n)$ is used.
    - Apply compound interest formulas to analyze financial issues
    - Create a table or graph to show the difference between compound interest and simple interest.
  - Borrowing
    - Compute payments and charges associated with loans.
    - Identify the true cost of a loan by computing APR
    - Evaluate the costs of buying items on credit
    - Compare total loan cost using varying lengths and interest rates.
  - Investing
    - Calculate the future value of an investment and analyze future value and present value of annuities Take into consideration possible changes in rate, time, and money.
    - Compare two stocks and justify your desire to buy, sell, or hold stock investment.

- Explore different types of investment options and how choices may impact one's future such as in retirement.
- Number, Ratio, and Proportional Reasoning
  - Solve real-life problems that include interpretation and comparison of summaries which extend beyond simple measures, such as weighted averages, indices, or ranking and evaluate claims based on them.
  - Solve real-life problems requiring interpretation and comparison of various representations of ratios.
  - Distinguish between proportional and non-proportional situations and, when appropriate, apply proportional reasoning leading to symbolic representation of the relationship. Recognize when proportional techniques do not apply.
  - Solve real-life problems requiring conversion of units using dimensional analysis.
  - Apply scale factors to perform indirect measurements (e.g., maps, blueprints, concentrations, dosages, and densities).
  - Order real-life data written in scientific notation.
- Modeling
  - Observation
    - Through an examination of examples, develop an ability to study physical systems in the real world by using abstract mathematical equations or computer programs
    - Collect measurements of physical systems and relate them to the input values for functions or programs.
    - Compare the predictions of a mathematical model with actual measurements obtained
    - Quantitatively compare linear and exponential growth
    - Explore behind the scenes of familiar models encountered in daily life (such as weather models, simple physical models, population models, etc.)
  - Mathematical Modeling and Analysis
    - Collect measurements and data gathered into tables, displays, charts, and simple graphs.
    - Create graphs and charts that are well-labeled and convey the appropriate information based upon chart type.
    - Explore interpolation and extrapolation of linear and non-linear data. Determine the appropriateness of interpolation and/or extrapolation.
    - Identify and distinguish linear and non-linear data sets arrayed in graphs. Identifying when a linear or non-linear model or trend is reasonable for given data or context.
    - Correctly associate a linear equation in two variables with its graph on a numerically accurate set of axes
    - Numerically distinguish which one of a set of linear equations is modeled by a given set of data points
    - Identify a mathematical model's boundary values and limitations (and related values and regions where the model is undefined). Identify this as the domain of an algebraic model.
    - Using data gathered, a computer program and/or calculator to create different regressions (linear and non-linear), determine the best model, and use the model to extrapolate.
  - Application
    - Starting with a verbally described requirement, generate an appropriate mathematical approach to creating a useful mathematical model for analysis
    - Explore the graphical solutions to systems of simultaneous linear equations, and their real world applications

- Numerically analyze and mathematically critique the utility of specific mathematical models: instructor-provided, classmate generated, and self-generated
- Validity Studies
    - Identify logical fallacies in popular culture: political speeches, advertisements, and other attempts to persuade
    - Analyze arguments or statements from all forms of media to identify misleading information, biases, and statements of fact.
    - Develop and apply a variety of strategies for verifying numerical and statistical information found through web searches.
    - Apply the use of basic symbolic logic, truth values, and set theories to justify decisions made in real-life applications, such as if-then-else statements in spreadsheets, Venn Diagrams to organize options, truth values as related to spreadsheet and flow-chart output.

A slightly more detailed outline of material covered in [MTH 154](#) can be found by consulting the VCCS Courses page for the course.

**Course Learning Outcomes:**

Upon completion of MTH 154 a successful student will be able to …

- Critique data-based claims and evaluate data-based decisions
- Use software to summarize data numerically and visually, and to perform data analysis and generate reports.
- Create linear and non-linear models for numerical response (dependent) variables using a single explanatory (independent) variable as well as using multiple explanatory variables.
- Solve small systems of linearly independent equations
- Interpret analysis results correctly, effectively, and in context without relying on jargon.
- Use set theory to be able to later construct and interpret probability models.
- Use basic logic concepts to test claims truth.
- Demonstrate knowledge and skills needed to make financial decisions.

**Code of Conduct:** Student must observe the course *academic honesty policy*. A copy of the policy is distributed to all students at the beginning of the term. A copy of the document is also available online by visiting the course HGS Virtual School web pages.

All forms of academic dishonesty (also known as academic misconduct or cheating) are dealt with harshly. In keeping with school policy, the <u>minimum</u> penalty will be no credit for the work involved. The instructor refers matters of academic dishonesty to the Governor's School's Director for disposition of outcome. Nevertheless, the course instructor reserves the right to take independent action including, but not limited to, imposition of a failing grade for the work submitted or the course itself.

**Policy Applicability:** The policy stated in this syllabus as to exam dates, homework assignment submission requirements, academic honesty, etc. supersedes any student's home school policy.

**Changes:** The instructor reserves the right to amend, alter, and otherwise change this syllabus throughout the term on an as-needed basis. Any/all changes will be announced with sufficient notice via email, announcement posting, and/or "in class".

**Withdrawal Deadlines:** The last day to withdraw from the class (i.e., "drop" the class), with a grade of "W" (withdrawal), depends upon which community college issues the student's dual enrollment credit. The withdrawal/drop deadline dates are as follows:

| | |
|---|---|
| Mountain Empire Community College | October 30, 2023 |
| Southwest Virginia Community College | October 26, 2023 |
| Virginia Highlands Community College | November 1, 2023 |
| Wytheville Community College | October 26, 2023 |

Instructor approval is not required to drop the course. Students are, however, expected to notify the instructor as soon as possible if they drop the course. Students should consult their high school guidance counselor if they have any questions regarding the above dates and/or consequences of dropping the class. Also, students considering dropping the class should verify the above dates with their guidance counselor well before the deadline.

**Email Privacy:** Many types of email accounts are not secure. As such, email service providers and others not associated with ALHGS may have access to any confidential information (such as grades or performance) that A. Linwood Holton Governor's School communicates through email.

**Information & Instructions for Individuals with Disabilities:** Students may request academic accommodations for identified disabilities through Holton Governor's School's (HGS) main office, which is located on the second floor of the Southwest Virginia Higher Education Center on the Virginia Highlands Community College campus (276- 619-4326). Administrative staff will evaluate the request, consult with appropriate officials from the student's home school, and develop a plan that outlines necessary and reasonable accommodations to be followed. All correspondence will be kept confidential.

**Emergency Statement:** In the event of a major interruption of technological connectivity or actual emergency affecting the student's school or the offices of Linwood Holton Governor's School, class meeting times or schedules, assignment

deadlines, and grading schemes are subject to changes that may include alternative delivery methods, alternative methods of interaction with the instructor, alternate class materials, changes to class membership, a revised attendance policy; a revised semester calendar and/or grading scheme, etc.

For more general information about plans for dealing with such catastrophic events or emergencies, please consult the following resources:
- The student's home school's Emergency Notification and Response Plan
- The Holton Governor's School web site - http://www.hgs.k12.va.us – where instructions will be posted in the event of an emergency.

Should such a situation arise, HGS's Director will work closely with the appropriate school division and college personnel to resolve it as soon as possible. Students will be contacted through available forms of communication and given specific directions as to how they will proceed to complete their course work, how timelines will be adjusted, etc.

**Contact ALHGS**:
> Linwood Holton Governor's School
> P.O. Box 1987
> Abingdon, Virginia  24210
> (276) 619-4326

**Civil Rights and Non-Discrimination Statement:**

A. Linwood Holton Governor's School is committed to providing an environment that is free from harassment and discrimination based on any status protected by law. Accordingly, this Policy prohibits sex discrimination, which includes sexual harassment, sexual assault, sexual exploitation, domestic violence, and stalking. This Policy also prohibits retaliation. This policy supplements the following general policy statement set forth by the Virginia Community College System:  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. This policy also addresses the requirements under the Violence Against Women Reauthorization Act of 2013, (also known as the Campus SaVE Act), and Virginia law.

The following person has been designated to handle inquiries regarding non-discrimination policies, student misconduct, equity issues based on gender, and employee issues regarding misconduct and equity:  Mike Robinson, director. For more information, contact (276) 619-4326, P. O. Box 1987, Abingdon, VA, 24212.

**Family Education Rights and Privacy Act (FERPA)**

The Family Educational Rights and Privacy Act (FERPA) of 1974 is a Federal law that protects the privacy of student educational records.  The law allows students access to their educational records and prohibits the release of information from students' educational records by the institution without the written consent of the student, with certain specified exceptions.

**Copyright Law**

You are expected to comply with federal copyright law.  The United State Copyright Law protects all copyrighted materials: printed materials such as books and journals, music, sound recordings; films, videocassettes, art works, and computer software.  Most internet sites and all their contents are protected by copyright.  The Copyright Act of 1976 grants copyright owners exclusive rights to publish, reproduce, perform, and display their works.  Anyone publishing, reproducing, performing or displaying all or part of a copyrighted work is guilty of infringing the copyright unless the act falls within one of the fair use exceptions, or unless they have acquired permission to use the work from the copyright owner. Read the law at http://lcweb.loc.gov/copyright/

**Community College Syllabus Material**

The content below is required to be included in this document by the community college listed.

**Mountain Empire Community College**

**MTH 154  Quantitative Reasoning**

**Broad Goals:**

This course is designed to meet college general education requirements and to help the student:

- generate a positive attitude toward and an interest in mathematics;
- develop problem-solving skills; and
- gain appreciation of the beauty and power of mathematics.

**Core Competencies:**

This course satisfies the following core competencies:  Communication, Critical Thinking, Information Literacy, Quantitative Reasoning, and Scientific Reasoning.

**Learning Outcomes:**

Students will compute, analyze, and communicate quantitative data using mathematical and logical methods to solve problems (e.g. tables, graphs, formulas, or other relevant formats).