Mathematics Content (5–9)
Probability and Statistics I
Course of Study for GEC1/2 and GET1/2

Description
This course outline presents the required sequence of learning steps and activities to help you prepare for the GEC1/2 objective assessment and GET1/2 summative performance assessment. In this case, your competence will be assessed when you pass an objective assessment and then a performance assessment. As with any learning activity, you may complete steps more quickly than noted below, or it could take you the full amount of time indicated. This course of study may take up to twelve weeks to complete, depending on your educational background, work experience, and the amount of time that you are able to dedicate to your studies. Consult with your mentor if you wish to accelerate your progress through this course of study. We provide the pacing (Week 1, Week 2, etc.) as a guide to the amount of time you should take to acquire target competencies and prepare to complete the required assessment on time. Completing assessments in the required timeline will keep you on track for satisfactory academic progress (SAP) and graduation.

Introduction
Welcome to the beginning of your study of Probability and Statistics. My name is Michael Rotundo, and I will serve as your course mentor as you work through the Mathematics Content (5–9) Probability and Statistics I Course of Study. I have a BS degree with three majors (physics, chemistry, and psychology) and one minor (mathematics). I also have an MA degree in mathematics, an MEd in mathematics education, and ten teaching certificates in New York State (physics, chemistry, biology, mathematics, general science—grades 7–12 with a 5–6 grade extension for each). I am currently pursuing a PhD in psychology with a specialization in educational psychology. My office hours are posted below and in the community, and I am available via IM, e-mail, and phone. I look forward to working with you as we complete this educational journey together.

Course Mentor ................. Michael Rotundo
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Office Hours ....................... Monday, 8:00am – 4:00pm, Eastern Time
                                Tuesday, 2:00pm – 10:00pm, Eastern Time
                                Wednesday, 8:00am – 4:00pm, Eastern Time
                                Thursday, 8:00am – 4:00pm, Eastern Time
                                Friday, 8:00am – 4:00pm, Eastern Time

Although the subdomain of GEC1/2 and GET1/2 covers only selected topics in an objective assessment and a summative performance assessment, Probability and Statistics is an immense subject area. Several selected topics will be covered on the GEC1/2 objective assessment and the GET1/2 performance assessment, as well as some topics showing up in more advanced assessments (i.e., state mathematics content exams, Praxis II exams, etc.). This component of your work at Western Governors University is designed to help you gain a broad overview of the field of Probability and Statistics with a fundamental understanding of some key concepts and principles. Probability and statistics are key topics that are increasingly addressed earlier in the mathematics curriculum, so the chances are great that you will end up teaching some of these principles someday.
What is the best way to use this course of study? You should first carefully review all of the work that will be conducted from start to finish in order to gain an overview of what will be expected of you. Although you must first pass the objective assessment prior to submitting any work in TaskStream for the summative task, you should carefully review what needs to be done for this summative task. You will design, implement, and analyze the results of an original investigation that requires data collection, display, and interpretation. As you prepare for the upcoming objective assessment, you should also carefully think about the original investigation that you plan to construct.

Within the learning resources for this assessment in your AAP, you should find a Summative Task Template. Save a copy of this template to your desktop and print a copy for your personal use. As you prepare for the objective assessment, you should try to start filling in relevant components of this template. Remember that each of the activities you engage in to prepare for the objective assessment will also expose you to many topics. This exposure can stimulate ideas for an investigation. Try to capture these ideas as they arise. Do so in the provided template so that by the time you pass the objective assessment and have access to the summative task in TaskStream, you will already have a constructed a rudimentary framework for an investigation to build upon.

Note: It is important for you to plan ahead since the timeline for the construction and submission of the summative task may vary (i.e., exceed 12 weeks) depending upon the nature and scope of your investigation.

It is important that you engage in the learning steps and activities as prescribed by this course of study. They have been constructed in such a manner as to help you prepare for the upcoming objective assessment and performance assessment. You will first review relevant topics, pass the preassessment, pass the objective assessment, and then further refine your preexisting knowledge and skills with the intent of passing a summative performance assessment. One final note, you should treat each learning step and activity as a scaffold upon which to build upon prior knowledge and skills. This should be done with the intent of taking possession of target competencies along the way. You will need to do this to pass the objective assessment and performance assessment.

WGU Statement of Teaching Dispositions
Western Governors University supports the development and demonstration of professional teaching dispositions throughout the course of its Teachers College (TC) licensure programs. All TC students and faculty will demonstrate the following dispositions described in the Teachers College’s conceptual framework and code of ethics:

- Competent and caring
- Respectful and embracing of diversity
- Reflective practitioners
- Equitable and fair
- Professional practice consistent with the belief that all students can learn
- Collaborative professionals
- Professional leaders and change agents

Please review the “Teacher’s College Code of Ethics” found in the WGU Student Handbook (http://kb.wgu.edu/display/2n/articleDirect/index.asp?aid=1489&r=0.8879663). Practice the dispositions above while working through this course of study. Reflect on your learning and believe that you will learn the material needed to pass your assessment(s). Care about your education by scheduling time each week to devote to your studies. Collaborate with other teachers by interacting in the learning community, and be a leader of change by making suggestions to improve this learning document.

Competencies
There are several academic competencies associated with this Probability and Statistics Course of Study that will be addressed over the next several weeks. The list is a good overview of precisely what you will
know and be able to do at the conclusion of this course of study and demonstrate through the assessment and performance assessment.

**Competency 209.5.1: Problem Solving I**
The graduate applies the principles of probability and statistics to solve problems and to make predictions.

**Competency 209.5.2: Data Collection, Analysis and Display I**
The graduate designs and implements surveys, analyzes data, and summarizes and represents data using appropriate displays.

**Competency 209.5.3: Counting Principles I**
The graduate applies counting principles to determine probabilities.

**Competency 209.5.4: Probability and Expected Value I**
The graduate calculates probabilities for compound events and events involving discrete, normal, and binomial probability distributions; and solves problems involving probability.

**Required Learning Resources:**
**MyStatLab:** This is an online, independent learning resource that includes the required e-textbook for this course of study:

**Week 1**

**Prepare for Success**
To successfully complete GEC1/2 and GET1/2, you will need the appropriate resources to help with your learning. You should also prepare a calendar to schedule times devoted to your studies. Share your calendar with family and friends so they are aware of your obligations.

**Acquire Learning Resources**
Arrange to obtain the learning resources listed below so there will be no delays in your studies. These items are essential for you as this document will guide you weekly in the use of these materials. Some of these items must be shipped to you, so be sure that your mailing address information is current. If you click your name on your AAP, you can check your contact information.

- Enroll in the Required Learning Resources
  Sign up for MyStatLab via the “Available LRs” in your AAP. This is an interactive web version of the text listed below, and it includes a multitude of additional resources such as lectures, interactive applets, practice tests, and other multimedia.

- Download Journal Articles
  Download the following journal articles found in WGU e-reserves. To access the WGU e-reserves, click on the “Resources” tab in the student portal. Then click on the “Library” link. Once there, be sure to copy the Dokutek E-Reserves password seen on that page. Then click the “Enter the WGU Library” link. The “E-Reserves” link is found at the bottom of the next page. Follow that link and then select “Teacher Education”. Once there, click on the “Secondary Mathematics Content” link. Use the password you copied earlier when
prompted. You may read the article online or download it and read it from your computer. See the "FAQ" link if you have trouble downloading or reading these Adobe Acrobat PDF files.

- **Purchase an Appropriate Calculator**
  The TI-84+ Graphing Calculator; its predecessors TI-82, TI-83, or TI-83+; or equivalent calculators of other brands are recommended. Graphing calculators possessing built-in computer algebra systems are not allowed on objective assessments, so we recommend you do not use such a calculator while working on the mathematics tasks and topics. To download your TI screenshots to your computer, you will need a TI Connectivity Kit, available at [http://education.ti.com/educationportal/sites/US/productDetail/us_ti_connectivity_kit.html](http://education.ti.com/educationportal/sites/US/productDetail/us_ti_connectivity_kit.html)

- **Access the Learning Community**
  Learning communities are an integral part of the WGU learning experience. Take advantage of the learning opportunities through communication with your course of study leader and other students. This is a way to ask questions and get concepts clarified by your peers and the course of study mentor. Watch for announcements about Web conferences and other opportunities to meet your peers online. In studying human development, we have found that you can often learn substantially more when working with others than you can learn in isolation. Try it out. See if it is true for you.

- **Best Practices Tool: Get a Study Notebook**
  It is suggested that you create a paper or digital notebook for your study notes as you go through this document. Use organizers or dividers to separate your work. You may want to include a glossary, study notes, topics to revisit, and helpful websites.

  *Note: The resources you are using to master the competencies for this assessment will also be valuable as you as you prepare for the Praxis II exam and any state-mandated mathematics content exams. Therefore, it is recommended that you complete each activity contained in this document.*

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**Elementary Statistics Review I**
The activities for Week 1 will introduce you to a variety of elementary statistics concepts.

**Background Information**
There are a variety of topics that you should review prior to a more in-depth exploration of statistics. During Weeks 1, 2, and 3, you will encounter a review of elementary statistics topics with the intent of constructing a framework to build upon for the understanding of more complex statistic concepts.

During Week 1, a variety of relevant questions will be addressed:
- What are the characteristics of a well-designed and well-conducted investigation?
- What are the different types of data that you may encounter during an investigation?
- How can you identify common misuses of statistics using a critical thinking process?

These are just a few of the important topics that will be covered this week. Think about these questions as you engage in the activities. Be sure to record your thoughts, questions, and subsequent answers in your study notebook for later review prior to the assessments.

**Competency 209.5.1: Problem Solving I**
The graduate applies the principles of probability and statistics to solve problems and to make predictions.
Competency 209.5.2: Data Collection, Analysis, and Display I
The graduate designs and implements surveys, analyzes data, and summarizes and represents data using appropriate displays.

Introductory Statistics Topics
You will be provided with a review of relevant introductory statistics concepts, the types of data that you may encounter, the critical thinking process, and the elements of experimental design.

☐ Study Plan
Go to the “Study Plan” area in MyStatLab and take the sample test for chapter 1A. Based on the sample test results you will be directed to specific sections in chapter 1 that you need to review further.

It is important that you read the text and then work through the identified exercises. These exercises will allow for a mastery of the material.

There is also a multimedia library you can use to help you better visualize those concepts that require further study. Once you have successfully mastered the topics in chapter 1, you should proceed to the next topic.

☐ Final Review
Go to the “Study Plan” area in MyStatLab and take the sample test for chapter 1B. It is important that you wait to take this sample test when you feel you have mastered the concepts in chapter 1. As before, the “Study Plan” will identify any areas of weakness that you will need to address. It is important that you read the text and then work through the identified exercises. You should complete all identified exercises prior to moving on to Week 2.

Week 2
Elementary Statistics Review II
The activities for Week 2 will introduce you to a variety of elementary statistics concepts.

Background Information
There are a variety of topics that you should review prior to a more in-depth exploration of statistics. During Weeks 1, 2, and 3, you will encounter a review of elementary statistics topics with the intent of constructing a framework to build upon for the understanding of more complex statistic concepts.

During Week 2, a variety of relevant questions and topics will be addressed:

Give the definition the following terms:
  • Frequency distributions
  • Histograms and statistical graphics that include frequency polygons
  • Ogive graphs
  • Dot plots
  • Stemplots
  • Pareto charts
  • Pie charts
  • Scatter plots
  • Time-series graphs
Which method should you select to organize and summarize a set of data in an appropriate manner?

How do you use a variety of graphical representations in such a way so that you can support your claims?

These are just a few of the important topics that will be covered this week. Think about these questions as you engage in the activities. Be sure to record your thoughts and answers in your study notebook for later review prior to the assessments.

**Competency 209.5.2: Data Collection, Analysis, and Display I**
The graduate designs and implements surveys, analyzes data, and summarizes and represents data using appropriate displays.

**Summarizing and Graphing Data**
You will be provided with a review of relevant chapter concepts, frequency distributions, histograms, and statistical graphics that include frequency polygons, ogive graphs, dot plots, stemplots, Pareto charts, pie charts, scatter plots, and time-series graphs.

☐ **Study Plan**
Go to the “Study Plan” area in MyStatLab and take the sample test for chapter 2A. Based on the sample test results you will be directed to specific sections in chapter 2 that you need to review further.

It is important that you read the text and then work through the identified exercises. These exercises will allow for a mastery of the material.

There is also a multimedia library you can use to help you better visualize those concepts that require further study. Once you have successfully mastered the topics in chapter 2, you should proceed to the next topic.

☐ **Final Review**
Go to the “Study Plan” area in MyStatLab and take the sample test for chapter 2B. It is important that you wait to take this sample test when you feel you have mastered the concepts in chapter 2. As before, the “Study Plan” will identify any areas of weakness that you will need to address. It is important that you read the text and then work through the identified exercises. You should complete all identified exercises prior to moving on to Week 3.

**Week 3**
**Elementary Statistics Review III**
The activities for Week 3 will introduce you to a variety of elementary statistics concepts.

**Background Information**
There are a variety of topics that should be reviewed prior to a more in-depth exploration of statistics. During Weeks 1, 2, and 3, you will encounter a review of elementary statistics topics with the intent of constructing a framework to build upon for the understanding of more complex statistic concepts. Think of these activities as digging the foundation upon which greater things can later be built.

During Week 3, a variety of relevant questions will be addressed:
- How do you acquire a quantitative measure of the center of a set of data?
- How do you acquire a quantitative measure of dispersion?
• In other words, how do you acquire a quantitative measure that describes the spread of a given data set?
• How do you acquire a quantitative measure of relative standing?
• Why is it useful to use such standardized measures when making comparisons?
• How do you use a variety of descriptive statistics in such a way so that they can support your claims?

These are just a few of the important topics that will be covered this week. Think about these questions as you engage in the activities. Be sure to record your thoughts and answers in your study notebook for later review prior to the assessments.

**Competency 209.5.1: Problem Solving I**
The graduate applies the principles of probability and statistics to solve problems and to make predictions.

**Competency 209.5.2: Data Collection, Analysis, and Display I**
The graduate designs and implements surveys, analyzes data, and summarizes and represents data using appropriate displays.

**Statistics for Describing, Exploring, and Comparing Data**
You will be provided with a review of relevant chapter concepts, measures of center, measures of variation, measures of relative standing, and exploratory data analysis. Consider the following questions: What is the difference between the three measures of central tendency discussed? How can you best present data? Are some graphical representations more appropriate than others?

Think about these questions as you engage in the activities. Be sure to record your thoughts and answers in your study notebook for later review prior to the assessments.

**Study Plan**
Go to the “Study Plan” area in MyStatLab and take the sample test for chapter 3A. Based on the sample test results you will be directed to specific sections in chapter 3 that you need to review further.

It is important that you read the text and then work through the identified exercises. These exercises will allow for a mastery of the material.

There is also a multimedia library you can use to help you better visualize those concepts that require further study. Once you have successfully mastered the topics in chapter 3, you should proceed to the next topic.

**Final Review**
Go to the “Study Plan” area in MyStatLab and take the sample test for chapter 3B. It is important that you wait to take this sample test when you feel you have mastered the concepts in chapter 3. As before, the “Study Plan” will identify any areas of weakness that you will need to address. It is important that you read the text and then work through the identified exercises. You should complete all identified exercises prior to moving on to Week 4.
Week 4

Elementary Probability Review

The activities for Week 4 will introduce you to a variety of elementary probability concepts.

Background Information
There are a variety of topics that you should review prior to a more in-depth exploration of probability.

During Week 4, a variety of relevant questions will be addressed:
- What is probability?
- Probabilities can be combined under the operation of addition or multiplication.
- You will need to understand how to combine probabilities using the addition or multiplication rule to compute probabilities in selected applications.
- In what ways can graphical representations be used to describe selected probabilities?
- How are specific counting practices used to generate probabilities in selected applications?
- How can simulations be used to generate probabilities?

These are just a few of the important topics that will be covered this week. Think about these questions as you engage in the activities. Be sure to record your thoughts and answers in your study notebook for later review prior to the assessments.

Competency 209.5.1: Problem Solving I
The graduate applies the principles of probability and statistics to solve problems and to make predictions.

Competency 209.5.3: Counting Principles I
The graduate applies counting principles to determine probabilities.

Competency 209.5.4: Probability and Expected Value I
The graduate calculates probabilities for compound events and events involving discrete, normal, and binomial probability distributions and solves problems involving probability.

Probability
You will be provided with a review of relevant chapter concepts, fundamental probability concepts, the addition rule, the multiplication rule, complements and conditional probability, probability through simulations, counting, and Bayes' theorem. Consider the following questions: When is it appropriate to use each of these rules? When is it inappropriate to do so? How can you tell when each is appropriate or not?

Think about these questions as you engage in the activities. Be sure to record your thoughts and answers in your study notebook for later review prior to the assessments.

Study Plan
Go to the “Study Plan” area in MyStatLab and take the sample test for chapter 4A. Based on the sample test results you will be directed to specific sections in chapter 4 that you need to review further.

It is important that you read the text and then work through the identified exercises. These exercises will allow for a mastery of the material.

There is also a multimedia library you can use to help you better visualize those concepts that require further study. Once you have successfully mastered the topics in chapter 4, you should proceed to the next topic.
Final Review

Go to the “Study Plan” area in MyStatLab and take the sample test for chapter 4B. It is important that you wait to take this sample test when you feel you have mastered the concepts in chapter 4. As before, the “Study Plan” will identify any areas of weakness that you will need to address. It is important that you read the text and then work through the identified exercises. You should complete all identified exercises prior to moving on to Week 5.

Week 5
Probability Distributions
The activities for Week 5 will introduce you to selected probability distributions.

Background Information
The study of probability distributions will help you to better visualize elementary statistics and probability concepts in the context of real-world applications. During this week, you will explore discrete and normal probability distributions.

During Week 5, a variety of relevant questions will be addressed:

- What is the difference between a discrete and continuous random variable?
- What is mathematical expectation?
- What is a probability distribution?
- In which applications do discrete random variables arise?
- In which applications do continuous random variables arise?
- How can probability distributions be used to support claims regarding discrete or continuous random variables?
- What are the characteristics of each distribution?
- How will you know when to use each?

These are just a few of the important topics that will be covered this week. Think about these questions as you engage in the activities. Be sure to record your thoughts and answers in your study notebook for later review prior to the assessments.

Competency 209.5.4: Probability and Expected Value I
The graduate calculates probabilities for compound events and events involving discrete, normal, and binomial probability distributions; and solves problems involving probability.

Probability Distributions
Activities have been provided to facilitate an exploration of both discrete and normal probability distributions. With regard to discrete probability distributions, you will be provided with a review of relevant chapter concepts, random variables, binomial probability distributions, mean, variance, and standard deviation for the binomial distribution, and the Poisson distribution. With regard to normal probability distributions, you will be provided with a review of relevant chapter concepts, the standard normal distribution, applications of normal distributions, sampling distributions and estimators, the central limit theorem, the use of the normal distribution as an approximation to the binomial distribution, and the assessment of normality. Critically think about the similarities and differences that exist with regard to how to use probability distributions to describe discrete and continuous random variables in selected applications.
Study Plan
Go to the “Study Plan” area in MyStatLab and take the sample tests for chapters 5A and 6A. Based on the sample test results you will be directed to specific sections in chapters 5 and 6 that you need to review further.

It is important that you read the text and then work through the identified exercises. These exercises will allow for a mastery of the material.

There is also a multimedia library you can use to help you better visualize those concepts that require further study. Once you have successfully mastered the topics in chapters 5 and 6, you should proceed to the next topic.

Final Review
Go to the “Study Plan” area in MyStatLab and take the sample test for chapters 5B and 6B. It is important that you wait to take this sample test when you feel you have mastered the concepts in chapters 5 and 6. As before, the “Study Plan” will identify any areas of weakness that you will need to address. It is important that you read the text and then work through the identified exercises. You should complete all identified exercises prior to moving on to Week 6.

Week 6
Bivariate Data Analysis
The activities for Week 6 will introduce you to several techniques that can be used to analyze bivariate data.

Background Information
As the name suggests, bivariate data analysis involves the analysis of two variables. One variable is called the independent variable whereas the other variable is called the dependent variable. Bivariate analyses attempts to ascertain whether or not there exists a mathematical relationship between an independent and dependent variable (correlation). If a discernible relationship exists, you can then attempt to construct a best fit mathematical model (regression) from a given data set with the goal of using the constructed model to make future predictions. Since this analysis involves two variables, you can also use a Cartesian plane to visualize the existence of trends or patterns by plotting the independent variable along the abscissa (x-axis) and the dependent variable along the ordinate axis (y-axis). Such graphing of ordered pairs \((x, y)\) generates graphs called scatter plots or scatter diagrams. These graphs were initially discussed in section 2.4 in *Elementary Statistics*.

During Week 6, a variety of relevant questions will be addressed:

- What is the independent and dependent variable in a selected application?
- How do you construct an appropriate graphical representation for a selected bivariate relationship?
- How do you use correlation results to support claims regarding a bivariate relationship that is under investigation?
- How can you use linear regression results to make future predictions in selected applications?

These are just a few of the important topics that will be covered this week. Think about these questions as you engage in the activities. Be sure to record your thoughts and answers in your study notebook for later review prior to the assessments.
Competency 209.5.1: Problem Solving I
The graduate applies the principles of probability and statistics to solve problems and to make predictions.

Correlation and Regression
You will be provided with a review of the following relevant chapter concepts: correlation, regression, variation and prediction intervals, multiple regression, and modeling.

☐ Study Plan
Go to the “Study Plan” area in MyStatLab and take the sample test for chapter 10A. Based on the sample test results you will be directed to specific sections in chapter 10 that you need to review further.

It is important that you read the text and then work through the identified exercises. These exercises will allow for a mastery of the material.

There is also a multimedia library you can use to help you better visualize those concepts that require further study. Once you have successfully mastered the topics in chapter 10, you should proceed to the next topic.

☐ Final Review
Go to the “Study Plan” area in MyStatLab and take the sample test for chapter 10B. It is important that you wait to take this sample test when you feel you have mastered the concepts in chapter 10. As before, the “Study Plan” will identify any areas of weakness that you will need to address. It is important that you read the text and then work through the identified exercises. You should complete all identified exercises prior to moving on to Week 7.

Week 7
Objective Assessment
The activities for Week 7 will provide you with an opportunity to reflect on the content that was covered during Weeks 1 through 6 with the intent of preparing you for taking the objective assessment. Be sure to review your study notebook as a good way to refresh your memory of all the topics you have studied and your answers to the reflective questions posed throughout this course of study.

Background Information
During Weeks 1 through 6, you have covered many topics relevant to statistics and probability. These topics include introductory statistics topics; summarizing and graphing data; statistics for describing, exploring, and comparing data; probability; probability distributions; and correlation and regression. During Week 7, it will be important for you to reflect on prior understandings with the intent of preparing for the objective assessment. You will also review the results from the tests you’ve taken so far in the “Study Plan,” and you are encouraged to focus your preparation on those areas in which you scored poorly.

Competency 209.5.1: Problem Solving I
The graduate applies the principles of probability and statistics to solve problems and to make predictions.

Competency 209.5.2: Data Collection, Analysis, and Display I
The graduate designs and implements surveys, analyzes data, and summarizes and represents data using appropriate displays.
Competency 209.5.3: Counting Principles I
The graduate applies counting principles to determine probabilities.

Competency 209.5.4: Probability and Expected Value I
The graduate calculates probabilities for compound events and events involving discrete, normal, and binomial probability distributions; and solves problems involving probability.

Preparing for the Objective Assessment
It is important that you reflect on your performance on each of the sample tests you took during Weeks 1 through 6. The activity provided below will provide guidance with regard to how you should reflect on prior assessments with the intent of preparing for the objective assessment. It is now time to review the data that you generated during the past few weeks to make informed decisions with regard to whether or not you are ready to take the preassessment.

☐ Reflection
During Weeks 1 through 6, you completed 2–4 sample tests per week for a total of 14 sample tests. Carefully review the sample test results for parts A and B of chapters 1–6, and 10. Reflect on your performance on each of these sample tests: Which concepts did you perform well on? Which concepts did you encounter difficulties with? Did you carefully use the “Study Plan” for chapters 1–6, and 10 to identify where your strengths and weaknesses were? For problematic areas, did you complete each of the identified exercises to receive further assistance? Remember that these exercises provide immediate feedback to help you resolve any problems that you may be encountering.

It is important that you reread relevant sections in the Elementary Statistics textbook and engage in any relevant animations, videos, and exercises that arise throughout each of these sections to assist in your review of those identified areas that require further study. Once you have successfully mastered the topics in the aforementioned chapters, you should proceed to the next topic.

☐ Taking the Preassessment (PGEC)
At this point, you need to critically think about whether or not you should take the preassessment for the objective assessment based on the available data (i.e., 14 sample test results). To take the preassessment, you should submit your request to take it via your Academic Action Plan (AAP) in the usual way.

Note: Remember that the validity of the preassessment is diminished every time you take it. It is for this reason you are not permitted an unlimited number of attempts.

Note: Please treat every attempt as a serious effort at assessing how much you know in anticipation of taking the objective assessment.

☐ Preassessment
To take the preassessment:
1. Log in to the MyWGU Student Portal.
2. Click on the “AAP” tab.
3. Click on the “GEC Course Code” link on the left-hand side of your AAP.
4. On the “Assessment Detail” screen, select the “Preassessment” tab.
5. Follow the instructions for placing the referral.
6. Coordinate with your mentor who will approve the referral.
☐ Taking the Objective Assessment (GEC1/2)

At this point, you need to decide whether or not you should take the objective assessment, based on the available evidence (i.e., 14 sample test results, plus a passing score on the preassessment). To take the objective assessment, you should submit your request to take it via your Academic Action Plan in the usual way.

Note: Remember that the validity of the objective assessment is diminished every time you take it. It is for this reason you are not permitted an unlimited number of attempts. Note: Please treat every attempt as a serious effort to pass the objective assessment. Retaking the objective assessment may require administrative review which requires you to provide evidence to justify your next attempt which extends well beyond just passing the preassessment.

Once you pass the objective assessment, you need to ask your mentor to refer you for the performance assessment. At this point, you should proceed to Week 8.

☐ Objective Assessment

To take the objective assessment:
1. Log in to the MyWGU Student Portal.
2. Click on the “AAP” tab.
3. Click on the “GEC Course Code” link on the left-hand side of your AAP.
4. On the “Assessment Detail” screen, select the “Assessment Referral” tab.
5. Follow the instructions for placing the referral.
6. Coordinate with your mentor who will approve the referral.
7. Keep a keen eye on the required completion date when scheduling your objective assessment. Objective assessments take at least 14 days to schedule.

Week 8

Simulations

The activities for Week 8 will further refine and extend understandings that were acquired during Week 4 that pertain to using simulations to make informed decisions.

Background Information

During Week 8, you will be provided with an opportunity to learn more about using simulations to generate probabilities relevant to selected, real-life applications. During Week 4, you were provided with a review of fundamental probability concepts, the addition rule, the multiplication rule, complements and conditional probability, probability through simulations, counting, and Bayes’ theorem.

During Week 8, a variety of relevant questions will be addressed to further refine and extend what you learned during Week 4.
• What is a simulation?
• Which simulation methods are computer based and which are not?
• How are these simulation methods used to generate probabilities relevant to real-life applications?

These are just a few of the important topics that will be covered this week. Think about these questions as you engage in the activities. Be sure to record your thoughts and answers in your study notebook for later review prior to the assessments.
Competency 209.5.1 Title: Problem Solving I
The graduate applies the principles of probability and statistics to solve problems and to make predictions.

Probabilities Through Simulations
You will be provided with a review of relevant chapter concepts, fundamental probability concepts, the addition rule, multiplication rule, complements and conditional probability, probability through simulations, counting, and Bayes’ theorem. A special emphasis will be placed on how to use simulations to generate selected probabilities relevant to a variety of real-life applications.

☐ Study Plan
Recall that during Week 4 you completed sample tests for chapters 4A and 4B. During Week 8, you should begin by revisiting your performance on these sample tests with the intent of reviewing each of the areas that you were weak in. Such review may require that you complete additional exercises identified by each sample test and that you reread relevant sections.

It is important that you carefully reread section 4.6 (“Probabilities Through Simulations”) in Elementary Statistics. As you review this section, click on “Video” or “Animation” to reinforce target understandings. You should also work through each of the examples and relevant highlighted exercises labeled “You Try It,” which span this section. Finally, you should work through each of the highlighted exercises labeled “Exercises” at the end of this section.

☐ Learning Abstract Statistics Concepts Using Simulation
Read through the Mills e-reserve article and reflect on ways that computer simulation methods (CSMs) can be used to promote learning abstract statistics concepts. Which abstract statistics concepts do teachers recommend that CSMs be used to teach? Which theoretical framework of how you learn statistics was this article based on? In what ways can you link using CSMs to teaching selected abstract statistics concepts in the context of this theoretical framework? Once you have read through this article and found the answers to these questions, you should proceed to Week 9.

☐ Course of Study Task 1
Complete course of study task 1 in TaskStream. Be sure to check your submission against the scoring rubric before submitting your task for evaluation. Remember that you will need to successfully complete all of the course of study tasks before referring for the GET summative performance assessment.

Week 9
Designing Investigations
The activities for Week 9 will further refine prior understandings to help you acquire knowledge that is essential for designing investigations.

Background Information
What does it mean to conduct an investigation? Although this question may appear to be easy to answer, it is not easy to answer for a variety of reasons. You need to realize that there are many different types of investigations. How you respond to this question will depend on your perspective and the nature of the problem that you choose to study. Would a forensic scientist, botanist, teacher, or doctor conduct an investigation in the same way? A forensic scientist would be interested in investigating the presence
of any evidence at the scene of a crime that may assist in identifying the perpetrator(s) of a crime and reconstruction of a crime. A botanist may want to investigate how well a new fertilizer promotes growth and a particular flower’s development. A teacher may want to investigate how effective a new pedagogical approach is at promoting the acquisition of target understandings and skills. A doctor may want to investigate how effective a particular experimental drug is in order to treat a specific type of cardiac arrhythmia. Clearly, each investigation is unique and will require a specialized design, implementation methodology, and analysis. Are there any common themes? Each investigation is focused on extracting data from a given system with the intent of making informed decisions. To obtain the necessary data to resolve each problem, you need to focus on how you go about designing, implementing, and analyzing the results of each investigation.

During Weeks 9, 10, and 11, you will explore three topics, which include design (Week 9), implementation (Week 10), and analysis (Week 11). In an effort to help you construct an original investigation for the culminating TaskStream task, you will continue to explore the following examples of investigations during the next three weeks: How do the design, implementation, and analysis associated with a selected investigation depend on the nature of the investigation? The understanding required to answer this question will serve as the framework upon which you can develop your own original investigation.

Note: Remember that these examples are to be used for illustrative purposes and are not required topics for the investigation that you will need to construct. You are free to choose a topic that is commensurate with your interests and fulfills the requirements set forth in the task directions.

- **Plant Growth and Development** – A student is interested in investigating how well a selected fertilizer promotes the growth and development of a particular plant over a specified period of time (i.e., How does the level of fertilizer influence plant growth and development over a period spanning six months?).
- **Advertising Patterns** – A student is interested in investigating whether or not there are any advertising patterns in a selected medium over a specified period of time (i.e., During prime time, are there any weekly patterns with regard to the frequency of political, restaurant, theatrical, programming, or store television commercial advertisements over a period spanning two months?).
- **Technology Usage** – A student is interested in investigating how well a selected pedagogy promotes technology usage in a particular classroom over a specified period of time (i.e., In what ways does a selected pedagogy influence graphing calculator usage in a classroom for a unit that spans three weeks?).
- **Stock Market Patterns** – A student is interested in investigating whether or not there are any stock market patterns over a specified period of time (i.e., Are there any weekly patterns with regard to the closing stock prices for companies A, B, C, D, and E over a period spanning six months?).
- **Behavioral Patterns** – A student is interested in investigating whether or not there are behavioral patterns exhibited by an animal or human participant over a specified period of time (i.e., On Saturdays and Sundays, which sections of a selected bookstore experience the highest frequency of customers during a specified hour during the day over a period spanning one year?).

Hopefully you can see that each of these investigation examples will require a unique and distinctive design, implementation protocol, and analysis. Unfortunately there is no such thing as a learning resource that describes how to construct a perfect investigation. Since there are infinitely many perspectives and problems out there, there cannot be a recipe for conducting a perfect investigation to solve a problem. The good news is that there are logical ways to go about constructing an investigation so that your decisions are informed and feasible based on the available evidence.
Competency 209.5.2: Data Collection, Analysis, and Display I
The graduate designs and implements surveys, analyzes data, and summarizes and represents data using appropriate displays.

Design
In the context of five investigation examples given above, relevant connections can be made between prior understandings and how the design of a selected investigation is dependent upon the nature of the investigation.

☐ Construction of Design
Five investigation examples were provided with the intent of illustrating how the design of a selected investigation is dependent upon the nature of the investigation. The examples included plant growth and development, technology usage, advertising, stock market patterns, and behavioral patterns.

For each of these examples, you should ask some important questions:

• What is the purpose of the investigation?
• What is the target population?
• What is the sampling methodology?
• How would you describe the sample(s) that will be used?
• What are the variables (i.e., dependent vs. independent, levels of measurement, etc.)?
• Is it important to establish a baseline or use a control group?

Prior to answering these questions, you should carefully reread chapters 1, 2, and 3 in Elementary Statistics to reinforce the knowledge you acquired during Weeks 1, 2, and 3, respectively. Once you have carefully reread these chapters, you should attempt to make relevant connections between the content in these chapters to the construction of a response to each of these questions for each example.

Consider the first example, which involves plant growth and development. The purpose of this investigation is to assess the extent to which a selected fertilizer promotes plant growth and development over a specified period of time. The target population of this investigation includes all plants that have the scientific name of the plant that will be studied. The sampling methodology will involve random sampling where seeds will be selected at random from a package. The sample will consist of one seed for each group for a total of eight seeds (one seed for control group, seven seeds for each experimental group containing different levels of fertilizer). The variables will include a dependent variable that involves plant growth and development (i.e., height of plant, level of measurement = ratio) and the independent variable will include the level of fertilizer used (i.e., weight in grams, level of measurement = ratio). In this case, you will use a control group (i.e., seeds planted in soil with no fertilizer) and several experimental groups (i.e., seeds planted in soil with varying levels of fertilizer) for comparison.

At this point, you should now apply a similar logic to each of the remaining investigation examples to respond to the aforementioned questions. Once you complete this activity, you should think about how you will design your original investigation. It is important that you apply and answer each of the aforementioned questions in the context of your proposed design. Once you have completed this activity, you should proceed to Week 10.
Week 10

Implementing Investigations

The activities for Week 10 will further refine prior understandings to help you acquire target understandings that are essential for implementing investigations.

Background Information

During Weeks 9, 10, and 11, you will explore three topics, which include design (Week 9), implementation (Week 10), and analysis (Week 11). In an effort to help you construct an original investigation for the culminating TaskStream task, you will continue to explore the following examples of investigations: How do the design, implementation, and analysis associated with a selected investigation depend on the nature of the investigation? The understandings required to answer this question will serve as the framework upon which you can develop your own original investigation.

Note: Remember that these examples are to be used for illustrative purposes and are not required topics for the investigation that you will need to construct. You are free to choose a topic that is commensurate with your interests and fulfills the requirements set forth in the task directions.

- **Plant Growth and Development** – A student is interested in investigating how well a selected fertilizer promotes the growth and development of a particular plant over a specified period of time (i.e., How does the level of fertilizer influence plant growth and development over a period spanning six months?).
- **Advertising Patterns** – A student is interested in investigating whether or not there are any advertising patterns in a selected medium over a specified period of time (i.e., During prime time, are there any weekly patterns with regard to the frequency of political, restaurant, theatrical, programming, or store television commercial advertisements over a period spanning two months?).
- **Technology Usage** – A student is interested in investigating how well a selected pedagogy promotes technology usage in a particular classroom over a specified period of time (i.e., In what ways does a selected pedagogy influence graphing calculator usage in a classroom for a unit that spans three weeks?).
- **Stock Market Patterns** – A student is interested in investigating whether or not there are any stock market patterns over a specified period of time (i.e., Are there any weekly patterns with regard to the closing stock prices for companies A, B, C, D, and E over a period spanning six months?).
- **Behavioral Patterns** – A student is interested in investigating whether or not there are behavioral patterns exhibited by an animal or human participant over a specified period of time (i.e., On Saturdays and Sundays, which sections of a selected bookstore experience the highest frequency of customers during a specified hour during the day over a period spanning one year?).

During Week 9, you acquired the rudimentary skills necessary for designing an investigation. During Week 10, you will critically think about what implementing an investigation involves.

**Competency 209.5.2: Data Collection, Analysis, and Display I**

The graduate designs and implements surveys, analyzes data, and summarizes and represents data using appropriate displays.

**Construction of Implementation Methodology**

In the context of five investigation examples, relevant connections can be made between prior understandings and how the implementation methodology of a selected investigation is dependent upon the nature of the investigation.
Implementation Methodology

Five investigation examples were provided with the intent of illustrating how the implementation of a selected investigation is dependent upon the nature of the investigation. The examples included plant growth and development, technology usage, advertising, stock market patterns, and behavioral patterns. For each of these examples, you should ask some important questions:

- What materials are needed for the investigation?
- What types of measurements will you be recording (i.e., behavior, length, etc.)?
- How will you record the data?
- How much time will you allot for recording measurements per day, week, or month?
- How long will the investigation take?

Prior to answering these questions, you should review the animated tour of figures 1–3 Statistical Studies in section 1.4 Design of Experiments in Elementary Statistics. You will be taken on tour through a typical flowchart used to review the kinds of statistical studies that can be used in different situations. This exploration will help you better organize your plans when you construct an implementation strategy for your investigation. Once you have taken this tour, you should attempt to make relevant connections between the content in this tour to the construction of a response to each of these questions for each example.

Consider the first example, which involves plant growth and development. The materials you will need will include eight clay pots (one for the control group, seven for the experimental groups), potting soil, eight seeds, a water can, access to water, a metric ruler, a dedicated location on the windowsill for the plants to grow, fertilizer, a scale to assess how much fertilizer is used per pot, and a composition notebook and pen to record observations. Use a spreadsheet program to analyze the data. Measurements of plant growth and development will be based on plant height. Length determinations will be made using a metric ruler and then recorded in pen in a composition notebook. The time that will be allotted per day for measurements will be approximately 10 minutes. The length of the investigation will span six months.

At this point, you should now apply a similar logic to each of the remaining investigation examples to respond to the aforementioned questions. Once you complete this activity, you should think about how you will implement your original investigation. It is important that you apply and answer each of the aforementioned questions in the context of your proposed implementation methodology. Once you have completed this activity, you should proceed to Week 11.

Week 11
Analyzing Investigations

The activities for Week 11 will further refine prior understandings to help you acquire target understandings that are essential for analyzing investigations.

Background Information

During Weeks 9, 10, and 11, you will explore three topics, which include design (Week 9), implementation (Week 10), and analysis (Week 11). In an effort to help you construct an original investigation for the culminating TaskStream task, you will continue to explore the following examples of investigations: How do the design, implementation, and analysis associated with a selected investigation depend on the nature of the investigation? The understanding required to answer this question will serve as the framework upon which you can develop your own original investigation.
Note: Remember that these examples are to be used for illustrative purposes and are not required topics for the investigation that you will need to construct. You are free to choose a topic that is commensurate with your interests and fulfills the requirements set forth in the task directions.

• **Plant Growth and Development** – A student is interested in investigating how well a selected fertilizer promotes the growth and development of a particular plant over a specified period of time (i.e., How does the level of fertilizer influence plant growth and development over a period spanning six months?).

• **Advertising Patterns** – A student is interested in investigating whether or not there are any advertising patterns in a selected medium over a specified period of time (i.e., During prime time, are there any weekly patterns with regard to the frequency of political, restaurant, theatrical, programming, or store television commercial advertisements over a period spanning two months?).

• **Technology Usage** – A student is interested in investigating how well a selected pedagogy promotes technology usage in a particular classroom over a specified period of time (i.e., In what ways does a selected pedagogy influence graphing calculator usage in a classroom for a unit that spans three weeks?).

• **Stock Market Patterns** – A student is interested in investigating whether or not there are any stock market patterns over a specified period of time (i.e., Are there any weekly patterns with regard to the closing stock prices for companies A, B, C, D, and E over a period spanning six months?).

• **Behavioral Patterns** – A student is interested in investigating whether or not there are behavioral patterns exhibited by an animal or human participant over a specified period of time (i.e., On Saturdays and Sundays, which sections of a selected bookstore experience the highest frequency of customers during a specified hour during the day over a period spanning one year?).

During Weeks 9 and 10, you acquired the rudimentary skills necessary for designing and implementing an investigation, respectively. During Week 11, you will critically think about what analyzing the results from an investigation involves.

**Competency 209.5.2: Data Collection, Analysis, and Display I**
The graduate designs and implements surveys, analyzes data, and summarizes and represents data using appropriate displays.

**Construction of Analysis**
In the context of five investigation examples, relevant connections can be made between prior understandings and how the analysis of a selected investigation is dependent upon the nature of the investigation.

**Analysis**
Five investigation examples were provided with the intent of illustrating how the analysis of a selected investigation is dependent upon the nature of the investigation. The examples included plant growth and development, technology usage, advertising, stock market patterns, and behavioral patterns. For each of these examples, you should ask some important questions:

• Which statistical methods and graphical representations will you use to summarize the results of your investigation?

• How will these methods and representations be used to make informed decisions?

Prior to answering these questions, you should carefully review chapters 2 and 3 in *Elementary Statistics* to reinforce the target understandings that were acquired during Weeks 2 and 3, respectively. Once you have carefully reread these chapters, you should...
attempt to make relevant connections between the content in these chapters to the
construction of a response to each of these questions for each example.

Consider the first example, which involves plant growth and development. Suppose that
there was a control plant (no fertilizer) and seven experimental groups, which include
plants exposed to varying levels of fertilizer (low to high levels).
  • Descriptive statistics, which include quantitative measures of central tendency (i.e.,
    mean) and variation (i.e., standard deviation) could be used to assess weekly
    changes in plant height for the control and experimental groups over a period of
    six months.
  • You could generate a scatter plot of average weekly plant height vs. time for the
    control and each experimental group. All eight scatter plots could be superimposed
    onto a single scatter plot for comparison.
  • You could compare the scatter control group’s scatter plot to each experimental
    group to assess the influence that different levels of fertilizer would have on plant
    height over a six-month period.

Try to envision these results. What do you think would happen? Through a careful
analysis of these results, you may be able to identify an appropriate level of fertilizer to
use to promote a higher than normal plant growth and development (i.e., plant height)
over a six-month period.

At this point, you should now apply a similar logic to each of the remaining investigation
examples to respond to the aforementioned questions. Once you complete this activity,
you should think about how you will analyze your original investigation. It is important that
you apply and answer each of the aforementioned questions in the context of how you will
ultimately analyze the data that will be collected. Once you have completed this activity,
you should proceed to the next topic.

☐ Quantitative and Qualitative Research: Beyond the Debate

Read through the Gelo, Braakmann, & Benetka e-reserves article to further refine and
extend your understanding of investigation design, implementation, and analysis.
Although this article focuses on psychological research, several important questions that
are relevant across many content areas are addressed in this article:

What are several differences between qualitative and quantitative research approaches?
  • Go to table 1 to compare these differences.

What is validity?
  • Compare and contrast the different types of validity that are discussed in this
    article.

What is the difference in the sampling, data collection, data analysis, and data
interpretation methodologies used in qualitative and quantitative research?
  • Go to table 2 to compare and contrast these differences.

What is a mixed methods research design?
What is triangulation?

Once you have read through this article to answer these questions, you should critically
think about how these topics relate to the investigation that you plan to conduct. A
thorough understanding of the topics covered in this article will not only help you to further
refine your investigation, the acquired understandings will also help you plan to engage in
more complex research endeavors long after you pass the summative assessment. Upon the completion of this activity, you should proceed to Week 12.

**Week 12**

**Design, Implement, and Analyze an Investigation**

You will have an opportunity to demonstrate your understanding of how to design, implement, and analyze the results of an original investigation that requires data collection, display, and interpretation.

**Background Information**

During Weeks 9, 10, and 11, you explored three topics, which included design (Week 9), implementation (Week 10), and analysis (Week 11). In an effort to help you construct an original investigation for the summative performance assessment in TaskStream, you have explored the following examples of investigations. How do the design, implementation, and analysis associated with a selected investigation depend on the nature of the investigation?

At this point, you should have acquired the understandings required to answer this question. They will serve as the framework upon which you can develop your own original investigation.

*Note: Remember that these examples are to be used for illustrative purposes and are not required topics for the investigation that you will need to construct. You are free to choose a topic that is commensurate with your interests and fulfills the requirements set forth in the task directions.*

- **Plant Growth and Development** – A student is interested in investigating how well a selected fertilizer promotes the growth and development of a particular plant over a specified period of time (i.e., How does the level of fertilizer influence plant growth and development over a period spanning six months?).

- **Advertising Patterns** – A student is interested in investigating whether or not there are any advertising patterns in a selected medium over a specified period of time (i.e., During prime time, are there any weekly patterns with regard to the frequency of political, restaurant, theatrical, programming, or store television commercial advertisements over a period spanning two months?).

- **Technology Usage** – A student is interested in investigating how well a selected pedagogy promotes technology usage in a particular classroom over a specified period of time (i.e., In what ways does a selected pedagogy influence graphing calculator usage in a classroom for a unit that spans three weeks?).

- **Stock Market Patterns** – A student is interested in investigating whether or not there are any stock market patterns over a specified period of time (i.e., Are there any weekly patterns with regard to the closing stock prices for companies A, B, C, D, and E over a period spanning six months?).

- **Behavioral Patterns** – A student is interested in investigating whether or not there are behavioral patterns exhibited by an animal or human participant over a specified period of time (i.e., On Saturdays and Sundays, which sections of a selected bookstore experience the highest frequency of customers during a specified hour during the day over a period spanning one year?).

As a result of carefully considering each of these examples during Weeks 9, 10, and 11, you should now be able to identify the unique and distinctive design, implementation protocol, and analysis associated with different types of investigations. Unfortunately, there is no such thing as a learning resource that describes how to construct a perfect investigation. Since there are infinitely many perspectives and problems out there, there cannot be a recipe for conducting a perfect investigation to solve a problem. The good news is that there are logical ways to go about constructing an investigation so that your decisions are informed and feasible based on the available evidence.
Competency 209.5.2: Data Collection, Analysis, and Display I
The graduate designs and implements surveys, analyzes data, and summarizes and represents data using appropriate displays.

**Application—Design, Implement, and Analyze an Investigation**
You will have an opportunity to demonstrate your understanding of how to design, implement, and analyze the results of an original investigation that requires data collection, display, and interpretation.

- **Performance Assessment**
  Talk to your mentor about being referred for GET1/2 through your AAP. After being referred, you will be able to access the GET1/2 summative assessment in TaskStream. The directions for this task can be found in TaskStream.

Now that you have reached this point in the course of study, it is time to construct a response to the summative assessment for final review. Using the Summative Task Template that was mentioned at the beginning of this course of study, you should further refine your responses for submission in TaskStream for final review and evaluation.

*Note: It is important for you to plan ahead since the timeline for the construction and submission of the summative assessment may vary (i.e., exceed 12 weeks) depending on the nature and scope of your investigation.*

**Conclusion**
Congratulations! You have completed a rigorous course of study that focused on the study of selected probability and statistics topics. These topics included introductory statistics topics; summarizing and graphing data; statistics for describing, exploring, and comparing data; probability; probability distributions; and correlation and regression. Upon successful completion of the objective exam, you then implemented an investigation where you had to demonstrate your ability to apply what you learned to study a real-world problem of your own choosing. At this point, you should be commended for all of your hard work in making it this far in your program. Great job!

**Background Information**
How does the study of probability and statistics apply to your profession? This branch of mathematics has relevance across many professions since the overwhelming majority of the topics that you studied attempted to help you critically think about the world around them. Many of the skills that you should acquire from the study of probability and statistics involve the ability to critically think about the available evidence, with the intent of making decisions that are informed. To that end, successful completion of this course of study should make you feel confident in your ability to apply these critical thinking skills when called to do so.

**Feedback**
If you wish to provide feedback on this course of study, please contact Conrad Lotze at clotze@wgu.edu.