MATH 411A PROBABILITY THEORY
FALL 2020 (Sept 9-Nov 20)

Instructor: Sahadeb Upretee, PhD
E-mail: upretees@cwu.edu
Office Hours: MTWR 10 - 10:50am or by appointment
Classroom: Online Web
Class Time: MTWR 11 AM - 11:50AM

TEXTBOOK: Hogg R.V, Tanis E. A., and Zimmerman D. L. (2015): *Probability and Statistical Inference*, 9th Ed. Pearson.

PRE-REQUISITES: Math 273 with a grade C or higher; permission

COURSE CONTENT: This course provides basic knowledge of the fundamental probability tools for quantitatively assessing risk. By applying these tools students can find mean, variance, distribution, and other properties of both discrete and continuous distributions.

Chapter 1: Probability
Properties of Probability, Methods of Enumeration, Conditional Probability, Independent Events, Bayes' Theorem.

Learning Outcomes
The students will be able to:

- Define set functions, Venn diagrams, sample space, and events. Define probability as a set function on a collection of events and state the basic axioms of probability.
- Calculate probabilities using addition and multiplication rules.
- Define independence and calculate probabilities of independent events.
- Calculate probabilities of mutually exclusive events.
- Define and calculate conditional probabilities.
- Calculate probabilities using combinatorics, such as combinations and permutations.
- State Bayes Theorem and the law of total probability and use them to calculate conditional probabilities

Chapter 2: Discrete Distributions
Discrete Random Variables, Mathematical Expectation, Special Mathematical Expectations, Binomial Distribution, Negative Binomial Distribution, Poisson Distribution.

Learning Outcomes
The students will be able to:

- Apply the concepts of random variables, probability and probability density functions, cumulative distribution functions.
- Calculate mean variance, standard deviation, and coefficient of variation
- Define probability generating functions and moment generating functions and use them to calculate probabilities and moments

Chapter 3: Continuous Distributions
Continuous Random Variables, Exponential, Gamma, and Chi-Square Distributions, Normal Distribution, other Models.

Learning Outcomes
The students will be able to:

- Apply the concepts of random variables, probability and probability density functions, cumulative distribution functions.
- Calculate expected value, mode, median, percentile, and higher moments
- Calculate mean variance, standard deviation, and coefficient of variation
- Define probability generating functions and moment generating functions and use them to calculate probabilities and moments

Chapter 4: Bivariate Distributions
Discrete Bivariate Distributions, Correlation Coefficient, Conditional Distributions.

Learning Outcomes
The students will be able to:

- Explain and perform calculations concerning joint probability functions, probability density functions, and cumulative distribution functions.
- Determine conditional and marginal probability functions, probability density functions, and cumulative distribution functions.
- Calculate moments for joint, conditional, and marginal random variables.
- Explain and apply joint moment generating functions.
- Calculate variance, standard deviation for conditional and marginal probability distributions

REQUIRED CALCULATOR: A scientific calculator is required. If you are planning to take Exam P, some recommended calculators are TI-30XS MultiView, TI-30Xa, TI-30X II (IIS solar or IIB battery).

IMPORTANT DATES:
Wednesday, Sep 9 – First day of classes.
Class End: Nov 13
Study day: Nov 16
Midterm Exam One: Oct 1
Midterm Exam Two: Oct 29
Comprehensive Final Exam: Update later

EVALUATIONS:

Class Participation:	5%
Weekly Assignments:	30%
Midterm Exam One:	20%
Midterm Exam Two:	20%
Comprehensive Final Exam:	25%

Note: In the Class Participation, I expect your active involvement while discussion in the online class.

GRADING SCALE (MINIMUM CUTOFFS):

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
93	90	87	83	80	77	73	70	67	63	60	below 60

NOTE: This course covers most of SOA Exam P material. Students are encouraged to take Exam P in March and enroll in MATH416A next quarter. For more information, see https://www.soa.org/education/exam-req/edu-exam-p-detail.aspx

BLACKBOARD ULTRA ACCESS: The course information, assignment, and announcements will be posted on Canvas. Real time class, and office hours will be held on **Blackboard Ultra**. To get your real time class: First Log into Canvas then click on Blackboard Ultra which is button in the left-hand menu in Canvas, then click on class link.

EMAIL CORRESPONDENCE: I will respond to student communications during business hours (M-F, 8am-5pm). You can typically expect a reply within approximately 24 hours, not including weekends. If you email me with questions about specific problems, I can be more helpful if you send pictures of what you've tried so far.

HOMEWORK: Each week homework will be assigned, and due dates will be announced in the Canvas. I will select homework problems from both the textbook and relevant SOA sample questions. Students are encouraged to discuss among the friends but do not copy other's work directly. If I find identical solutions, then both parties will get zero points. Your work should be clear, in a logical order, and provide sufficient explanation. You must upload a single pdf file of the homework into Canvas.

EXAM POLICY: There will be two midterm exams and one comprehensive final exam. All exams are cumulative. They will be taken in Canvas, will be timed, and you will be allowed to use your book and notes. You must upload your written exam as a single pdf file in Canvas.

TIME INVESTMENT REQUIREMENT**:**
The information listed below illustrates the total investment of time by an average student to achieve the learning goals of the course. (30 hours/credit x 4 = 120 hours)
The amount of time that an average student should expect to spend on this class is as follows:

- 40 hours - Time spent in the classroom, online instruction, taking exams and doing worksheets etc.
- 80 hours - Time for preparation and study for in-class worksheets, homework, monthly and final exams, discussion during the office hours.

COURSE POLICIES

COVID-19 STATEMENT:

"*Due to COVID-19, and under the directive and mandate of public health officials and the president of Central Washington University, students must adopt face covering protocol before entering any classroom or building at CWU until further notice. Students must also follow the social distancing placement marks in buildings and classrooms. If you do not have a face covering Central Washington University can provide one for you. If you have not yet received your CWU-supplied facial covering, please go the SURC Information Desk. Please do so prior to the start of your first class.*"

MENTAL HEALTH STATEMENT:

"*Stress and other life circumstances that may be out of your control can make learning and focusing difficult. If you find stress or other mental health concerns make academics difficult, Central has resources to support you. I encourage you to reach out as soon as you notice you're struggling.*"

RESOURCES FOR STUDENTS:

CWU Counseling Center: https://www.cwu.edu/medical-counseling/counseling-clinic

Mental Health Crisis Support outside normal business hours: 1-800 – 273 - 8255, Text HOME to 741741 or call 911.

Wellness Center: https://www.cwu.edu/wellness/ 509-963 -3213

Student Rights and Responsibilities: https://www.cwu.edu/student-rights/office-student-rights-responsibilities

CENTRAL WASHINGTON UNIVERSITY COVID-19 REPORTING FORM: available on http://cwu.edu/student-success/covid-form

POLICY ON ACADEMIC DISHONESTY:
Students are on their honor to follow the student conduct code as outlined in the Washington Administrative Code. Violations of this section will result in a failing grade in the course in addition to further possible university sanctions. (See http://apps.leg.wa.gov/WAC/default.aspx?cite=106-125)

POLICY ON DIVERSITY:
University-level education is about broadening horizons and looking at academic issues from a variety of perspectives. With this in mind, the participants in this class are encouraged to bring their own life experiences and viewpoints to bear on classroom discussions and assignments. Along with the freedom to express one's own views comes the responsibility to respect the views of others. No student will be discriminated against on the basis of race, ethnicity, age, creed, religion, gender, sexual orientation, marital status, or political ideology.

DISABILITY SERVICES:
Central Washington University is committed to creating a learning environment that meets the needs of its diverse student body. If you anticipate or experience any obstacles to learning, contact Disability Services to discuss a range of available options. Student Disability Services is located in Hogue 126. Call (509) 963-2214 or email ds@cwu.edu for more information. (see https://www.cwu.edu/disability-services/)

SUBMITTING ELECTRONIC FILES:
All electronic files must be submitted in .doc, .docx or .pdf format. If you don't have Microsoft Office, you can download it for free, using your CWU email and password from the MS Office website. Here is the guide on (https://cwu.teamdynamix.com/TDClient/2015/Portal/KB/ArticleDet?ID=9080), how to download MS Office. Mac users make sure to save documents with visible extension (.docx or .rtf).

RELIGIOUS HOLIDAY ABSENCES: In compliance with RCW 28B.137.010, CWU makes every effort to deal reasonably and fairly with students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Students must present written notice to their instructor within the first two weeks of class listing the specific dates on which accommodations are required. Contact the Dean of Student Success at (509) 963-1515 for further information or questions.