

**Mathematical Statistics - Online**  
STAT 301/ FALL 2020

**Instructor:** Adam Childers / [childers@roanoke.edu](mailto:childers@roanoke.edu)

**Office:** Trexler 270G

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**Office Hours:** 1:10-2:10 PM, Monday, Wednesday Friday, 12:00-1:00 PM, Thursday, and by appointment. All office hours will be conducted on Zoom. Please send me an email to schedule and appointment. You can email me to set up an appointment at a different time. Zoom Link: <https://roanoke-edu.zoom.us/j/5403752449>

**Meeting Time:** 2:20-3:20PM

**Meeting Place:** Trexler 263

**Required Text:** *Mathematical Statistics with Application 7<sup>th</sup> Edition*, by Wackerly, Mendenhall, and Scheaffer.

**Course Objective:** The objective of this course is to apply calculus to the subject of probability to form a strong foundation for statistical methods. We will start by defining probability models and learning the rules of probability. Next, we will learn about discrete and continuous random variables including expectation and moment generating functions. We will finish the course discussing multivariate distributions and functions of several random variables and their applications including the central limit theorem.

**Intended Learning Outcomes:** By the end of this course, students will be able to:

- understand and apply rules of probability.
- understand and interpret a probability model.
- distinguish the difference between continuous and discrete random variables and understand how to use them to describe random processes.
- understand moment generating functions and their applications

**Content:** We will cover most of the first 6 chapters in the text as well as the central limit theorem. Included in these chapters is:

- An Introduction to Descriptive Statistics
- Probability
- Discrete Random Variables and Their Distributions
- Continuous Random Variables and Their Distributions
- Expectation
- Moment Generating Functions
- Multivariate Distributions
- Covariance
- Conditional and Marginal Distributions
- Functions of Random Variables and Their Distributions
- The Central Limit Theorem

**Structure of the course:** All the material you need for this course will be posted on Inquire. You will find all your assignments and course material there. I will keep the gradebook up to date.

**Homework:** I will be collecting homework sets. The problems in the sets and their due dates will be clearly posted on Inquire.

**Final Exam:** The final exam will be cumulative and will be given on November 20<sup>th</sup>, 1:00-5:00PM.

**Grading:** Grades will be assigned based on written assignments, tests, and a final exam.

Topics Tests	70%
Homework	15%
Final Exam	15%

A *tentative* guideline for determination of grade will then be:

A	> 93	B	83 – 86.9	C	73 – 76.9	D	63 – 66.9
A-	90 – 93	B-	80 – 82.9	C-	70 – 72.9	D-	60 – 62.9
B+	87 – 89.9	C+	77 – 79.9	D+	67 – 69.9	F	< 60

**MCSP Conversation Series:** Attending at least two MCSP conversation series event is required. Within one week of the lecture, a one-page reflection paper will be due. Please upload them on Inquire. These will be on Zoom this year and count as part of your problem of the day grade. You can find the schedule at: [https://www.roanoke.edu/inside/a-z\\_index/math\\_cs\\_and\\_physics/conversation\\_series/fall\\_2020](https://www.roanoke.edu/inside/a-z_index/math_cs_and_physics/conversation_series/fall_2020)

**Missed Test:** I will not give make-up tests. If you miss a test and have discussed it with me before the class takes the test, I will use your final exam grade for replacement.

**Make-up Work:** No make-up work will be accepted. Any excused work will be replaced by the final exam.

**Expected Hours of Work:** This course expects you to spend at least 12 hours of work each week inside and outside of class.

**Attendance:** Attendance is required and expected and is crucial to be successful in this course. An absence that is not discussed with the instructor prior to class is considered unexcused. Regardless of whether the absence is excused or not, you are responsible for all the material covered in class.

**Technology:** Scientific calculators, Mathematica, R, Minitab will be used throughout the semester in the classroom and on assignments. Cell phones are expected to be turned off before entering the class and computers will be used in the classroom exclusively for academic purposes. All of the software is free for you to download.

- R - <https://cloud.r-project.org/>
- Rstudio - <https://rstudio.com/products/rstudio/download/>
- Minitab and Mathematica are available through the college - <https://www.roanoke.edu/softwaredownload>

We will be collecting data using the mobile application Classroom Stats though out the semester. Please download this free app onto your phone. It is available for Android and iOS and you can easily find it in the app store.

**Academic Integrity System:** Students are expected to adhere to the Academic Integrity policies of Roanoke College. All work submitted for a grade is to be your own work! No electronic devices other than calculators can be taken out during any class or testing period (this includes cell phones) unless written consent is given by the professor (e.g. Mathematica may be allowed for some tests). Note that looking at or using your cell phone during a test or quiz is considered a violation of Academic Integrity regardless of your purpose or intent in doing so.

**Subject Tutoring,** located on the lower level of Fintel Library (Room 5), is open 4 pm – 9 pm, Sunday – Thursday. We are a Level II Internationally Certified Training Center through the College Reading and Learning Association (CRLA). Subject Tutors are friendly, highly-trained Roanoke College students who offer free, one-on-one tutorials in a variety of general education and major courses such as: Business, Economics, Mathematics, INQ 240, Modern Languages, Lab Sciences, INQ 250, and Social Sciences (see all available subjects at [www.roanoke.edu/tutoring](http://www.roanoke.edu/tutoring)). Tutoring sessions are available in-person or online in 30 or 60-minute appointments (please specify if you prefer to meet with a tutor online or in-person when you make your appointment). All in-person appointments will maintain at least 6 feet of physical distance,

desks will be cleaned between appointments, and masks must be worn in all indoor, public spaces. In the event that all classes go online this semester, Subject Tutoring will remain available online, too. Schedule an appointment at [www.roanoke.edu/tutoring](http://www.roanoke.edu/tutoring) or contact us at 540-375-2590 or [subject\\_tutoring@roanoke.edu](mailto:subject_tutoring@roanoke.edu). We hope to see you soon!

**Accessible Education Services (AES)** is located in the Goode-Pasfield Center for Learning and Teaching in **Fintel Library**. AES provides reasonable accommodations to students with documented disabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentation of a disability along with recommendations from the qualified specialist. Please contact Laura Leonard, Assistant Director of Academic Services for Accessible Education, at 540-375-2247 or by e-mail at [aes@roanoke.edu](mailto:aes@roanoke.edu) to schedule an appointment. If you have registered with AES in the past and would like to receive academic accommodations for this semester, please contact Laura Leonard at your earliest convenience to schedule an appointment.

### Mastery Topics:

Topic 1: Probability Models
Topic 2: Counting Sample Points
Topic 3: Conditional Probability and Probability Laws
Topic 4: Event Composition and Bayes Theorem
Topic 5: Discrete Random Variables
Topic 6: Expected Value - Discrete
Topic 7: Special Discrete Distributions
Topic 8: Moment Generating Functions
Topic 9: Continuous Random Variables - PDF
Topic 10: Continuous Random Variables - CDF
Topic 11: Expected Value - Continuous
Topic 12: The Normal Distribution
Topic 13: The Uniform and Gamma Distribution
Topic 14: Multivariate Distributions - Discrete
Topic 15: Multivariate Distributions - Continuous
Topic 16: Marginal and Conditional Distributions
Topic 17: Expectation of Functions of Random Variables and Covariance
Topic 18: The Method of Distribution Functions
Topic 19: The Method of Moment Generating Functions and Transformations
Topic 20: The Central Limit Theorem

**Daily Schedule:** This is my plan but as we enter an uncertain semester, know that this could change, and I will update you on any changes with a modified schedule.

Day	Date	Topic	HW Problems
1	19-Aug	Introduction	
2	21-Aug	2.3 Set Notation, 2.4 A Probabilistic Model for an Experiment	2.3 - 1,2, 2.8   2.4 - 2.10, 2.11, 2.12, 2.14, 2.15
3	24-Aug	2.5 The Sample Point Method	2.5 - 2.25, 2.27, 2.28, 2.29, 2.30
4	26-Aug	2.6 Counting Sample Points	2.6 - 2.37, 2.38, 2.40, 2.46, 2.49, 2.51
5	28-Aug	2.7 Conditional Probability and Independent Events, 2.8 Two Laws of Probability	2.7 - 2.71, 2.72, 2.74   2.8 - 2.85, 2.86, 2.90
6	31-Aug	2.9 Event Composition Method	2.9 - 2.110, 2.113, 2.114
7	2-Sep	2.10 Law of Total Probability and Bayes Theorem	2.10 - 2.124, 2.129, 2.135

8	4-Sep	Topics 1-4 Test	Do your best!
9	7-Sep	3.1 Random Variables, 3.2 Discrete Random Variables	3.2 - 3.1, 3.2, 3.3, 3.6, 3.7
10	9-Sep	3.3 Expected Value	3.3 - 3.12, 3.17, 3.21
11	11-Sep	3.4 Binomial Distribution	3.4 - 3.37, 3.39, 3.40, 3.43
12	14-Sep	3.5 Geometric Distribution, 3.6 Negative Binomial Distribution	3.5 - 3.67, 3.68, 3.70   3.6 - 3.90, 3.91, 3.96
13	16-Sep	3.8 Poisson Distribution	3.8 - 3.121, 3.124, 3.128
14	18-Sep	3.9 Moment Generating Functions	3.9 - 3.147, 3.148, 3.150, 3.155
15	21-Sep	Topics 5-7 Test	Do your best!
16	23-Sep	3.9 Moment Generating Functions	3.9 - 3.147, 3.148, 3.150, 3.155
17	25-Sep	4.2 Continuous Random Variables	4.2 - 4.1, 4.2, 4.4, 4.8
18	28-Sep	4.2 Continuous Random Variables	4.2 - 4.10, 4.12, 4.14, 4.18
19	30-Sep	4.3 Expected Value	4.3 - 4.20, 4.21, 4.29, 4.30
20	2-Oct	4.4 Uniform Distribution	4.4 - 4.41, 4.42, 4.45, 4.46, 4.51
21	5-Oct	Topics 7-10	Do your best!
22	7-Oct	4.5 Normal Distribution	4.5 - 4.58, 4.71, 4.73, 4.77
23	9-Oct	4.6 Gamma Distribution	4.6 - 4.88, 4.89, 4.91
24	12-Oct	4.9 Moment Generating Functions - Continuous	4.9 - 4.136, 4.138, 4.140
25	14-Oct	5.2 Multivariate Distributions	5.2 - 5.1, 5.2, 5.4
26	16-Oct	5.2 Multivariate Distributions	5.2 - 5.5, 5.6, 5.9, 5.12
27	19-Oct	Topics 12-15	Do your best!
28	21-Oct	5.3 Marginal and Conditional Distributions	5.3 - 5.19, 5.22, 5.23, 5.25
29	23-Oct	5.4 Independent Random Variables	5.4 5.45, 5.48, 5.50, 5.52, 5.53
30	26-Oct	5.5 Expected Value of a Function of Random Variables, 5.6 Special Theorems	5.6 - 5.72, 5.76, 5.77, 5.80
31	28-Oct	5.7 Covariance	5.7 - 5.89, 5.91, 5.96
32	30-Oct	5.8 Expected Value and Variance of Linear Functions	5.8 - 5.103, 5.105, 5.106
33	2-Nov	Topics 15-17	Do your best!
34	4-Nov	6.3 The Method of Distribution Functions	6.2 - 6.1, 6.2, 6.3, 6.6
35	6-Nov	6.3 The Method of Distribution Functions	6.2 - 6.1, 6.2, 6.3, 6.6
36	9-Nov	6.4 The Method of Transformations	6.4 - 6.23, 6.24
37	11-Nov	6.5 The Method of Moment Generating Functions	6.5 - 6.37, 6.38, 6.40
38	13-Nov	7.2 The Central Limit Theorem	7.2 - 7.42-7.45
39	16-Nov	Topics 18-20	Do your best!
<b>Exam</b>	<b>20-Nov</b>	<b>Exam 1pm</b>	