

**Mathematical Statistics I | STAT 725 | Fall 2021**  
**Mackay Science (MS) 321, TR noon-1:15PM**  
**3 credits**

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**Instructor:** Ilya Zaliapin **Office:** Davidson Math & Science (DMS), Room 221

**Office hours:** TR 11:00–11:50AM + by appointment

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**Registered students will access the course via [Canvas \(Web Campus\)](#)**

**Catalog's Description:** This is a first part of a PhD level sequence in mathematical statistics (the second part is STAT 726). The course covers distribution theory; statistical models and applications; generation of random samples; methods of estimation; unbiasedness; sufficiency; completeness; uniform minimum variance unbiased (UMVU) estimators; and asymptotic estimation results.

**Prerequisites:** STAT 352 (Probability and Statistics), or STAT 467/667 (Statistical Theory)

**Required textbook:** *Statistical Inference* by George Casella and Roger L. Berger

**Course Content:** Selected material from Chapters 5,6,7 and 10 (see a tentative schedule on the last page). Course schedule, homework assignment and exam information, will be available on [WebCampus](#).

**Student Learning Outcomes (SLOs):** Upon completion of this course, students will be able to:

1. Develop alternative estimators of parameters in a range of statistical models
2. Evaluate properties of estimators
3. Assess asymptotic properties of the estimators and prove convergence statements

**Midterm:** There will be two midterms preliminary scheduled on [Tuesday, October 12](#) and [Tuesday, November 9](#).

**Final exam:** A final exam will be given on [Monday, December 13, 12:10-2:10PM](#).

**Exam policies (for midterms and final):** All exam work must be independent. There will be **no make-ups** for exams, except legitimate medical reasons. In case of participating in University-related activities or in any other special circumstances, contact instructor **in advance**.

**Homework** will be given weekly. The assignments will be posted online via [WebCampus](#); they will refer to the problems from the required textbook. The handwritten or typed solutions should be submitted to instructor by the next Tuesday, noon.

**Homework policies:** You are encouraged to discuss HW assignments among each other and with instructor. However, your work must be done individually; this includes all calculations and writing. HW that include duplicate work will be given zero score and may result in disciplinary actions. Late HW will not be accepted and result in zero score. Special circumstances (medical, family, University-related) are to be discussed with instructor.

**Statistical Lab** is a part of the course. Some of the course topics will be illustrated using package **R**. You might be given take-home assignments that require application of selected statistical techniques using the package. Results should be presented in a form of illustrated reports (we will discuss the report writing in the class). The previous knowledge of **R** is not required. **R** is a free software; the **R**-portal with downloads, manuals, FAQs, and much more is located at: <http://www.r-project.org/>. You are encouraged to discuss the Lab assignments with other students and instructor, but your calculations and reports have to be done individually and demonstrate that you are able to perform and present the analysis independently.

**Grading policy:** Your letter grade for the course will be based on home works (30%), midterms (25% each), and final exam (20%).

Letter	A	A-	B+	B	B-	C+	C	D+	D	F
Min. Score	93%	90%	87%	83%	80%	77%	70%	67%	60%	0%

**Re-grading:** If you find that your grade for exam or HW is incorrect, contact instructor with a rational justification. All re-grading requests must be submitted to instructor within one week after the discussed grade is announced; late requests will not be granted. A regrading request must include the work in question. The final decision about the new grade is made by the instructor.

**Class Attendance Policy:** Students are responsible for material covered in class, and it is the student's responsibility to arrange for the completion of all missed classroom work. It is the student's responsibility to be familiar with the course content and announcements made via [WebCampus \(Canvas\)](#). University-approved extracurricular activities are defined as those sanctioned by a college dean and/or the provost, and may include, but are not limited to, intercollegiate athletics, band, drama, forensics, and recruitment. It is the responsibility of the student to arrange for written notice from the appropriate college dean or the Office of the Provost to their instructor of their participation in official University activities in advance and as soon as the student is aware of the potential need to miss class or assignment. In cases of missed assignments due to extended illness, family emergency, bereavement, or other compelling reason, students should notify their instructors as soon as possible and within one week of the assignment due date, and work with them to develop plans, including appropriate deadlines, to make up missed coursework. Faculty have the right to request formal, written documentation in such cases as appropriate. For university policy regarding class absence, see [UAM 3,020](#).

### **Communication Policy**

There are several ways you can use to communicate with instructor:

1. [WebCampus \(Canvas\)](#) Inbox – best for fast response
2. Regular e-mail [[zal@unr.edu](mailto:zal@unr.edu)] – if you use this option, please indicate our class (STAT 725) and your name as in the class roster, either in the message body or subject
3. Office hours or personal appointments.

I will try to respond as soon as possible (most of the time I respond within hours). As a general policy, you should expect to hear back within 24 hours during workdays and within 48 hours during weekends/holidays. If you do not have e-mail response within this timeframe – please accept my apologies and resend your message. Also, you will be able to communicate with other students in the class via Discussions.

**Academic dishonesty** will not be tolerated and will lead to an F grade. See <http://www.unr.edu/stsv/acdispol.html>

**Class recording policy:** Surreptitious or covert video-taping of class or unauthorized audio recording of class is prohibited by law and by Board of Regents policy. This class may be videotaped or audio recorded only with the written permission of the instructor. In order to accommodate students with disabilities, some students may have been given permission to record class lectures and discussions. Therefore, students should understand that their comments during class may be recorded.

**Disability Services:** Any student with a disability needing academic adjustments or accommodations is requested to speak with the [Disability Resource Center](#) (Thompson Building, Suite 101) as soon as possible to arrange for appropriate accommodations.

**Academic success:** Your student fees cover usage of the University Math Center (775) 784-4433, University Tutoring Center (775) 784-6801, and University Writing Center (775) 784-6030. These centers support your classroom learning; it is your responsibility to take advantage of their services. Keep in mind that seeking help outside of class is the sign of a responsible and successful student.

**Title IX:** The University of Nevada, Reno is committed to providing a safe learning and work environment for all. If you believe you have experienced discrimination, sexual harassment, sexual assault, domestic/dating violence, or stalking, whether on or off campus, or need information related to immigration concerns, please contact the University's Equal Opportunity & Title IX office at 775-784-1547. Resources and interim measures are available to assist you. For more information, please visit: <https://www.unr.edu/equal-opportunity-title-ix>

**COVID-19 Training Policies:** Students must complete and follow all guidelines as stated in the Student COVID-19 Training modules found on Canvas, or any other trainings or directives provided by the University.

**COVID-19 Face Coverings:** In response to COVID-19, and in alignment with State of Nevada Governor Executive Orders, Roadmap to Recovery for Nevada plans, Nevada System of Higher Education's directives, the University of Nevada President directives, and local, state, and national health official guidelines face coverings are required at all times while on campus, except when alone in a private office. This includes the classroom, laboratory, studio, creative space, or any type of in-person instructional activity, and public spaces.

A "face covering" is defined as a covering that fully covers a person's nose and mouth, including without limitation, cloth face mask, surgical mask, towels, scarves, and bandanas.

Students that cannot wear a face covering due to medical condition or disability, or who are unable to remove a mask without assistance may seek an accommodation through the Disability Resource Center.

**COVID-19 Social Distancing:** Face coverings are not a substitute for social distancing. Students shall observe current social distancing guidelines when possible in accordance with the Phase we are in while in the classroom. Laboratory, studio, creative space (hereafter referred to as an instructional space) setting and in public spaces. Students should avoid congregating around instructional space entrances before or after class sessions. If the instructional space has designated entrances and exit doors students are required to use them. Students should exit the instructional space immediately after the end of instruction to help ensure social distancing and allow for the persons attending the next scheduled class session to enter.

**COVID-19: Disinfecting Your Learning Space:** Disinfecting supplies are provided for you to disinfect your learning space. You may also use your own disinfecting supplies.

**COVID-19, COVID-19 Like Symptoms, and Contact with Someone Testing Positive for COVID-19:** Students must conduct daily health checks in accordance with [CDC guidelines](#). Students testing positive for COVID 19, exhibiting COVID 19 symptoms or

who have been in direct contact with someone testing positive for COVID 19 will not be allowed to attend in-person instructional activities and must leave the venue immediately. Students should contact the [Student Health Center](#) or their health care provider to receive care and who can provide the latest direction on quarantine and self-isolation. Contact your instructor immediately to make instructional and learning arrangements.

**Failure to Comply Policy:** In accordance with section 6,502 of the University Administrative Manual, a student may receive academic and disciplinary sanctions for failure to comply with policy, including this syllabus, for failure to comply with the directions of a University Official, for disruptive behavior in the classroom, or any other prohibited action. "Disruptive behavior" is defined in part as behavior, including but not limited to failure to follow course, laboratory or safety rules, or endangering the health of others. A student may be dropped from class at any time for misconduct or disruptive behavior in the classroom upon recommendation of the instructor and with approval of the college dean. A student may also receive disciplinary sanctions through the Office of Student Conduct for misconduct or disruptive behavior, including endangering the health of others, in the classroom. The student shall not receive a refund for course fees or tuition.

**Misc.:** Any behavior that may disrupt the learning environment will not be tolerated. Please be considerate of your fellow students and instructor.

**Tentative schedule (may change as class progresses)**

<b>Week</b>	<b>Tuesday</b>	<b>Topic &amp; Reading</b>	<b>Thursday</b>	<b>Topic &amp; Reading</b>
1	Aug. 24	Probability Review: Random variables, p.d.f., c.d.f., moments, exponential family (Chapters 1-3)	Aug. 26	Probability Review: Limit theorems, joint distributions, independence, sampling (Chapters 4-5)
2	Aug. 31	Generating Random Samples Sect. 5.6	Sep. 2	Generating Random Samples Sect. 5.6
3	Sep. 7	Data Reduction: Sufficiency (Sect. 6.1-6.2)	Sep. 9	Data Reduction: Sufficient, Ancillary, Complete Statistics (Sect. 6.1-6.2)
4	Sep. 14	Data Reduction: Likelihood principle (Sect. 6.3)	Sep. 16	Data Reduction: Equivariance principle (Sect. 6.4)
5	Sep. 21	Estimation Method of Moments (Sect. 7.2.1)	Sep. 23	Estimation Maximum Likelihood Estimator (Sect. 7.2.2)
6	Sep. 28	Estimation Maximum Likelihood Estimator (Sect. 7.2.2)	Sep. 30	Estimation Maximum Likelihood Estimator in Exponential Families (Sect. 7.2.2)
7	Oct. 5	Estimation Bayes Estimators (Sect. 7.2.4)	Oct. 7	Estimation Bayes Estimators (Sect. 7.2.4)
8	Oct. 12	<b>Test 1</b>	Oct. 14	Estimation Minimax estimators
9	Oct. 19	Evaluating Estimators Mean-Square Error (Sect. 7.3.1)	Oct. 21	Evaluating Estimators Sufficiency, unbiasedness, UMVU (Sect. 7.3.2, 7.3.3)
10	Oct. 26	Evaluating Estimators Sufficiency, unbiasedness, UMVU (Sect. 7.3.2, 7.3.3)	Oct. 28	Evaluating Estimators Information Inequality, Cramer-Rao bound (Sect. 7.3.2)
11	Nov. 2	Evaluating Estimators Rao-Blackwell theorem (Sect. 7.3.3)	Nov. 4	Evaluating Estimators Loss function optimality, risk (Sect. 7.3.4)
12	Nov. 9	<b>Test 2</b>	Nov. 11	<b>Veteran's Day</b>
13	Nov. 16	Asymptotic Results: Consistency, efficiency (Sect. 10.1.1-10.1.2)	Nov. 18	Asymptotic Properties of MLE: Regularity conditions, consistency efficiency (Sect. 10.1.3)
14	Nov. 23	Asymptotic Results: Delta Method (Sect. 10.1.3)	Nov. 25	<b>Thanksgiving</b>
15	Nov. 30	Asymptotic Results: Bootstrap (Sect. 10.1.4)	Dec. 2	Asymptotic Results: Robustness, M-estimators (Sect. 10.2)
16	Dec. 7	<b>Final Review</b>		
Monday, Dec. 13, 12:10-2:10PM – Final				