

University of Nevada, Reno

Department of Mathematics and Statistics

**Statistics and Data Science M.S. Program**

Handbook of Policies and Procedures  
for Current Graduate Students

2020-2021

The M.S. Program in Statistics and Data Science at the University of Nevada, Reno is offered by the Department of Mathematics and Statistics. The Department is home of a dynamic group of about 25 graduate faculty with diverse interests and expertise in Probability and Statistics as well as Pure and Applied Mathematics.

Faculty of the DMS are engaged in cutting-edge interdisciplinary research and collaborate with other researchers both locally and at multiple institutions throughout the US and internationally. Graduate students can be part of these exciting activities. UNR and the Reno business community provide ample opportunities for internships, research collaborations, and consulting.

Teaching and research assistantships, departmental and university scholarships are available for qualified students. All graduate students accepted with teaching or research assistantships receive tuition waiver, a stipend, and a subsidized medical plan.

Located where the Sierra Nevada meets the Great Basin, the University is 45 minutes from Lake Tahoe and relatively close to San Francisco Bay Area and the Napa-Sonoma Wine Country. Reno offers an excellent living environment, short commutes, a growing arts community, and an increasingly cosmopolitan flavor. Join us!

**Apply at <https://www.unr.edu/grad/admissions>**

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University of Nevada, Reno  
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**Web:** <https://www.unr.edu/math>

**E-mail:** math@unr.edu

**Phone:** (775) 784-6773

## Program Description

The M.S. Program in Statistics and Data Science is designed to provide training in fundamental and applied methods and concepts of modern Statistics. The program gives opportunity for people emphasizes interdisciplinary collaborative research. The program builds research and computational skills that will position students to be competitive in pursuing careers in academic, government, and business environments.

## Questions Contact

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## Web Links

You should apply at UNR Graduate School web site:  
<https://www.unr.edu/grad/admissions/how-to-apply>  
All applicants must meet the University requirements:  
<http://www.unr.edu/grad/admissions>

## Degree Requirements

### Thesis vs Non-Thesis

Students may complete this program of by choosing a plan: The Master's Thesis Degree Plan (Thesis Plan), or The Comprehensive Exam Plan (Non-Thesis Plan).

To complete their master's degree via the Thesis Plan, students must complete at least 30 credits of acceptable graduate courses, which must include: at least 6 thesis credits (by enrolling in the thesis course STAT 797), and at least 12 non-thesis credits of 700-level courses, and at least 21 credits through on-campus courses at the university. For transfer credits, please consult the Graduate Director.

To complete their master's degree via the Non-Thesis Plan, students must pass the comprehensive exam and complete at least 32 credits of acceptable graduate courses, which must include: at least 18 non-thesis credits of 700-level courses, at least 23 credits through on-campus courses at the university. For transfer credits, please consult the Graduate Director, and 1 credit of the Comprehensive Exam course Math 795 (Stat 795 coming in Fall 2020).

## Required Courses

To graduate, students must successfully complete the following six courses:

- STAT 645 - Introduction to Statistical Computing (3 units, offered every fall semester)
- STAT 661 - A First Course in Probability (3 units, offered every semester)
- STAT 667 - Statistical Theory (3 units, offered every semester)
- STAT 755 - Multivariate Data Analysis (3 units, offered every spring semester)
- STAT 757 - Applied Regression Analysis (3 units, offered every fall semester)
- STAT 760 - Statistical Learning (3 units, offered every spring semester)

In addition to the required courses, students following the Thesis Plan, must complete 6 elective and 6 thesis credits; and students following the Non -thesis Plan, must complete 12 elective and 1 comprehensive exam credits.

An internship may be included in the plan of study, subject to availability and approval of the Graduate Director.

## Electives

Electives will be approved by the student's Graduate Advisory Committee. Appropriate courses outside the Department of Mathematics and Statistics may be approved, depending on the student's research interests. Example electives in the Department of Mathematics and Statistics:

- STAT 653 Categorical Data Analysis
- STAT 775 Advanced Topics in Statistics
- STAT 758 Time Series
- MATH 666 Numerical Methods I
- MATH 667 Numerical Methods II

Example electives in other departments:

- ATMS 745 Atmospheric Turbulence
- ATMS 746 Atmospheric Modeling
- BCH 706 Functional Genomics
- BCH 707 Protein Structure and Function
- BCH 709 Bioinformatics
- BIOL 604 Population Genetics
- CS 615 Parallel Computing
- CS 657 Database Management Systems
- CS 677 Analysis of Algorithms
- EE 782 Random Signal Analysis and Estimation Theory
- PHY 732 Statistical Mechanics

# The Comprehensive Exam

Students who choose the Non-Thesis Plan must complete the Comprehensive Exam. This exam is offered once every semester, close to the end of semester. The exact date for the exam is announced by the Graduate Director in a timely fashion.

## General information

The exam is to evaluate students' fundamental knowledge of probability and statistics. The topics for the exam are a union of the major topics from the Probability (STAT 661) and Mathematical Statistics (STAT 667) courses.

## Study guidelines

To study for the exam, we recommend taking both Probability (STAT 661) and the Statistics Theory (STAT 667) classes; practicing by doing problems assigned as homework and more problems from the course textbooks; doing relevant problems from the actuarial exams; studying proofs of theorems in the texts. Students are expected to know all definitions and theorems with proofs.

## References

This exam is based not on any book, but on knowledge of fundamental topics in probability and mathematical statistics. Some texts you may find helpful:

Richard J. Larsen, Morris M. Marx (2017). *An Introduction to Mathematical Statistics and Its Applications*. 6<sup>th</sup> edition, Pearson.

Michael A. Bean (2001). *Probability: The Science of Uncertainty with Applications to Investments, Insurance and Engineering*, American Mathematical Society.

## Syllabus

1. **The formal language of probability:** Random experiment, set theory, sample space, counting and combinatorial methods, probability of union of events, conditional probability, multiplication rule, independent events, the law of total probability and Bayes' theorem.
2. **Univariate and multivariate random variables and probability distributions:** Discrete, continuous, and mixed distributions; cumulative distribution function; probability density function; probability mass function; quantile function and percentile; marginal and conditional distributions; independence; functions of random variables and random vectors; linear transformations; sums, products, and quotients of random variables; minima and maxima of random variables; order statistics; mixtures and compound distributions and their applications; probability integral transform theorem and random variate generation; Monte-Carlo methods.

3. **Measures of expectation, variation and risk:** expected value, geometric mean, median, mean squared and mean absolute error, variance and standard deviation, moments and moment generating function, survival and hazard functions, covariance and correlation, conditional expectation and variance.
4. **Special discrete and continuous distributions:** Bernoulli, binomial, Poisson, hypergeometric, multinomial, negative binomial, geometric, exponential, gamma, Weibull, beta, uniform, Pareto, univariate and multivariate normal and lognormal distributions.
5. **Convergence:** Convergence in distribution, convergence in probability, and almost sure convergence; Markov and Chebyshev inequalities; the law of large numbers and the central limit theorem; normal approximation to binomial; Delta Method.
6. **Distributions related to the normal:** Sample mean and its properties; chi-square, Student t, and F distributions; joint distribution of the sample mean and variance.
7. **Estimation:** The method of moments; maximum likelihood estimation and its properties; efficiency, consistency, sufficiency, and unbiasedness; small and large sample confidence intervals; information inequality; loss and risk functions; uniformly minimum variance unbiased (UMVU) estimation; Bayesian estimation.
8. **Testing hypotheses:** Mathematical setup and terminology; power and sample size calculations; p-values; likelihood ratio tests, 1- and 2-sample z- and t-tests; F-test; Kolmogorov-Smirnov test; chi-square tests of goodness-of-fit; contingency tables and tests for homogeneity.
9. **Linear models:** The method of least squares, linear regression, statistical inference under linear regression model.

The Comprehensive Exam is 6 hours and is broken up into a 3-hour morning session (0900-1200) and a 3-hour afternoon session (1300-1600). Students will be allowed a maximum of two attempts at passing the Comprehensive Exam. If the first written attempt is not successful, the student may ask for an opportunity of an oral exam to be scheduled as soon as practical (usually within 2 weeks) the same semester. If the student does not pass the oral exam, this student will have a second chance to take the written test the following semester, as scheduled. There is no opportunity for an oral exam after the second written Comprehensive Exam. During the semester the student takes the exam, this student must be enrolled in STAT 795, the Comprehensive Exam course.

## Graduate School Academic Requirements

### Cumulative GPA

All graduate students must maintain a cumulative graduate GPA of 3.0. If their GPA drops below 3.0, they are placed on probation or dismissed. Undergraduate courses do not count towards graduate GPA.

### Probation

Students whose cumulative graduate GPA is 0.1 to 0.6 points below that needed for a 3.0 GPA are put on probation. Students are placed on academic probation for one semester. If they fail to raise their cumulative GPA to 3.0 by the end of one semester, they are dismissed from their graduate program. Thesis, dissertation, S/U graded credits, and transfer credits have no impact on a student's GPA.

Dismissal: students whose cumulative graduate GPA is 0.7 or more grade points below that needed for a 3.0 GPA are dismissed. Dismissed students are no longer in a graduate program but may take graduate-level courses as a Grad Special. Students wishing to complete their degree must obtain approval to take graduate-level courses, raise their graduate GPA to at least 3.0 and then re-apply to a graduate program. Any courses taken to raise their GPA will be included in the graduate special/ transfer credit limitation (9 credits for master's degrees).

## Transfer Credits

These are credits transferred from another institution. Credits completed at UNR in another program or as a graduate special do not need to be transferred. Transfer credit is requested on the Graduate Credit Transfer Evaluation Request form available on the Graduate School website: <https://www.unr.edu/grad/student-resources/forms>. The form must be signed by the student, major advisor, and graduate director. Transfer credits applied to the M.S. program must comply with the time limitation on work (6 years). Thus, if a student took a course five years prior to admission, they would have to complete the degree within one year for the course to apply to the degree. Credits from a completed master's degree will be exempt from the 8-year time limitation for those students earning a doctoral degree.

## Thesis

Students who choose the Thesis Plan (Section 2.1) must write a master's Thesis to complete the program. This process starts with the student choosing a Thesis Advisor, a choice typically made during the student's first year in the program. The Advisor is a graduate faculty member of the Department of Mathematics and Statistics who works in a research area of interest to the student. To initiate the Student-Advisor collaboration, the student should approach the faculty member and ask if this faculty is willing to serve as the student's Advisor. The student and Advisor jointly choose members of the student's Graduate Committee (Section 4).

Once an Advisor has been identified, she/he will guide the student through the thesis writing process. This may involve preparatory work such as reading of books and/or research papers, computer programming, intense calculations, etc. While working on the thesis, the student needs to be enrolled in the thesis course STAT 797, completing a total of 6 credits. These are typically broken up as 3 credits during the student's 3rd semester and 3 during the student's 4th semester (though the student could choose to take all 6 credits in the 4th semester, for example).

The Advisor will instruct the student about the content and format of the thesis. Upon completion, the student will defend thesis by giving a public presentation, followed by a period of questions by the student's Graduate Committee members.

MS thesis defense is a public event. It is the student's responsibility to contact Graduate Committee and the Graduate Director (all that sign the Notice of Completion) regarding their availability. It is strongly advised that the student schedules defense no later than 1 month before the planned defense date. It is also the student's responsibility to reserve an appropriate room for defense. Defense announcements should be sent to the Mathematics and Statistics office for further dissemination.

Each master's student on the Thesis Plan must secure a Thesis Advisor, and a Graduate Committee. The Graduate Committee (Advisory-Examining Committee), chosen in communication between the student and the Advisor, serves as an advisory board to the student, on issues such as class selection, research work, thesis preparation and defense. The student is encouraged to form their committee as early as possible, but not later than the beginning of their 3rd semester.

The Graduate Committee must consist of a minimum of 3 graduate faculty members, including the Advisor, who functions as the committee's Chair. At least 2 faculty members must be from the student's major department/program, and 1 faculty, from another department in a field related to the student's major member, serves as the Graduate School's representative. Formal approval of committee is made by the Graduate Dean.

## **Timeline for Degree Completion**

### Recommended timeline for Thesis Plan

1. Take 6-9 graduate credits per semester. For example, to reach the needed 30 credits for graduation, you may take 9 credits for two semesters and 6 credits for the other two semesters.
2. Identify a Thesis Advisor and Graduate Committee by the end of your 1st year.
3. As early as possible, but no later than the beginning of your 3rd semester in the program, complete the Program of Study form.
4. Start work on your master's thesis by no later than the beginning of your 3rd semester.
5. Complete work on your master's Thesis during your 4th semester. Circulate your complete thesis among members of your Graduate Committee, at least two weeks prior to the thesis defense. In case of a very long or very detailed thesis, committee members may need more time to review your work.
6. Schedule a public defense of your thesis. Consult your Advisor, Graduate Committee members, and the Graduate Director about their time and availability.
7. Upon a successfully defended thesis, file the Notice of Completion with the Graduate School.



## Recommended timeline for Non-Thesis Plan

1. Take 6-9 graduate credits per semester. For example, to reach the needed 32 credits for graduation, you may take 9 credits for three semesters and 5 credits during the remaining semester.
2. As early as possible, but no later than the beginning of your 3rd semester in the program, complete the Program of Study form.
3. Schedule the Comprehensive Exam during your second year (3rd or 4th semester) of the program. Enroll in STAT 795, the Comprehensive Exam course.
4. Upon a successfully defended thesis, file the Notice of Completion with the Graduate School.

## Forms with deadlines required to be submitted to the Graduate School

- Declaration of Advisor/Major Advisor/Committee Chair  
Must be submitted to Graduate School by the end of the student's second semester.
- Program of Study  
Must be submitted to Graduate School by the end of the student's third semester.
- Graduation Application  
Must be submitted to Graduate School several weeks in advance (check web site).
- Notice of Completion  
Must be submitted after all requirements have been met
- Exit Survey

You can find an updated list of forms and requirements here:

<https://www.unr.edu/grad/student-resources/forms>

## Graduate Assistantships

Teaching Assistantships award a competitive stipend for the academic year plus a tuition waiver and a subsidized medical plan. Teaching assistants will be expected to perform specific teaching and grading duties. Normally this will not exceed teaching 6 credit hours per semester or the academic equivalent. Awards are based on academic credentials submitted with the graduate school application. Research Assistantships are sometimes available as well. They also provide tuition waiver and a subsidized medical plan.

### Teaching Assistantships Guidelines

TA support is normally approved for 4 semesters subject to satisfactory degree progress. To get TA support beyond this period requires special semester-by-semester approval of the Graduate Committee.

Students being supported by a TA are expected to enroll in at least 6 credits of approved graduate coursework. The courses Grad 701 and Math 899 do not count toward this 6-credit requirement.

All graduate students holding an assistantship (GTA or GRA) are considered Nevada residents for tuition purposes. Non-resident tuition is only waived for the duration of the assistantship. To be eligible for an assistantship, students must be admitted to a degree-granting program and be in good academic standing. The student must have an overall GPA of at least 3.0 and must be continuously enrolled in at least 6 graduate level credits (600-700) throughout the duration of the assistantship.

State-funded assistantships (GTA/GRA) may be held for a maximum of three (3) years for master's degree students and five (5) years for doctoral degree students.

## Useful Web Pages

General information:

<http://www.unr.edu/grad/funding/graduate-assistantships>

Graduate Assistantship handbook:

<https://www.unr.edu/grad/admissions/funding/assistantships/graduate-assistant-handbook>

## Health Insurance

All domestic degree seeking graduate students, who are enrolled in six or more credits (regardless of the course level) in a semester, will be automatically enrolled and billed for the University sponsored health insurance for each term they are eligible (fall & spring/summer). If a student has other comparable coverage and would like to waive out of the student health insurance, it is the student's responsibility to complete the University online waiver form prior to the deadline. If approved, a health insurance waiver is good for the current academic year only. A new waiver must be submitted each academic year. All international graduate students must have student health insurance, and the cost is added to the student account. An international graduate student can ask about insurance at the Office of International Students and Scholars. See <http://www.unr.edu/grad/health-insurance>

## Leave of Absence

### Continuous Enrollment

To maintain good standing all graduate students are required to enroll in a minimum of three (3) graduate credits each fall and spring semester until they graduate. International students may be required to enroll in nine graduate credits each fall and spring semester depending on the requirements of their visa. All students holding assistantships (whether

teaching or research assistantships) are required to enroll in a minimum of six (6) graduate credits each semester they hold the assistantship.

## Leave of Absence

Students in good standing may request a leave of absence by completing a leave of absence form available on the Graduate School website <https://www.unr.edu/grad/student-resources/forms>

During this time, they are not required to maintain continuous registration. Usually, a leave of absence is approved for one or two semesters. The leave of absence request may be extended by the student filing an additional leave of absence form. Students applying for a leave of absence should not have any incomplete grades which could be changed to F and have a detrimental impact on their cumulative GPA. Requests for leave of absences must be received by the Graduate School no later than the last day of enrollment for the semester the leave is to begin.

## Reinstatement

When a student has been absent for one semester or more without an approved leave of absence, he or she may request reinstatement via the Reinstatement Form on the Graduate School website <https://www.unr.edu/grad/student-resources/forms>

This form allows the program the option to recommend the student be re-admitted to their graduate program based on their previous admission or require the student to re-apply for admission. The latter requires students to submit a new application and pay the application fee. The Notice of Reinstatement to Graduate Standing must be received by the Graduate School by the last day of enrollment for the semester when the reinstatement is to begin.

## Graduate Student Association

The Graduate Student Association (GSA) represents all graduate students and promotes the welfare and interests of the graduate students at the University of Nevada, Reno. The GSA works closely with appropriate university administrative offices, including the Graduate School and Student Services and reports to the President of the University. The GSA government functions through the Council of Representatives, Executive Council and established committees. <http://www.unr.edu/gsa/>