


**Time Series Analysis (STAT 758) Fall 2018**  
**Davidson Mathematics and Science (DMS) 106**  
**TR 9:00-10:15PM**  
**3 credits**

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**Instructor:** Ilya Zaliapin **Office:** DMS 221  
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**Intro:** Time series are all around us: Whether you are tracking global warming, looking for the best moment to sell your assets, or simply wonder why the gas prices keep climbing up. Time series is one of the most common forms of data in physics, finance, economics, geosciences, biology, and social sciences. Accordingly, time series analysis is an inevitable component in a toolbox of a professional statistician. In this class we will discuss essential theoretical and practical methods of time series analysis, including descriptive techniques, stationary and non-stationary model building and verification, analysis in time and frequency domains, and forecasting. The professional statistical package  will be used to apply the concepts discussed in the class to real data sets.

**Learning outcomes.** Upon completion of this course, students will be able to:

- Understand and use the terminology of time series analysis
- Perform comprehensive descriptive analysis of data in time series format
- Construct and mathematically analyze basic time series models (white noise, random walk, moving average)
- Apply the time domain (SARIMA) and spectral domain (Fourier analysis, spectral filtering) modeling and verification approaches to a given time series
- Perform second-order forecasting and forecast quality assessment for a given time series
- Implement essential time series analyses in a professional statistical package R
- Perform independent time series analysis projects, write project reports and present the results to a professional audience
- Independently build time series analysis proficiency using professional literature

**Required textbook:**

- Brockwell, P.J., and Davis, R.A. (2002) *Introduction to Time Series and Forecasting*, 2nd ed, New-York: Springer.

**Optional reading:**

- Chatfield, C. (2004) *The Analysis of Time Series: An Introduction*, 6th ed., Chapman & Hall: London, NY.
- Tsay, R. (2005) *Analysis of Financial Time Series*. 2<sup>nd</sup> ed. Wiley.
- Brockwell, P.J., and Davis, R.A. (1991) *Time Series: Theory and Methods*, Springer-Verlag, New-York.

**Tentative list of topics:**

- Descriptive techniques
- Stochastic processes, stationarity, simple time-series models
- Time domain methods (ARMA, ARIMA, SARIMA, Box-Jenkins approach, GARCH)
- Forecasting
- Frequency domain methods, spectral analysis

**Home work** will be given weekly. You are encouraged to discuss HW assignments between each other and with instructor during office hours. The solutions must be written individually.

**Quizzes:** There might be occasional pop quizzes aimed at helping us in choosing the right course pace. Quizzes contribute to approximately 2% of your overall performance, and may be crucial when evaluating borderline performance.

**Statistical Lab** is an integral part of the course. The lab runs approximately every second week to learn/discuss applied statistical techniques using the package R. Take-home lab assignments will be given that require application of statistical techniques to real or model data sets. The results should be presented in a form of illustrated reports (we will discuss the report writing in the class). Previous knowledge of R is not required. R is a free software and it is very similar to S-plus. 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 and can do them in groups; your reports however, have to be written individually and demonstrate that you are able to perform the presented analysis independently.

**Midterms:** There will be two midterms, tentatively scheduled on Thursday, October 25 and Thursday, December 6.

**Final project:** The final project will consist of comprehensive theoretical and practical statistical analysis of time series of your choice; it will result in a **project report** and a **presentation** that will be delivered at the end of the semester to the class. Report and presentation will be graded separately. The project should demonstrate that you are (i) familiar with essential concepts and techniques studied in the class; (ii) able to use package R for analysis and report preparation; (iii) ready to present your findings to professional audience. To get a full credit for the final project, its different parts must be accomplished by specific deadlines through the semester. A detailed discussion of how to complete the final project will follow in the class.

**Grading policy:** Your letter grade (which may include + or -) for the course will be based on home works (15% total), statistical lab reports (15% total), two midterms (15% each), final project report (30%), final project presentation (10%) and quizzes (2%).

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

**Final meeting (presentations):** Tuesday, December 18, 7:30-9:30AM

**Prerequisites:** MATH 311; MATH 330; MATH/STAT 352.

**Disability statement:** The Department of Mathematics and Statistics supports providing equal access for students with disabilities. Any student needing accommodations for a specific disability is encouraged to meet with instructor or any Department representative at your earliest convenience to ensure timely and appropriate accommodations.

**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.

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

**Academic Success Services:** Your student fees cover usage of the [Math Center](#) (775) 784-4422, [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.

**Equal opportunity:** 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>