Statistics 8281-10:
Advanced Time Series Analysis
Fall, 2021

6:10 - 8:40 Wednesdays

Instructor:	**Feifang Hu**
Department Phone:	**8043100383**
Office Hours:	**3:30-5:00pm Monday**, Phillips Hall 727
E-mail:	**feifang@gwu.edu**(I am always available via e-mail)
Grader:	**Zeyu Yang**
E.mail:	**zyang42@gwu.edu**
Office Hours:	TBD

Course Description: This class offers an introduction to time series methods from both a theoretical and applied perspective. Topics to be discussed in this class are: exploratory techniques for time series (autocorrelations, periodogram, etc.); time series regression models; Autoregressive Moving Average (ARMA) models; Box-Jenkins methodology; forecasting in time series; seasonality; diagnostics of time series models, and state-space models (Kalman filter/smoother). Special topics include Bayesian approaches, hidden Markov models, ARCH-GARCH and stochastic volatility models. The methodology will be illustrated with the analysis of different data sets arising in the context of the physical sciences, psychology, economics and finance, etc.

Prerequisite(s): Mathematical Statistics (STAT 6201/6202) or equivalent. Previous experience with linear regression (STAT 6214/2218) and statistical computing is a plus but not required.

Required Text: *Time Series Analysis and Its Applications by Shumway & Stoffer, 4th Edition*

Reference Texts: *Time Series: Theory and Methods* by Brockwell & Davis, 2nd Edition *Introduction to Time Series and Forecasting* by Brockwell & Davis, 2nd Edition

Course Objectives: At the completion of this course, students will be able to apply time series methods (AR, MA, ARMA, ARCH-GARCH models) to analyze data, interpret the fit of a time series models, perform diagnostics to the fit, use the model to obtain predictions and make inferences on the data. Students will also be able to identify the limitations of time series mothods in certain situations and suggest alternative strategies.

Grading: HW Assignments 30%; Midterm Exam 30%; Final Exam and/or Project 40%.

Homework Assignments: Homework will be assigned about every other week. Late assignments will not be accepted. Students are expected to write up their own solutions to all assigned problems. If two homework submissions are very similar, students may be questioned about their solutions.

- *Midterm Exam*: The exam will be given during class time. The date of the midterm is on the class schedule.
- *Final Exam*: In accord with university policy, the final exam will be given during the final exam period and not the last week of the semester. The exam will be cumulative (by nature of the subject) with more of a focus on material covered after the midterm.
- *Project*: Students will complete a data analysis project using the statistical methods discussed in class. Students will locate their own data to analyze and will give a project proposal, present in-class and submit report.

Computing:

- We will use R for analysis. Please download the R software online at: http://www.r-project.org/. Short introductions to R and tutorials for R can be found via a simple Google search. If students have trouble finding a tutorial please let the instructor know and they will be provided.
- We will be using Rstudio as a front end for R. Please also download Rstudio (after you download R). It should automatically locate and link with the installation of R you have on your machine. If you have any trouble please let me know.

Class Attendance

It is important that you attend the class. Everyone should attend the class. If you cannot attend, please let me know the reason. You are responsible for any materials covered or any announcements made in class.

University policies

Academic Integrity Code:
Academic integrity is an essential part of the educational process, and all members of the GW community take these matters very seriously. As the instructor of record for this course, my role is to provide clear expectations and uphold them in all assessments. Violations of academic integrity occur when students fail to cite research sources properly, engage in unauthorized collaboration, falsify data, and otherwise violate the Code of Academic Integrity. If you have any questions about whether particular academic practices or resources are permitted, you should ask me for clarification. If you are reported for an academic integrity violation, you should contact the Office of Student Rights and Responsibilities (SRR) to learn more about your rights and options in the process. Consequences can range from failure of assignment to expulsion from the university and may include a transcript notation. For more information, please refer to the SRR website (https://

studentconduct.gwu.edu/academic-integrity), email rights@gwu.edu, or call 202-994-6757.

University policy on observance of religious holidays
Students must notify faculty during the first week of the semester in which they are enrolled in the course, or as early as possible, but no later than three weeks prior to the absence, of their intention to be absent from class on their day(s) of religious observance. If the holiday falls within the first three weeks of class, the student must inform faculty in the first week of the semester. For details and policy, see “Religious Holidays” at provost.gwu.edu/policiesprocedures-and-guidelines.

Use of Electronic Course Materials and Class Recordings
Students are encouraged to use electronic course materials, including recorded class sessions, for private personal use in connection with their academic program of study. Electronic course materials and recorded class sessions should not be shared or used for non-course related purposes unless express permission has been granted by the instructor. Students who impermissibly share any electronic course materials are subject to discipline under the Student Code of Conduct. Please contact the instructor if you have questions regarding what constitutes permissible or impermissible use of electronic course materials and/or recorded class sessions.
Please contact Disability Support Services at disabilitysupport.gwu.edu if you have questions or need assistance in accessing electronic course materials.

Academic support

Writing Center
GW’s Writing Center cultivates confident writers in the University community by facilitating collaborative, critical, and inclusive conversations at all stages of the writing process. Working alongside peer mentors, writers develop strategies to write independently in academic and public settings. Appointments can be booked onlinenat gwu.mywconline.com

Academic Planning and Assessment
Academic Commons
Academic Commons provides tutoring and other academic support resources to students in
many courses. Students can schedule virtual one-on-one appointments or attend virtual dropin
sessions. Students may schedule an appointment, review the tutoring schedule, access other
academic support resources, or obtain assistance at academiccommons.gwu.edu

Support for students outside the classroom

Disability Support Services (DSS) 202-994-8250
Any student who may need an accommodation based on the potential impact of a disability
should contact Disability Support Services at disabilitysupport.gwu.edu to establish eligibility
and to coordinate reasonable accommodations.

Counseling and Psychological Services 202-994-5300
GW's Colonial Health Center offers counseling and psychological services, supporting mental health and
personal development by collaborating directly with students to overcome challenges and difficulties that may interfere with academic, emotional, and personal success.
healthcenter.gwu.edu/counseling-and-psychological-services.

Safety and Security
Monitor GW Alerts and Campus Advisories to Stay Informed before and during an emergency
event or
Situation. In an emergency: call GWPD/EMeRG 202-994-6111 or 911. For situation-specific
actions: refer to GWU's Emergency Response Handbook and Emergency Operations Plan. In the
event of an armed Intruder: Run. Hide. Fight.