ST566: Time Series Analytics
Winter 2018

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Teaching Assistant: TBD

Course Credits
This course is 3 credits. The class combines approximately 90 hours of instruction, online activities and assignments for 3 credits.

Prerequisites
ST516, ST517, ST518 or equivalent.

Course Description
ST566 aims to learn and apply statistical methods for the analysis of data that are observed sequentially over time. The main challenge is to account for the serial correlation in the data. Topics include:

- Descriptive techniques for time series: trend, seasonality, autocorrelation and correlogram;
- Probability models for time series and stationary process: MA, AR, ARMA and ARIMA models;
- Estimation in the time domain;
- Forecasting; exponential smoothing; forecasting from ARIMA models;
- Spectral analysis of time series;
- State-space models: dynamic linear models and Kalman Filter.

The focus will be on applied problems, though some mathematical statistics is necessary for a solid understanding of the statistical issues. In addition, Statistical Software R will be used to illustrate and implement above statistical methods.

Learning Outcomes
By the end of the class students will be able to:

- present and summarize time series data in an informative way
- apply fundamental statistical methods to analyze time series data
• appropriately model and analyze the correlation structure of the time series in both
time and frequency domains

• perform prediction using appropriate time series models

• carry statistical analysis in statistical software R

• present and communicate, both orally and in written-form, the results of statistical
analyses of time series data.

Learning Resources

All class materials will be posted online through canvas. There is no assigned text-
book for the class. Readings will be assigned from publicly available materials or materials
available through the Oregon State University library.

Tentative Course Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Reading</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Week 1  Introductions to Time Series; Simple Descriptive Techniques</td>
<td>TBD</td>
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<tr>
<td>2</td>
<td>Week 2  Stationary Process; Autocorrelation function</td>
<td>TBD</td>
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<tr>
<td>3</td>
<td>Week 3  AR and MA models, Yule-Walker Equations</td>
<td>TBD</td>
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<tr>
<td>4</td>
<td>Week 4  Estimation in ARMA models</td>
<td>TBD</td>
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<tr>
<td>5</td>
<td>Week 5  Fitting Time-Series in Time Domain</td>
<td>TBD</td>
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<tr>
<td>6</td>
<td>Week 6  Forecasting</td>
<td>TBD</td>
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<tr>
<td>7</td>
<td>Week 7  Stationary processes in Frequency Domain</td>
<td>TBD</td>
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<tr>
<td>8</td>
<td>Week 8  Spectral Analysis</td>
<td>TBD</td>
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<tr>
<td>9</td>
<td>Week 9  Linear systems in Time Domain</td>
<td>TBD</td>
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<tr>
<td>10</td>
<td>Week 10 State-space models and Kalman Filter</td>
<td>TBD</td>
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Evaluation of Student Performance

• **Discussion boards.** We will have weekly discussions on the course content material
assigned during that week. The discussing board is an important way to interact
with other students in the course, the TA and the instructor. As part of your course
grade, you are expected to participate (in a substantive way) in the discussion boards
each week. This can take the form of asking or answering questions about the course
material, or simply writing a comment about something to make sure that you’re
understanding a particular topic correctly. There is a separate discussion board set up
for asking/answering “how to” questions about R.

• **Homework.** There will be regular homework assignments in this class. Your home-
work solutions need to be submitted through Canvas and will be graded. There will
be a closing time after which each homework assignment will no be accepted (i.e., you
will no longer be able to submit through Canvas)—please be aware of these times! On
the homework problems, it is fine to discuss them with your classmates on discussion
board. You are expected to write up the solutions on your own in your own words.
• **Final project.** Final project will involve the analysis of a real time series data set and creating a report of your findings. More details will be given in week 5.

• **Course grade.** Discussion participation 20%; Homework 50%; Final Project 30%.

**Disability statement**

Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at [http://ds.oregonstate.edu](http://ds.oregonstate.edu). DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

**Expectations for Student Conduct**

Student conduct is governed by the university’s policies, as explained in the Office of Student Conduct and Community Standards ([http://oregonstate.edu/studentconduct/offenses-0](http://oregonstate.edu/studentconduct/offenses-0)).

**Academic integrity**

Students are expected to comply with all regulations pertaining to academic honesty. For further information, visit Student Conduct and Community Standards, or contact the office of Student Conduct and Mediation at 541-737-3656.

OAR 576-015-0020 (2) Academic or Scholarly Dishonesty:

a) Academic or Scholarly Dishonesty is defined as an act of deception in which a Student seeks to claim credit for the work or effort of another person, or uses unauthorized materials or fabricated information in any academic work or research, either through the Student’s own efforts or the efforts of another.

b) It includes:

i) CHEATING - use or attempted use of unauthorized materials, information or study aids, or an act of deceit by which a Student attempts to misrepresent mastery of academic effort or information. This includes but is not limited to unauthorized copying or collaboration on a test or assignment, using prohibited materials and texts, any misuse of an electronic device, or using any deceptive means to gain academic credit.

ii) FABRICATION - falsification or invention of any information including but not limited to falsifying research, inventing or exaggerating data, or listing incorrect or fictitious references.

iii) ASSISTING - helping another commit an act of academic dishonesty. This includes but is not limited to paying or bribing someone to acquire a test or assignment, changing someone’s grades or academic records, taking a test/doing an assignment for someone else by any means, including misuse of an electronic device.
device. It is a violation of Oregon state law to create and offer to sell part or all of an educational assignment to another person (ORS 165.114).

iv) TAMPERING - altering or interfering with evaluation instruments or documents.

v) PLAGIARISM - representing the words or ideas of another person or presenting someone else’s words, ideas, artistry or data as one’s own, or using one’s own previously submitted work. Plagiarism includes but is not limited to copying another person’s work (including unpublished material) without appropriate referencing, presenting someone else’s opinions and theories as one’s own, or working jointly on a project and then submitting it as one’s own.

c) Academic Dishonesty cases are handled initially by the academic units, following the process outlined in the University’s Academic Dishonesty Report Form, and will also be referred to SCCS for action under these rules.