

Course Goals and Learning Objectives: This course will teach you to apply your knowledge of probability and statistics to construct models for time-dependent stochastic processes (i.e., time series), to evaluate their adequacy, and to use them for prediction in real-world situations.

Room and Schedule: 330 Ingersoll Extension; Tuesday, Thursday, 9:05 - 10:45 a.m.

Text: *Time Series Analysis: With Applications in R* (2nd Edition), by Jonathan D. Cryer and Kung-Sik Chan. This text will be complemented by my lecture notes which will be your other main source of material for this course. A copy of the textbook is on reserve at the library.

Instructor: Christian Beneš; Office: 1119a N; E-mail: CBenes@brooklyn.cuny.edu.

Office Hours: Tuesday 10:45 - 11:15 a.m.; Thursday 10:45 a.m. - 12:15 p.m. No appointment is needed. Please attend as often as you would like.

Prerequisite: Math 4501 is a prerequisite for this course, but you may be allowed to take Math 4506 if taking Math 4501 simultaneously.

Class Attendance: It is strongly recommended that you attend every single lecture. I will sometimes be giving essential information in class that you may not become aware of otherwise. The syllabus is only a rough guideline and you will need to attend class to know what is actually being covered.

Work Outside of Class: While coming to class will help you in grasping the material, it will not be sufficient to pass the course. You should expect to spend a substantial number of hours every week working on the course outside of class (how many will depend on your mathematical background and how comfortable you are with the material).

E-mail: I will regularly share information with you by e-mail and will do so under the assumption that you check your e-mail at least once a day. I will be using the e-mail address available for you on WebCentral, so **make sure you check that e-mail address regularly**. You should also feel free to e-mail me with questions you might have but make sure you read the “Golden Rules of E-mail Correspondence” at the end of this syllabus. If you fail to follow these rules, I will most likely not reply to you. If you do follow them, you can generally expect that I will respond within 24 hours. **Please never send me Microsoft attachments** as Brooklyn College will block all e-mails with such attachments and **please never send me an attachment unless I have previously agreed that you do**.

Homework/Quizzes: I will assign homework regularly, **but will not collect it**. The homework is meant to make you think and not just reproduce the steps of examples seen in class. You are encouraged to work on it in groups and to ask me about it during office hours. There will be 5 quizzes throughout the semester. Each quiz will be based closely on the homework or will consist of a computational project to be completed individually. You can generally expect that I will grade your quizzes within a week. I will not allow any resubmissions for any quizzes.

Exams: There will be one midterm exam and a final exam, scheduled on the dates indicated on the Lecture and Exam Schedule. **I will not give make-up exams**. If you are forced to miss a midterm due to illness, I need to be notified within 24 hours. When you are healthy again we can discuss re-weighting your grades. I will need to see original written documentation in the form of a letter from your doctor. **If you do not follow these guidelines, a score of zero will be given for the missed exam**. Exams may have an “in-class” component (that is, taking place during the scheduled time), or a “take-home” component, or both. You will be told well before every exam what the exact format will be. You can generally expect that I will return your graded exams within a week. I will not allow any resubmissions for any exams.

Software: One of the goals of this course is to allow you to analyze data sets, some of which may be large. We will be using *R*, a free software available on the web.

Submitting Documents: You will occasionally need to submit take-home parts of quizzes and exams on Blackboard. You will be told in advance where each quiz or exam needs to be submitted. You will need to make sure the document you submit on Blackboard is a **single legible .pdf** file (no other format will be accepted). Since scans tend to reduce legibility, you will need to make a particular effort to write neatly with a good pen with preferably dark ink, to leave enough space between lines, and to start new thoughts or ideas in new paragraphs.

Calculator Policy: Unless specified otherwise, you may use any calculators or computers you would like on quizzes and exams.

Grades: Your quiz grade (the average of your grades on the semester's quizzes) will be worth a total of 30% of your final grade. The mid-term and the final will be worth 30% and 40% of your final grade, respectively. Your letter grade will be determined by the following table:

93+	90-92	87-89	83-86	80-82	77-79	73-76	70-72	67-69	63-66	60-62	<60
A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F

To obtain an A+ for the course, you need a numerical average of 98.0 **before rounding**.

Website: All relevant information will be on Blackboard, which can be reached through the CUNY Portal. If you ever have technical issues with Blackboard, please contact the HelpDesk at StudentBlackboard@brooklyn.cuny.edu.

Important Dates:

Thursday, August 31: Last day to add a course

Tuesday, September 5: Last day to submit a Pass/Fail elective application online

Thursday, September 14:: Last day to drop a course without a grade

Friday, September 15: Last day to file for December or February Graduation

Monday, December 11: Last day to withdraw from a course with a W grade

University's policy on Academic Integrity: The faculty and administration of Brooklyn College support an environment free from cheating and plagiarism. Each student is responsible for being aware of what constitutes cheating and plagiarism and for avoiding both. The complete text of the CUNY Academic Integrity Policy and the Brooklyn College procedure for policy implementation can be found at www.brooklyn.cuny.edu/bc/policies. If a faculty member suspects a violation of academic integrity and, upon investigation, confirms that violation, or if the student admits the violation, the faculty member **MUST** report the violation. *Students should be aware that faculty may use plagiarism detection software.*

Center for Student Disability Services: The Center for Student Disability Services (CSDS) will be working remotely for the fall semester. In order to receive disability-related academic accommodations students must first be registered with CSDS. Students who have a documented disability or suspect they may have a disability are invited to schedule an interview by calling (718) 951-5538 or emailing testingcsds@brooklyn.cuny.edu. If you have already registered with CSDS, email Josephine.Patterson@brooklyn.cuny.edu or testingcsds@brooklyn.cuny.edu to ensure the accommodation email is sent to your professor.

Student Bereavement Policy: In the case of the death of a loved one, the college offers a bit of flexibility in the context of your classes. See

<http://www.brooklyn.cuny.edu/web/about/initiatives/policies/bereavement.php>

Religious Accommodations: Title I, Article 5, Section 224-a of the New York State Education Law provides accommodations for non-attendance because of religious beliefs. For details see the front matter of the Undergraduate Bulletin and Graduate Bulletin, which may be found on the Academic Calendars, Course Schedules, and Bulletins page of the Registrar's website.

Math 4506 Lecture and Exam Schedule

This syllabus is intended only as a rough guideline. All topics are subject to changes without notice. Note that asterisks (*) mark the dates on which there will be a quiz.

Class#	Date	Chapters	Topics
1	08/29 (T)	1	Introduction and overview; the additive model
2	08/31 (H)		Trend Estimation; Holt-Winters forecasting
3	09/05 (T)		Multivariate random variables
4	09/07 (H)		Multivariate normal random variables
5	09/12 (T)	2	Stationary Time Series
6*	09/14 (H)	4	Linear Processes
7	09/19 (T)	4	MA processes
8	09/21 (H)	4	AR processes
9	09/26 (T)	4	Autocovariance of AR processes
10	09/28 (H)	4	Yule-Walker Equations
11*	10/03 (T)	4	Causality and Invertibility
12	10/05 (H)	4	ARMA processes
13	10/12 (H)	4	ACF of ARMA processes
14	10/17 (T)	3	Sample autocovariance and autocorrelation functions
15	10/19 (H)	8	Tests for the residual sequence
16*	10/24 (T)	5	Differencing
17	10/26 (H)	5, 6	Differencing and ARIMA models; logarithmic transformations
18	10/31 (T)		MIDTERM EXAM
19	11/02 (H)	6	Partial autocorrelation function
20	11/07 (T)	4, 7	Yule-Walker estimation
21	11/09 (H)	7, 9	Parameter estimation and forecasting
22	11/14 (T)	9	Forecasting
23*	11/16 (H)		Innovations algorithm
24	11/21 (T)	7	Maximum likelihood estimation
25	11/28 (T)	6, 8	AIC, Model diagnostics
26	11/30 (H)	9	Forecasting for ARMA models
27*	12/05 (T)		A full model
28	12/07 (H)		Tying things together

FINAL EXAM: Thursday, December 14, 8-10 a.m.

A Suggested Contract

To make sure that we all benefit from this course as much as possible, I am including a “contract” telling you what you can expect from me and what I expect from you.

Your side of the contract

Your main goals as college students should be to become educated citizens and prepare for professional life. It is a privilege to get a higher education, but performing well at a university or college rarely comes without serious effort. The points below give a few suggestions on how to make the best of your experience in the classroom.

- Be responsible! Read the syllabus and know the rules of the course. Read every handout I give you. I choose to spend time preparing them for your benefit, so you should spend time reading them. (In fact, handouts take WAY MORE time to prepare than to read.) It will help you be much more successful in the class.
- Use your time well. If your weekly schedule is tight (as I know it is for many of you), the 3 hours we’ll be spending in class together are precious time for you. Make sure you stay focussed and ask whenever something is not clear. As long as we don’t run behind, I will try to answer all your questions. If we don’t have time to cover them in or after class, come to my office hours or e-mail me.
- Give the material a fair chance. People often dislike mathematics because it’s difficult. If you’ve made it this far, you must find some pleasure in intellectual activities and should be able to find some beauty and stimulation in mathematics (many people do, so there has to be something good about it).
- Be willing to learn from your mistakes. Even the best mathematicians make mistakes all the time. What makes them good thinkers is that they use these mistakes to understand problems better and realize what is the right approach to solve them.
- Be sure to subscribe to appropriate e-mail etiquette. (See “The Golden Rules of E-mail Correspondence”)

My side of the contract

My role as a professor is to present the material to you as clearly as I can, to respect you as students willing to learn, to answer your questions and advise you on how to study better. I am here to assist you in your task of becoming educated citizens. My role is not to simplify the material or give out good grades freely. This would be insulting to you (even if I know some students wouldn’t complain). However, my role is to make the material as accessible to you as I can, to point out connections to the real world, to prepare handouts whenever these may be helpful. I have a large number of students and cannot reach out individually to each one. However, if you seek help, I will never turn you down.

- I will prepare a clear syllabus and, whenever I think it may be helpful to you, prepare handouts.
- I will teach with enthusiasm and try not to bore you (but you may also have to try not to be bored by having a positive attitude). I will challenge you and do my best to help you learn the material and, more importantly, help you retain it.
- I will answer your questions (unless the information you seek is on the syllabus or you don’t conform to correct e-mail etiquette) about the course material, even if it sometimes requires writing e-mails at 2 a.m. or on a Saturday night. I will listen to your requests to go more extensively over material you didn’t understand.
- I won’t be disrespectful to you by lowering the level of the course. On one hand, it would be insulting your intelligence. On the other, it is important that Brooklyn College stand up to national standards, so that your degree can be regarded as highly as any other when you look for a job.
- I won’t answer my phone in class. I won’t interrupt lectures to send text messages to my friends.
- I will use an e-mail address from which you can tell right away who is writing to you. I will sign my e-mails. I will read through my e-mails once I’m done writing them to check that what I wrote makes sense and that there are no spelling mistakes.

The Golden Rules of E-mail Correspondence

- Check your e-mail daily, whenever possible.
- Don't **ever** send me an attachment of more than 500kb without asking for my permission first. If I receive too many large attachments at once, my mailbox might reach its storage limit, causing my account to be blocked.
- Use an appropriate e-mail address. You and I are in a professional relationship and our electronic communications should reflect that. Don't write to me from an address such as "darkangel3472@aol.com" (unless your name really is Dark Angel). Your full name **MUST** appear in the header of each e-mail you send me. If you don't want to use your Brooklyn College e-mail address, get a gmail account for professional purposes and let your address be "[first name].[last name}@gmail.com". It takes 5 minutes to create such an account.
- When you correspond with your professors or employers, e-mail is a formal means of communication (unlike text messages). The use of simple words such as "please" and "thank you" is strongly encouraged. Do not use abbreviations or slang. Use capital letters, punctuation, greetings, and salutations. Don't start an e-mail with "Hey!" and don't forget to sign it. Don't send me any LinkedIn or Facebook invitations. I am not your buddy, even though I'll be happy if we have a friendly interaction.
- Do not e-mail me to let me know you were not in class (I will already know) or to let me know that you will be missing a class. If you must miss several classes due to illness, injury, or serious personal reasons, please do let me know, so that I can try to help you not to fall behind.
- Before sending your e-mail, read it! If you don't check for spelling, grammar, or logical mistakes, you are wasting someone else's time by trying to save yourself a few seconds. Honest mistakes are acceptable (you are not expected to be a proficient speller, but it should be your goal to become one); sloppy mistakes are impolite.

Below are two samples of e-mails that I received from students. These e-mails are unacceptable (even though they provided me with great entertainment). Note that they are slightly modified to preserve the students' privacy.

1. From: sinbad9705@gmail.com

Subject: can i cum to class tomorro

Date: November 27, 2007 8:58:37 PM EST

To: CBENES@brooklyn.cuny.edu

Hello Prof.

Its been a long time. How have you bin? I was just wondering if I could attend class tomorrow, since I dont have any classes tmorrow

2. From: sweetangel1342@aol.com

Subject:

Date: December 03, 2007 3:12:24 PM EST

To: CBENES@brooklyn.cuny.edu

When are your office hours?

Here are a few reasons why these e-mails are inappropriate:

- Neither e-mail was signed. None of the e-mail addresses reflected names of students I had at the time (I checked; no Sweet Angel or hero from the "1001 nights" were in my class). Therefore, I had no way of knowing who they were from and didn't respond.
- Please never ask me if you can come to class. Once you are registered for the class, it is clear that you are welcome to attend. In fact, believe it or not, it is even encouraged. Please never ask me when my office hours are, on what date the next quiz or exam is. All this information is on the syllabus.
- The first e-mail hasn't been spell-checked. "tmorrow" and "bin" are sloppy typos (I presume Sinbad knows that the words are spelled "tomorrow" and "been") and you don't "cum to class" but "come to class". Both of these mistakes look very bad. If you ever make typos like these in a letter to a future employer, there's a good chance that you won't be invited to an interview, so make sure you raise your standards as early on as you can.
- The second e-mail has no salutation nor subject. I usually don't even open e-mails without a subject since they may be spam (I get dozens of professional e-mails every day and don't have time to filter out spam carefully).