

GEORGE WASHINGTON UNIVERSITY  
DEPARTMENT OF STATISTICS

Course Information

STAT 2112.10--Business and Economic Statistics II--Spring 2023 (CRN: 61025)

Lectures:        Tuesday & Thursday                    6:10–7:25pm

Classroom:    DUQUES 152                                    Remote (Echo 360)

Instructor:    Saeid B. Amini, *Ph.D., MBA, JD, LL.M.*  
                  Adjunct Professor, Department of Statistics, GWU  
                  Attorney at Law

Offices:

                  Campus:    ROME Hall, Rm 764

                  Law Office: 730 24<sup>th</sup> St. NW, Suite One, Washington, DC 20037

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Phone No.: 202-965-8887

**Office Hours:** Tuesday 4:35-5:35pm, Rome Hall, 7<sup>th</sup> Floor (Rm.764)

**TA:** Muzhe Guo

**TA E-mail:** muzheguo@email.gwu.edu

**TA Office Hours:** TBA

**COURSE DESCRIPTION**

STAT2112 (Business and Economic Statistics II) is the second of the business statistics courses which builds upon basic statistical concepts covered in the previous introductory statistics courses such as STAT111, STAT1053 and STAT1051. It is continuation of Stat 1111, with emphasis on techniques of regression, chi-square (categorical data), nonparametric inference, index numbers, time series, and other topics used in economics and business. You are assumed to have a basic understanding of these concepts covered in these courses. However, to ensure that the students know the basic concepts and methods discussed in the prerequisite class, I will start the course by quick review of Chapters 5 through 8 of the textbook (Sampling Distributions, Introduction to Inference, Inference for Distribution and Inference for Proportion). I truly believe this is the most challenging course offered at GWU.

The course combines statistical theory with data analysis using statistical software. It is probably one of the most challenging courses you have taken.

## **TEXTS & Software (One Statistics Software is REQUIRED)**

<u>Author</u>	<u>Title</u>	<u>Edition</u>
McClave, Benson, & Sincich	Statistics for Business and Economics	12 <sup>th</sup>
Recommended: Student Solution Manual		
Software: Statistix ver. 10 (required; \$45 – <a href="https://www.statistix.com/">https://www.statistix.com/</a> ) or any other Statistics package such as R/Excel/Minitab/SPSS/SAS,..		

**Course Content:** The course will cover the review of ch. 6-8 and materials in Chapters 9-15

1. Chapter 9 (Design of Experiments and Analysis of Variance);
2. Chapter 10 (Categorical Data Analysis - Inference for Two-Way Tables);
3. Chapter 11 (Simple Linear Regression);
4. Chapter 12 (Multiple Regression, Model Building & Multiple Regression Diagnostic);
5. Chapter 13 (Methods for Quality Improvement and Statistical Process Control);
6. Chapter 14 (Time Series: Descriptive Analysis, Models and Forecasting);
7. Chapter 15 (Nonparametric Statistics).

(please note: Your textbook does not have Chap. 13-15 – I have already posted them on BB)

The main topics are: Analysis of Variance (hypothesis testing and multiple comparisons of means in Completely Randomized, Block and Factorial designs), categorical data analysis, simple linear regression and multiple regressions. Chapter 13 (Statistical Process Control), Chapter 14 (Time Series Analysis) and Chapters 15 (Nonparametric Test methods) will also covered. These statistical concepts and methods are used to analyze data in business, economics, social sciences and other areas of application. Students are responsible for all topics covered in the assigned reading or in class.

## **COURSE PREREQUISITE**

Successful completion of at least one introductory statistics course, such as STAT1051, STAT1053, STAT1111 or equivalent is a prerequisite. First two or three classes will be devoted to a review of the prerequisite such as summarizing data, interpreting confidence intervals, p-values and standard tests.

## **LEARNING OUTCOMES:**

As a result of completing this course, students will be able to:

1. Analyze data to test more than two means using analysis of variance technique.
2. Construct one-way and two-way tables to analyze categorical data.
3. Determine/interpret simple and multiple regression models.
4. Have basic understanding of methods used for quality improvement and process control.

5. Have basic understanding of methods used in analyzing time series data.
6. Have basic understanding of non-parametric methods.
5. Perform statistical procedures such as ANOVA, Chi-Square and Regression model using statistical software R/SAS/SPSS/Minitab/Statistix (SAS software can be accessed at Gelman library)

**COMPUTER PROGRAM: You need to make commitment and inform me by February 15, 2023**

For this course, you need to learn and use at least one statistical software package such as Statistix, SPSS/SAS/Minitab/R. **IT IS MANDATORY.** The most comprehensive and powerful among these packages is SAS. I personally like Statistix package. It is simple to use, yet very powerful and relatively cheap. It was ordered for the class and available at <https://www.statistix.com/> for about \$45 (I strongly recommend you buying a copy – you will not regret it). I will be using Statistix software throughout the semester. However, if you are familiar with any other statistical software that you wish to use it would be fine. SPSS and SAS are available through GWU and R programs are also free and available online.

**Course Homepage:** <http://blackboard.gwu.edu>. Please check this page frequently. I will post important information (class notes, homework, quizzes, projects, handouts, etc.).

**Course Structure:** The course consists of two lectures per week through Echo360 and BB Ultra. When lectures are online, I use two computers. It is broadcasted live with BB Ultra and recorded on Echo360 using two cameras (Document Camera and Computer background) while allowing you to participate through BB Ultra. The office hours are offered via Zoom.

**CLASS FORMAT**

This is a very challenging course to start with and teaching it online, without student participation, and seeing the reactions on your faces, has been doubly challenging. I hope to have live lectures but when it is online, I use document camera as a whiteboard and show PowerPoint and statistical analysis (I use Statistix software ver. 10) on computer screen. Dependent on the available technology, we can try to have as much interaction and class participation as we can. In any case, all the reading, lecture and homework assignments for the entire semester are provided herein and you should read them before each class. I also, post all my PowerPoints and other helpful materials on BB. You should review them at your leisure (hopefully before and again after the lectures).

**Homework:** From the 12<sup>th</sup> Edition of the textbook, Homework (HW) problems for the entire semester have been assigned and provided at the end of this syllabus. Please try to do the assigned HW problems after each lecture. You are required

to post your answers within 3 days of the completion of each chapter and post it through BB. While you are not going to be graded based on correct answers, HW will be graded as 10/10; 5/10 and 0/10 based on whether you attempted to answer all the questions (10/10); partial attempts (attempted 50% or less 5/10); and 0/10 if no answers submitted or attempted less than 50% of the assigned HW problems. You **MUST POST YOUR ANSWERS** before our answers post for a given chapter. We will post the answers to the assigned HW problems for previous chapter on the day we start a new chapter. For example, the answers for Chapter 9 HW problems will be posted on the day I start Chapter 10, etc. and if you post your answers after our posting, you will get 0/10 for that chapter.

In order for you to do well in this course, I strongly suggest that you do all the assigned HW problems before the due date because many problems and questions on the quizzes and exams are based on the homework problems and those discussed in class.

**Quizzes:** There will be 6 quizzes throughout the semester. These quizzes will cover materials from the preceding chapter. Quizzes may have multiple choice and essay questions and there will **be NO making up the quizzes.**

**Projects:** There will be a **mini**-project that you are required to work on individually. The project is designed to teach the students on how to work with data, use commercially available Statistical software (I ordered Statistix for the class but you can use any other packages such R, SAS) and statistical writing skills. A short report describing 1) your data, 2) statistical tools you used to analyze the data, 3) results and 4) conclusion, is expected. *You need to find or collect data on at least 80 objects/subjects/entities with at least 7 variables including at least **one nominal, one categorical and three numerical data.** You need to analyze your data using the materials you learned in at least two chapters (e.g. ANOVA and Multiple Regression; ANOVA and Categorical Data Analysis; Multiple Regression and Time series, etc.) The data collection and the first analysis must be completed and is due on or before midterm exam. The final project is due one week before the final exam. Additional instructions will be provided in the class.*

**For FULL credit, Data for the project MUST be identified by February 15, 2023.**

### **Some helpful hints/guidelines about the mini-project:**

The project is designed to teach the students on how to work with real data, use commercially available statistical software and develop statistical analysis and writing skills.

**Data:** I prefer you collect your own data (original) on at least 80 subjects on more than 7 variables. You should have at least two variable that are nominal, ordinal and two continuous variables (e.g., gender, race, how many times did you call home last month, how much cash you have in your pocket,

age, height, weight, the number of times you go to the gym every week, what is the distance of your home from GWU,.. etc.). If you cannot or do not want to collect your own data, you can use any database that has the above mentioned characteristics. Please ask me so I can provide you a dataset. Data is due by February 15, 2023.

**Analysis:** You need to use at least two methods you learned in the class to analyze your data. You should start with limited **descriptive** statistics (e.g., graphs, summary statistics, etc.) but you **MUST** perform **inferential** Statistics and hypothesis testing using the subjects you learned in two separate chapters (e.g., ANOVA, regression analysis, time series analysis, etc.). Note that chapters 11 & 12 are considered as one chapter.

**Report:** A short report (5-10 pages). You should describe 1) your data (e.g. where did you get it, how it was collected, how many subjects, variables of interest and whether they are nominal, ordinal, continuous, etc.); 2) what statistical tools you used to analyze the data, 3) results of your analysis and 4) conclusion, is expected. *Additional instructions may be provided in the class and you can contact me regarding your project at any time.*

**The project is a semester-long assignment and should NOT be done on the day it is due. It is 8% of your final grade and getting a good grade is highly correlated with your efforts during the entire semester.**

**Exams:** There will be a midterm and a final exam. The dates are set below but are subject to change. While any changes made will be announced well in advance (in class as well as online), it is the student's responsibility to keep up with these announcements. Also, since this course is being offered online, both the quizzes and exams will be open book until an alternative method such as online **proctoring** tools made available by the school.

Midterm Exam: Tentatively on **Tuesday, March 28 - during class**); covering Chapters 9-12

Final Exam: TBA (May ??????); Chapters 9-15 (cumulative)

**Grading:** Your final letter grade will be based on a total score computed as follows:

Quizzes:	15%
HW	7%
Project:	8%
Midterm:	30%
Final Exam:	40%

Letter Grades of A, A-, B+, B, B-, C+, C, C-, D+, D, D-, and F are possible results for the semester grade based on the student's performance. The major letter grades are pegged to the following total points out of a possible 100.

<b>Grade</b>	<b>Points Needed</b>	<b>Corresponding</b>
A	90+	90- 100%
B	80 - 89	80- 89%
C	70 - 79	70- 79%
D	60 - 69	60- 69%
F	< 60	< 60%

Plus and minus levels will be assigned accordingly between these scores. As a general rule, students should not anticipate any deviation from this grading scale. There is no “curve” in the grading scale.

>> ATTENDANCE: Students are expected and strongly encouraged to attend all the class meetings offered live. It is my expectation that students will have read the assigned text material prior to coming to class, and will be prepared to discuss this material in class. I would strongly suggest that if you are unable to attend a particular class, you should obtain the lecture notes from another student. I do not keep copies of my lecture notes. Furthermore, students are expected to be aware of any changes in the dates of assignments or tests. Absence will not be accepted as an excuse for ignorance.

>> HOLIDAYS & BREAKS (NO Class):

1. T & TR (March 14-16) (Spring Break)

### **CLASS POLICIES (emphasis added)**

**Attendance: I will not be taking attendance but I encourage you to attend our live lectures in classroom.**

**Make-Up Exams/Quizzes: There will be NO make-up quizzes or exams.**

### **SPECIAL REQUESTS FROM YOUR INSTRUCTOR. Please...**

- If you want a quick reply to your email, send them to:
  - a. [sbajd98@yahoo.com](mailto:sbajd98@yahoo.com)
  - b. your email must have your full name, course number (**STAT2112.10 or T/TR**) and a mention of the issue in the SUBJECT line of the email.

**Incomplete Grade.** A grade of Incomplete will only be given to a student who is passing the course but cannot complete the course due to illness or other well-documented circumstances beyond his/her control.

**Student resources.** (1) Statistical Software such as SAS and SPSS are available on GWU computers; (2) I'll inform you about the availability of FREE tutoring services by the GWU Department of Statistics.

**Study Groups.** If possible, I strongly advise you to form study groups with 4-5 students so you can work on homework problems and discuss the lecture materials.

### **University Policy on Religious Holidays:**

1. Students should notify faculty during the first week of the semester of their intention to be absent from class on their day(s) of religious observance;
2. Faculty should extend to these students the courtesy of absence without penalty on such occasions, including permission to make up examinations;
3. Faculty who intend to observe a religious holiday should arrange at the beginning of the semester to reschedule missed classes or to make other provisions for their course- related activities

[NOTE: for other university policies on teaching, see <http://www.gwu.edu/~academic/Teaching/main.htm> ]

### **ACADEMIC INTEGRITY**

I personally support the GW Code of Academic Integrity. It states: "Academic dishonesty is defined as cheating of any kind, including misrepresenting one's own work, taking credit for the work of others without crediting them and without appropriate authorization, and the fabrication of information." For the remainder of the code, see: <http://www.gwu.edu/~ntegrity/code.html>

### **SUPPORT FOR STUDENTS OUTSIDE THE CLASSROOM**

#### *DISABILITY SUPPORT SERVICES (DSS)*

Any student who may need an accommodation based on the potential impact of a disability should contact the Disability Support Services office at 202-994-8250 in the Marvin Center, Suite 242, to establish eligibility and to coordinate reasonable accommodations. For additional information please refer to: <http://gwired.gwu.edu/dss/>

### **UNIVERSITY COUNSELING CENTER (UCC) 202-994-5300**

The University Counseling Center (UCC) offers 24/7 assistance and referral to address students' personal, social, career, and study skills problems. Services for students include:

- crisis and emergency mental health consultations
- confidential assessment, counseling services (individual and small group), and referrals

<http://gwired.gwu.edu/counsel/CounselingServices/AcademicSupportServices>

### **UNIVERSITY TITLE IX POLICY**

The George Washington University (GW) and its faculty are committed to creating a safe and open learning environment for all students. If you or someone you know has experienced sexual harassment, including sexual assault, dating or domestic violence, and stalking, please know that help and support are available. GW strongly encourages all members of the community to take action, seek support, and report incidents of sexual harassment to the Title IX Office. You may contact the Title IX Office at 202-994-7434 or at

[titleix@gwu.edu](mailto:titleix@gwu.edu) or learn more by visiting [titleix.gwu.edu](http://titleix.gwu.edu). Please be aware that faculty members are required to disclose information about suspected or alleged sexual harassment or other potential violations of the Title IX Sexual Harassment and Related Conduct Policy to the Title IX Office. If the Title IX Office receives information about an incident, they will reach out to offer information about resources, rights, and procedural options as a member of the campus community. Community members are not required to respond to this outreach. If you, or another student you know, wishes to speak to a confidential resource who does not have this reporting responsibility, please contact Counseling and Psychological Services through the Colonial Health Center 24/7 at 202-994-5300, or the Office Of Advocacy and Support at 202-994-0443 or at [oas@gwu.edu](mailto:oas@gwu.edu).

### **SECURITY**

In the case of an emergency, if at all possible, the class should shelter in place. If the building that the class is in is affected, follow the evacuation procedures for the building. After evacuation, seek shelter at a predetermined rendezvous location such as in front of the buildings, etc.



01/17/23 - 05/01/23

## Class Schedule and Assignments

Date	Day	Topic	Chapter
1/17	T	*Introduction; Review of Chapters 5&6: sampling distribution Central limit theorem, computing the probability and critical values Confidence Interval, Sample Size calculation (study of single variable) - Introduce Statistix software & Sampling Distribution simulation software	5-6
1/19	TR	*Test of hypothesis about a population mean, a population variance Testing of population variances, Type I & Type II errors One and two Sided alternatives	7-8
1/21	<b>SAT</b>	* Review of Statistics-I Materials (classroom will be announced) Attendance is Voluntary (11am-1pm) Depending on the GWU Covid protocol, I may provide Pizza and Soft drinks	2-8
1/24	T	* Introduction to experimental design: elements, Factor, design § 9.1	Ch. 9
1/26	TR	* Complete Randomized design–Single Factor & use of software§ 9.2	
1/31	T	* Multiple comparisons of means and introduction to Randomized Block Design, § 9.3-9.4	
2/2	TR	* Randomized Block Design §§ 9.3-4	
2/7	T	* Factorial Design- two Factors with Interactions, §§ 9.1-5	
2/9	TR	*Review of Chapter 9	
2/14	T	*Categorical Data Analysis – Introduction and one-way table (§§ 10.1-10.2)	Ch. 10
2/16	TR	*Categorical Data Analysis – Two-way Contingency Tables (§§10.3-4) 2x2 Table – Fisher’s Exact Test	
2/21	T	*Simple Linear Regression Model & fitting a simple regression line (§§11.1-4)	Ch. 11
2/23	TR	*Coefficient of Correlation & determination & Using regression for Prediction and forecasting (§§11.5.11.7)	

- 2/28 T \*Multiple regression; inference about the regression coefficients (§12.1-2) Ch.12
- 3/2 TR \*Multiple regression- Coefficient of determination & using multiple Regression for prediction and forecasting (§§12.3-12.4)
- 3/7 T \*Model Building with Multiple Regression and concepts of higher order Models and use of dummy variables (§§ 12.5-12.7)
- 3/9 TR \*Fitting multiple regression models to data that includes both quantitative and qualitative data and Nested models (§ 12.8-10)
- 3/14, 16 T &TR **SPRING BREAK – NO CLASS**  
(review Chapters 9-12 materials on your own)
- 3/21 T \*Residual Analysis, Multicollinearity & parsimonious (§§ 12.11-12)
- 3/23 TR \*Review of Chapter 12
- 3/25 SAT \* Review of Chapter 9-12 & some of Review Materials such as P-value (classroom will be announced)  
Attendance is Voluntary (11am-1pm)  
Depending on the GWU Covid protocol, I may provide Pizza and Soft drinks
- 3/28 T **MIDTERM EXAM**  
Chapters 9-12 & Some Review Materials
- 3/30 TR \*Methods for Quality Improvement and process Control (§§13.1-13.4) Ch. 13
- 4/4 T \*Methods for Quality Improvement and process Control (§§13.5-13.8)
- 4/6 TR \*Time Series Analysis: Descriptive Analysis: Index Numbers Ch.14  
Simple, Weighted, Indices, CPIs (§§14.1)
- 4/11 T \*Time Series Analysis: Descriptive Analysis: smoothing techniques (§§14.2)
- 4/13 TR \*Time Series Analysis: time series components & Forecasting Techniques Trends (§§14.3-14.4)
- 4/18 T \*Time Series Analysis: Forecasting Techniques for Trend and Seasonality Data Trends (Holt's & Winter & SARIMA methods) §§14.5
- 4/20 TR \*Time Series Analysis: measuring forecast accuracy and other topics (§§14.6-14.9) & Review of Chapter 14

4/25 T \*Non-parametric Statistics (Distribution-free tests): Kruskal-Wallis Ch. 15  
Friedman test and Spearman Correlation (§§15.5-15.7)

4/25 TR \*Wilcoxon Signed rank and Two sample Wilcoxon Sum rank tests (§§15.3-4)  
\* Single sample problems{Sign & Wilcoxon signed-rank tests, Binomial  
Distribution (§§15.1-2)

(Last Day of the Class)

NOTE – In Chapter 15, I will start the lecture from the last section of this chapter and go backward and cover as much as the topics that we can ---we will definitely cover the following topics for which you are responsible in the final exam

Kruskal-Wallis test  
Friedman test  
Spearman Correlation  
Wilcoxon signed-rank tests

**SAT** (before the FINAL EXAM) \*Upon Request of at least 10 students –  
I'll provide Review of Chapters 9-15  
(11am-1pm)  
classroom will be announced)  
Last Day of Class: May 1  
FINAL EXAM: Chapters: 9-15 (Cumulative)

Final Exam Date, time: TBA (May 2+)

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**Suggested Homework Problems: (for some of the HW problems you may need to use Computer and statistics software)**

**Problems are assigned from 12<sup>th</sup> Edition (our Textbook)**

Chapters 6-8 (review): 6.97, 6.129, 7.26, 7.54, 7.86, 8.11, 8.31, 8.49, 8.62, 8.81, 8.93

Chapter 9: 9.7, 9.16, 9.20, 9.26, 9.28, 9.46, 9.53, 9.56, 9.75, 9.102

Chapter 10: 10.17, 10.18, 10.27, 10.33, 10.40, 10.44

Chapter 11: 10.13, 11.17, 11.34, 11.38, 11.42, 11.46, 11.64, 11.66, 11.89, 11.101

Chapter 12: 12.2, 12.11, 12.13, 12.17, 12.29, 12.37, 12.43, 12.53, 12.76, 12.103, 12.106, 12.113,  
12.120, 12.135, 12.146, 12.167

Chapter 13: 13: 13.1, 13.4, 13.6, 13.7, 13.8, 13.16 (let,  $\bar{X} = 23.9971$ ,  $\bar{R} = 0.1815$ ), 13.29,  
13.48, 13.81, 13.87

Chapter 14: 14.32, 14.48, 14.4, 14.5, 14.18, 14.21, 14.24, 14.31, 14.36, 14.46, 14.52

Chapter 15: 15.3, 15.4, 15.5, 15.8, 15.11, 15.15, 15.14, 15.26, 15.27, 15.34, 13.35, 15.36, 15.46,  
15.47, 15.55, 15.57, 15.70, 15.88, 15.89