STAT:1030:0AAA Statistics for Business, Fall 2022

SYLLABUS

Course ICON Site	To access the course site, log into Iowa Courses Online (ICON) https://icon.uiowa.edu/index.shtml using your Hawk ID and password.
Instructor (Course Supervisor)	Professor Joseph B. Lang, 271 SH, joseph-lang@uiowa.edu
Discussion Instructors (TAs)	See ICON
Lectures **Discussion Sessions**	3:30-4:45, MW, MacBride Hall Auditorium TTh, Times and locations depend on section enrolled
Student Drop-In and Supplemental Instruction Hours	Discussion Instructor (TA): See ICON Instructor: 10:30-12:00 MW, or by appointment, 271 SH Supplemental Instruction: See ICON
Pre-Requisites	MATH:1005 or MATH:1020 or MATH:1340 or MATH:1350 or MATH:1380 or MATH:1440 or MATH:1460 or MATH:1550 or MATH:1850
Approved General Education Course	Quantitative and Formal Reasoning
Department and Course Home	Statistics and Actuarial Science. The College of Liberal Arts and Sciences (CLAS) is the home of this course, and CLAS governs the add and drop deadlines, the "second-grade only" option (SGO), academic misconduct policies, and other undergraduate policies and procedures. Other UI colleges may have different policies.
DEO (Department Chair)	Professor Kung-Sik Chan, 241 SH, 335-0712, kung-sik-chan@uiowa.edu
Department Main Office	241 SH

Required Text: The online text is available on the course ICON site, in the form of Modules 1-10.[1]

[1] Supplementary Texts: There are many other free online textbooks available; several include worked examples. For instance, start at https://open.umn.edu/opentextbooks/textbooks/385 for a freely available intro business statistics textbook. See also https://textbookequity.org/Textbooks/introductorystatistics_Vol1.pdf and https://openstax.org/details/books/introductory-statistics. Non-free books that are very good include Moore, McCabe, Alwan, Craig (2016), *The Practice of Statistics for Business and Economics*, 4th edition, Macmillan; and Moore and Notz (2020), *Statistics: Concepts and Controversies*, 10th edition, Macmillan. There are also many entertaining and informative popular press books available; see Prof Lang for suggested reading.

Description: This is a one semester undergraduate course in business statistics. All the course material including the textbook will be made available on ICON. Lectures will introduce the student to statistical thinking and will cover introductory topics in descriptive and inferential statistics, with emphasis on business applications (see the appendix for a list of topics and some illustrative examples). Discussions will support lecture material and include a weekly computer lab component where software Excel will be used to carry out data analyses. The material is pitched at a level that should be comfortable to a first-year undergraduate student who has successfully completed a college-level algebra course (e.g. MATH:1005). This is an approved General Education course (Quantitative and Formal Reasoning).

Objectives: The successful student will leave this course with a basic understanding of many of the fundamentally important ideas in statistics. They will be equally comfortable (i) explaining statistical concepts, paradoxes, and fallacies to colleagues; (ii) using basic probability rules to measure uncertainty, (iii) graphically and numerically describing univariate and multivariate data; and (iv) applying elementary statistical inference procedures. They will also be comfortable using the computer software Excel to carry out many of the descriptive and inferential tasks.

Course Organization:

Lectures and Discussions.

Lectures. The 75-minute in-person meetings on M and W will typically be used to work through examples and to give a running summary of the material. We will cover most of the topics from Modules 1-10 in the online textbook. Students will be expected to come prepared and to participate in the worked examples and engagement activities. To be better prepared for lectures, students are strongly encouraged to look over the relevant material before class. The "engagement activities" and "skills building" exercises (see below) will serve as a guide to where we are and will be in the material.

Discussion Section. The 50-minute in-person meetings on T and Th will be used to work through examples related to the lecture material and skills building exercises. These sessions will also include engagement activities. **Computing.** On either T or Th, depending on the section of enrollment, discussion will be held in the Myer's Computing Lab in 41 SH. Among other things, in this lab, discussion instructors will help students with the computing aspects of the course. We will primarily use the spreadsheet program Excel to create graphical and numerical summaries of data and to carry out basic statistical inferences.

Note: Excel (https://en.wikipedia.org/wiki/Microsoft_Excel) is part of the Microsoft Office suite and is available in all the ITC labs on campus, including the Myers Computing Lab (41 SH).

ABC Work.

All student work in this class will be made up of three components: Engagement **A**ctivities, Skills **B**uilding, and Skills **C**hecks.

For planning purposes…Each week you should plan on submitting to ICON a piece of ABC work on Friday by 11:59pm (see the Assignments page in ICON). You will be in lecture Monday and Wednesday from 3:30-4:45 and in discussion for two 50-minute periods, one on Tuesday and one on Thursday. During any of these periods, an engagement activity may be carried out and handed in.

Note: Most of your ABC work will be submitted to ICON in a **single PDF file.** For those without scanners, there are free apps available for sequentially taking pictures of multiple pages and combining them into a single PDF file—the instructor has had some success with the iOS version of the free *Adobe Scan* app. It is your responsibility to make sure your ICON submission is easily readable.

A. Engagement Activities. Engagement activities will be carried out or assigned regularly (tentatively, around 10-15 over the semester) and will be handed in directly in discussion or lecture or submitted to ICON. These activities take a variety of forms, including class participation checks, short summaries of lectures and discussions, computing work, and self-created exercises with solutions. In-class engagement activities will not be pre-announced. For the activities that will be submitted to ICON (typically on Fridays by 11:59pm), see the Assignments section of ICON. If there are fewer than 10 activities, your lowest 2 will be dropped. And if there are at least 10 activities, your lowest 3 will be dropped. (There are no make-ups for engagement activities. If you must miss one for any reason, this will be a score that is dropped.)

B. Skills Building. To build the skills necessary to succeed in this course and then later in the workplace, skills building exercises will be assigned regularly (tentatively, around 8-10 over the semester). Your solution sets will be submitted to ICON, in a single pdf file. Details will be posted to the Assignments section of ICON. Due dates will typically be Fridays, at 11:59pm. Your lowest score will be dropped without penalty. (There are no make-ups for skills building exercise sets. If you must miss one for any reason, this will be the score that is dropped.)

C. Skills Checks. There will be three skills checks over the semester. These are *work-alone* projects that are open book, open computer, and open internet; they are, however, closed to queries: that is, you are not allowed to pose a question to any person or site to elicit a response. Projects will be based on lecture and discussion material, and on engagement activities and skills building exercises. Each skills check project is constructed to take between 1 and 3 hours to complete and can be completed anytime over a 24-hour window. Details will be posted to the Assignments section of ICON.

Course Pace (Tentative):

Modules 1-4:	Intro, Descriptive Stats (Univariate, Bivariate, Regression)	Weeks 1-5
	Skills Check #1:	Fri, Sep 30
Modules 5-8:	Data Production, Linking Data to Inference Targets, Probability and Process Distributions, Named Distributions	Weeks 6-9
	Skills Check #2:	Fri, Oct 28
Modules 9-10:	Statistical Inference, Fallacies and Paradoxes	Weeks 10-15
	Skills Check #3:	Dec 12-16 (?tbd)

Course-Specific Guidelines and Policies:

Attendance. Students are expected to attend all lectures and discussion sessions. Just as in the workplace, attendance is a critical predictor of success. If you have questions about these expectations, please see your discussion instructor (TA).

Announcements etc. Announcements, assignments, and supplementary material will be posted to ICON. You should check the course ICON site daily for announcements and updates.

Stay Caught Up. It is vitally important that you are self-disciplined enough to stay caught up. You should take note of the due dates of all ABC work and make sure to read and view the online text at least up to that point. You are expected to attend all lectures and discussion sessions.

Effort Expectations. My effort expectations align with the home college's guideline: "for each semester hour of class time around two hours per week of outside homework and class preparation should be completed by the average student." For example, in a 4-semester-hour course, standard out-of-class effort is 8 hours. Of course, you need to keep in mind that the '8 hours per week' is an average taken over the weeks in the semester. It is also an average taken over a diverse collection of students and courses. Thus, effort amounts will vary from week to week and from student to student. It is fair to say, however, that the more effort you put in, the more you will get out of the course.

Working Together. You must work alone on the Skills **C**heck projects. Unless instructed otherwise, you may work together on the Engagement **A**ctivities and Skills **B**uilding exercises. However, you must write up your own solutions in your own words. If you are personally asked to write up your own solutions, but then subsequently turn in material that is obviously in the same words as someone else, the work will be considered plagiarized. Plagiarism will be dealt with according to the policies of the College of Liberal Arts and Sciences and the University (see additional information on Academic Honesty and Misconduct at the end of this syllabus).

Late Work. Late submissions of Skills Check projects and Engagement Activities are not allowed. Late submissions of any Skills Building work will be penalized by 50% each 24-hour period. For example, if you scored a 7.6 out of 10 on a Skills Building exercise set, but it was submitted an hour late, you would receive a score of 3.8 out of 10; and if you submitted it 25 hours late, you would receive a score of 1.9 out of 10.

Questions about Graded Work. Questions about grading **must be asked within one week** of the graded work's return. Reach out directly to your discussion instructor (TA) with any questions.

Grading and Components for Evaluation:

Your final score S will be computed as

$$S = 0.20\,A + 0.35\,B + 0.25\,C_{(3)} + 0.15\,C_{(2)} + 0.05\,C_{(1)},$$

where $A =$ % credit on Engagement **A**ctivity work, $B =$ % credit on Skills **B**uilding work, and $C_{(3)} \geq C_{(2)} \geq C_{(1)}$ are the highest, median, and lowest of your three Skills **C**heck scores. This scoring scheme dramatically down-weights (i.e., is forgiving of) a low skills check score! See also the engagement activity and skills building sections above for low-score dropping information.

As an example, suppose Janice received a score of 92% on her Engagement **A**ctivity work, 85% on her Skills **B**uilding work, and received Skills **C**heck scores of 87%, 28%, and 95%. Because her highest, median, and lowest skills check scores are $C_{(3)} = 95\%$, $C_{(2)} = 87\%$, and $C_{(1)} = 28\%$, Janice's final score is

$$S = 0.20(92) + 0.35(85) + 0.25(95) + 0.15(87) + 0.05(28) = 86.35.$$

Letter grades (including $+$'s and $-$'s) will be awarded according to a 90-80-70-60 schedule. For example, if $S \geq 90$, then a grade of A$-$ or better will be awarded. These are guaranteed cutoffs, so it is possible, but unlikely, that everyone receives an 'A.'

With this grading scheme **you are NOT "graded on a curve,"** and so you are not competing with fellow students. Therefore, you are not penalized for working together on engagement activities and skills building exercises (unless instructed otherwise) to better understand concepts.

Miscellaneous Help and Resources:

Help Outside of Class

TA Office Hours: See ICON for TA information.

Instructor Office Hours: See top of this syllabus.

Supplemental Instruction (SI): This course has SI available. SI is an excellent peer facilitated, interactive group study session designed to not only help you learn the material, but also how to learn. See ICON for SI information or go to https://uc.uiowa.edu/student-success/academic-resource-center-arc/si-schedule

Statistics Tutorial Lab: There is a free statistics tutorial lab (1113 Red, Library Commons, First Floor, Main Library) for students in this course. During available times, a graduate student will be present to assist you. Hours for the lab can be found at https://www.stat.uiowa.edu/resources/tutoring. A list of paid private tutors can be found on this page as well.

Help with Excel (and R)

https://support.microsoft.com/en-us/excel or google any topic for video help

(http://www.math.csi.cuny.edu/Statistics/R/simpleR/index.html, SimpleR)

Scanning Apps (for creating images and combining them into a single PDF file)

The iOS version of the free *Adobe Scan* app seems to work reasonably well.

College of Liberal Arts and Sciences (CLAS) Policies:

Academic Honesty and Misconduct
All students in CLAS courses are expected to abide by the CLAS Code of Academic Honesty. Undergraduate academic misconduct must be reported by instructors to CLAS according to these procedures. Graduate academic misconduct must be reported to the Graduate College according to Section F of the Graduate College Manual.

Student Complaints
Students with a complaint about a grade or a related matter should first discuss the situation with the instructor and/or the course supervisor (if applicable), and finally with the Director or Chair of the school, department, or program offering the course. Undergraduate students should contact CLAS Undergraduate Programs for support when the matter is not resolved at the previous level. Graduate students should contact the CLAS Associate Dean for Graduate Education and Outreach and Engagement when additional support is needed.

Drop Deadline for this Course
You may drop an individual course before the deadline; after this deadline you will need collegiate approval. You can look up the drop deadline for this course here. When you drop a course, a "W" will appear on your transcript. The mark of "W" is a neutral mark that does not affect your GPA. Directions for adding or dropping a course and other registration changes can be found on the Registrar's website. Undergraduate students can find policies on dropping and withdrawing here**.** Graduate students should adhere to the academic deadlines and policies set by the Graduate College.

Date and Time of the Final Exam (*the 3rd Skills Check in this course*)
The final examination date and time will be announced by the Registrar generally by the fifth week of classes and it will be announced on the course ICON site once it is known. **Do not plan your end of the semester travel plans until the final exam schedule is made public. It is your responsibility to know the date, time, and place of the final exam.** According to Registrar's final exam policy, students **have a maximum of two weeks after the announced final exam schedule** to request a change if an exam conflict exists or if a student has more than two exams in one day (see the policy here).

Communication: UI Email
Students are responsible for all official correspondences sent to their UI email address (uiowa.edu) and must use this address for any communication with instructors or staff in the UI community.

University Policies:

Accommodations for Students with Disabilities
Basic Needs and Support for Students
Classroom Expectations
Exam Make-up Owing to Absence
Free Speech and Expression
Mental Health
Military Service Obligations
Non-discrimination
Religious Holy Days
Sexual Harassment/Misconduct and Supportive Measures
Sharing of Class Recordings

I hope you all have an enjoyable and rewarding semester. Good luck in all your courses. –Professor Lang

APPENDIX: STAT:1030 Course Topics[2]

Computing: Primarily, the spreadsheet software program Excel will be used in this course.

Module 1 Introduction

Variables and Variable Types
Data, Data Set, Data Base
Sample, Population, and Process (aka Probability) Distributions
Statistics vs. Population and Process Parameters
Descriptive vs. Inferential Statistics
Data Production (All Data are Not Created Equal)
Observational Study vs. Randomized Designed Experiment
Calculators: Probability and More

Module 2 Descriptive Statistics: Univariate Distributions

Graphical Descriptions
Numerical Descriptions
Relative Standing
Comparing Univariate Distributions

Module 3 Descriptive Statistics: Bivariate Distributions

Joint, Marginal, and Conditional Distributions
Association, Correlation, and Causation (Definitions)
Scatterplots and Two-Way Tables
Correlation
Summaries of Linear Combinations

Module 4 Descriptive Statistics: Regression for Bivariate Description and Prediction

Least Squares (LSQ) Line: Computations and Interpretations
Prediction
Regression to the Mean

Module 5 Data Production

Population Sampling Methods (Probability vs. Non-Probability)
Process Sampling Methods (Replication and Sequential)
Two-Stage Selection Sampling and Selection Bias

Module 6 Linking Data to Inference Targets

The Fundamental Theorem of Statistics (FTS)
The Law of Large Numbers (LLN)
Empirical Interpretations of Process Parameters

Module 7 Process (aka Probability) Distributions

The 7 Properties of Probability and Bayes Rule
Process Distributions
Summarizing Univariate Processes
Summarizing Bivariate and Multivariate Processes and Linear Combinations
Famous Approximations to Process Distributions (e.g., Central Limit Theorem)

[2] For more details, see the document STAT1030_Fall22_topics_unabridged.pdf on ICON.

Module 8 Named Process Distributions

Discrete: Binomial, Geometric, and Poisson Distributions
Continuous: Normal, Student's t, and Chi-Squared Distributions
Probability Calculators (online and in Excel)

Module 9 Statistical Inference

One-Sample Setting
Two-Sample Setting
Regression Setting

Module 10 Paradoxes and Fallacies

Association vs. Causation
Simpson's Paradox
Regression Fallacy
Switched Conditionals Fallacy
Sampling Fallacies and Data Snooping
Gambler's Fallacies

A sample of Illustrative Examples …

- *Utility of Time Series Plots for detecting time-by-expense associations/patterns.*
- *Market Basket Lift as a measure of association*
- *Portfolio Analysis*
- *Regression for improved prediction of actual (rather than projected) time to job completion.*
- *Size of Sales Force and Sales: Poor planning owing to an incorrect causal interpretation of regression results*
- *Beta Measure of Financial Risk. Regression for assessing sensitivity to overall market swings.*
- *Predicting 10-Year Returns on Investment: Using Monte Carlo Simulation*
- *Safety Stock Analysis*
- *A realtor found that the LSQ line for predicting the sale price of a home (P) based on the number of toilet paper holders (H) is $P = 120000 + 70000\,H$. Unfortunately, if we add another toilet paper holder to a home, we canNOT expect the price to go up by $\$70000$!*
- *Drug A is better than B overall. But Drug B is better than A for females…AND for males. Huh?*
- *Overall, Airline A has a lower delay rate than Airline B. Sheila has her employees fly with Airline B because there is less chance of delay. Huh?*
- *Stock A had return that was 3 std deviations above average this year. The best prediction for its relative standing next year is NOT 3 std deviations above average. A better prediction is closer to average, by the Regression-to-the-Mean phenomenon.*
- *Is there an employee-of-the-month curse? A Sports-Illustrated-cover curse?*
- *A diagnostic test for a rare (1 in 1000) virus is 90% accurate. A randomly selected person tests positive. The chances this person has the virus is NOT 90%; it is only around 0.9%!*