QUANTITATIVE TECHNIQUES 1
UP 6320
GPH 6420
Fall 2020

Instructor:	Rayman Mohamed
Office:	Online via Teams or Zoom or by phone call
Office Hours:	By appointment
Email:	rayman.mohamed@wayne.edu
Lectures:	Tuesdays 5:30 – 8:50, Synchronous Online

We can also set up a time to talk on the phone on Teams, or Zoom
To be successful in the class, it is really, really helpful if you ask questions!!

Texts

Required: Bowen, C., 2016, Straightforward Statistics, Sage, ISBN: 9781483358918.

Optional: Cronk, B., 2017, How to use SPSS statistics: A step-by-step guide to analysis and interpretation, 10th ed. Routhledge, ISBN 13: 978-1138308534, ISBN 10: 1138308536.

I strongly encourage you to keep Bowen handy as we go through the class. We will occasionally use examples from the book and it is helpful if you have it on hand.

In addition to the required textbook, I will provide occasional readings.

A scientific calculator capable of performing the following operations: Addition, subtraction, multiplication, division, squaring, square roots and a 'memory' function. Your cell phone is NOT an acceptable substitute for a calculator.

We will also learn and use SPSS to perform many analyses. SPSS is one of many statistical software packages available. It has become popular with social scientists and for that reason we will be using it.

Course Description

Planners summarize data, analyze them, carefully evaluate their meaning, and utilize them in professional writing and presentations. The underlying objective of this course is to provide you with the basic tools necessary to understand and work with quantitative data that occur in everyday planning practice. Accordingly:[1]

[1] The indented text in the next three paragraphs is fully taken from a sample syllabus provided by Professor Chieh-Chen Bowen, Ph.D., to accompany her textbook. Full credit belongs to Professor Bowen.

This course focuses on statistical reasoning and applications of inferential statistics to the analysis and interpretation of data in the social sciences, with special emphasis on hypothesis testing using different types of t-tests, correlation, regression, ANOVA and Chi-squares.

What this means: By the end of this course, you will be able to take a set of data, determine the best way(s) to describe the data, and conduct the appropriate analyses in order to extract useful information out of the data. Furthermore, given a research question about whether two variables are related (either your own question or a question given to you), you should be able to name the appropriate statistical test for answering this question, explain the steps for conducting the test, and actually calculate the necessary statistics. Finally, given a research question and the results from a statistical test, you should be able to interpret the statistical outcomes in terms of the research question (i.e., how do the statistics answer the research question).

In order to do this, you will need to develop both your knowledge and your skill. Your knowledge acquisition begins with you – you are expected to read the assigned material before EVERY class. Due to the 'building' nature of the information in this class, it is essential that you do not fall behind. Knowledge acquisition continues during class. Skill development occurs through practice. Much of our in-class time will be devoted to practicing the skills that you will need in real life (and on the test). Skill development will also continue outside of class; you should be practicing these behaviors on your own as you study the material.

Learning Outcomes

By the end of the course, you will be able to (in order in which the materials are covered):

- Apply a wide variety of descriptive statistics to describe places, people, of events. This activity will assist in the most basic of planning analysis: collecting, condensing, and presenting information about the issue to be addressed or analyzed.

- Construct comparisons using statistical inference between places, people, or events and highlight differences and/or similarities. Comparisons may be made over time, across cases, or by comparing actual results to the results predicted by one theory or another. Making geographic and socioeconomic comparisons is particularly salient for planners.

- Making predictions using statistical inference about the future is also critical to good planning. Planners rarely have complete information at their disposal, either because data were not systematically collected for the desired purpose or because it is too expensive to collect. At best, planners have a sample with which to work. Using this sample to make reasonable guesses about larger populations is critical requirement for good planning.

- For graduate students only: Write a research protocol; Design a survey in Qualtrics, administer the survey to students around campus, and write up the results of your survey.

- Use SPSS to perform the statistical analyses that we will cover in the class (ongoing throughout the semester).

Lab Requirements

We will have virtual labs many days during the semester.

Course Requirements

Attendance and participation: I expect that you will attend all classes. A missed class will be difficult to make up especially if that class combines lectures with labs. If you miss class due to an illness or an emergency, I recommend you call a classmate as soon as possible to get assignments and find out what you missed. Please do this before you get in touch with me.

Homework assignments: You will be assigned homework from the textbook and/or from a supplementary database. Because this is a large class, late homework will not be accepted. Homework assignments will be a mixture of short questions, longer questions that require data analysis, or short written answers.

Quizzes: There will be four quizzes during the semester on the dates shown in the syllabus at the beginning of class. However, these dates are subject to changes if students need more help and we fall behind in the class. Each will each count for 5% of your grade for a total of 20%. The quizzes will cover the material up to the previous class. These will be closed book, closed note quizzes.

Exams: There will be one mid-term exam and one final exam.

Summary of requirements for graduate students:

- Attendance and participation: 5%
- Homework assignments: 20%
- Quizzes: 20%
- Group research protocol: 5%
- Group research paper: 10%
- Mid-term: 20%
- Final exam: 20%

Summary of requirements for undergraduate students:

- Attendance and participation: 10%
- Homework assignments: 25%
- Quizzes: 20%
- Mid-term: 20%
- Final exam: 25 %

Note on grading: Because this class has a steady flow of homework assignments and quizzes and because the materials are "quantitative", there is little ambiguity in your final grade. Your grade is your grade and I have little leeway to change these grades at the end of the semester. Final grades will be assigned on a curve. Graduate and undergraduate students are graded on different curves. For this reason, if you are an undergraduate student you should be sure to register for GPH 6420.

Do not use the final grade you obtain in this class (or other "methods" classes you take with me) to predict your grades in advanced optional classes that I teach (such as Environmental Planning), or vice versa. The grading schemes I use for methods classes are different from the grading schemes I use for advanced classes.

Note to graduate students: Canvas promises to keep a running tab of your performance in class. Note to undergraduate students: Canvas will not an accurate tab of your performance in class.

I recommend that that both graduate and undergraduate students keep **a running tab** of your performance in the class by weighing the points you obtain on your submissions by the percentages given above. For graduate students, this should be consistent with the tab that Canvas keeps.

Regrades: If you discover an error in your grading or have a question about your grades, please be in touch soon after the work is returned to you. If you inform me too late, there is no guarantee that I will make the change. If during the discussions I agree to the change, you shall email me within 24 hours reminding me to make the change in the records. Make it clear that "we spoke in class about this." In the subject line of the email use the words: "grade change request" and the course number (UP 6320 or GPH 6420). If I do not make the grade change that we agreed on, feel free to remind me.

All homeworks will be submitted via Canvas.

Additional Notes

THIS CLASS STARTS OFF SLOWLY. BUT IT PICKS UP PACE RAPIDLY FROM THE MIDDLE OF OCTOBER. I HAVE SEEN MANY STUDENTS TAKE THE FIRST FEW WEEKS LIGHTLY ONLY TO BE SURPRISED BY THE RAPID INCREASE IN PACE AFTER A FEW WEEKS. EACH WEEK IS IMPORTANT!!!

The topics that students find the most difficult are: one sample tests of hypotheses, two sample tests of hypotheses, ANOVAS, and regressions. We devote a single class (three hours plus labs) to each of the first three topics and three weeks (nine hours plus labs) to regressions. **THIS IS SUFFICIENT FOR YOU TO LEARN THE WHAT WE WILL COVER. IT IS IN THESE WEEKS THAT MOST STUDENTS STUMBLE!!!**

Plagiarism

I expect independent work on homework assignments, quizzes, and exams.

Plagiarism is a serious academic office and carries penalties ranging from failing the particular assignment in question, failing the course, or university disciplinary action. See www.doso.wayne.edu/judicial/academic-integrity.htm.

Students with Disabilities

If you have a documented disability that requires accommodations, you will need to register with Student Disability Services (SDS) for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. SDS telephone number is 313-577-1851 or 313-577-3365 (TDD only). Once you have your accommodations in place, I will be glad to meet with you privately during my office hours to discuss your special needs. Student Disability Services' mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University.

Please be aware that a delay in getting SDS accommodation letters for the current semester may hinder the availability or facilitation of those accommodations in a timely manner. Therefore, it is in your best interest to get your accommodation letters as early in the semester as possible.

Course Schedule[2]

1. September 1

Introduction to Statistics
Chapter 1

Learning Objectives

1.1 Understand some basics about data collection

1.2 Define samples and populations

1.3 Define descriptive statistics and inferential statistics

1.4 Define scales of measurement

1.5 Provide two or three examples of each scale of measurement

1.6 Identify numeric characteristics of each scale of measurement

Summarizing and Organizing Data
Chapter 2

Learning Objectives

2.1 Construct a frequency distribution table with individual values to summarize data

2.2 Create a frequency distribution table with equal intervals to summarize data

2.3 Identify the differences between bar graphs and histograms

2.4 Identify the common distribution shapes

2.5 Define the positively skewed and negatively skewed distributions

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2. September 8

Descriptive Statistics
Chapter 3

Learning Objectives

3.1 Describe and differentiate among the three common central tendency measures: (1) mode, (2) median, and (3) mean

3.2 Calculate mean from the formula

3.3 Adjust the mean formula when using frequency tables

3.4 Choose the correct formulas to calculate variance and standard deviation in populations or samples

3.5 Adjust the variance and standard deviation formulas when using frequency tables

[2] Learning Outcomes are taken from Bowen, C., Straightforward Statistics, SAGE Publications, 2016

Standardized Z-scores
Chapter 4

Learning Objectives

4.1 Convert raw scores to Z scores to get measures of the difference of individual values from the mean in units of standard deviation

4.2 Identify unusual values and outliers using Z scores

4.3 Calculate Z scores from populations or samples

4.4 Explain how converting raw scores to Z scores does not change the shape of the distribution

4.5 Apply the empirical rule to connect Z scores with probabilities in special cases

HW 1 handed out

Lab 1: Frequency distribution tables in SPSS
Descriptive data in SPSS
Frequency Polygons
Calculation of z-scores in SPSS (may do or take to the next class)

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3. September 15

Basic Principles of Probability
Chapter 5

Learning Objectives

5.1 Define probability terms such as simple event, event, and sample space

5.2 Explain the addition rule, multiplication rule, and complementary rule in probability

5.3 Identify and provide an example of a binomial probability distribution

5.4 Explain how to construct a probability distribution table

5.5 Define Z score and explain the relationship between probability and Z score in a normal distribution

5.6 Describe the purpose of using the Z table

The Central Limit Theorem
Chapter 6

Learning Objectives

6.1 Define sampling error, and explain why it is a frequent, natural occurrence in empirical research

6.2 Identify the principal characteristics of the central limit theorem

6.3 Explain the law of large numbers in calculating probability

6.4 Describe how a Z test is conducted, and interpret the results of a Z test

HW 1 due
HW 2 handed out

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4. September 22

Quiz 1

Hypothesis Testing
Chapter 7

Learning Objectives

7.1 Define the terms Type I error and Type II error, and explain their significance in hypothesis testing

7.2 Identify and describe the four steps in conducting a hypothesis test

7.3 Explain the importance of the null hypothesis and the alternative hypothesis in conducting a hypothesis test

7.4 Compare and contrast a one-tailed test and a two-tailed test

7.5 Describe the relationship between a significance level and the rejection zone in conducting a hypothesis test

7.6 Explain why rejecting a null hypothesis or failing to reject a null hypothesis are mutually exclusive and collectively exhaustive

HW 2 due
HW 3 handed out

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5. September 29

One-Sample t-test
Chapter 8

Learning Objectives

8.1 Describe the purpose of a one-sample t test, and how it is conducted

8.2 Explain how a t test differs from a Z test

8.3 Define confidence interval, and describe how the confidence level is calculated

8.4 Name the three pieces of information needed to identify the critical t values that set the 8.5 boundaries of rejection zones in t tests

Reintroduction to Qualtrics

HW 3 due
Lab 2: One sample test of hypotheses in SPSS

Qualtrics

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6. October 6

Quiz 2

Independent Samples t-test
Chapter 9

Learning Objectives

9.1 Define the independent-samples t test and explain when it is used

9.2 Describe the decision rule for equal variances assumed versus equal variances not assumed

9.3 Explain the purpose of the folded-form F test and Levene's test in assessing the equality of variances

9.4 Describe the roles of Cohen's d and Glass's delta (Δ) in independent t-test calculations

Reid Ewing & Shima Hamidi (2014) Longitudinal Analysis of Transit's Land Use Multiplier in Portland (OR), *Journal of the American Planning Association*, 80:2, 123-137. Read the section on Difference-of-Means Tests, which contains discussions of Tables 3, 4, and 5.

Research Protocols

Lab 3: Independent sample test of hypotheses in SPSS

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7. October 13

Catch up and Mid-Term Review

Research protocol discussed

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8. October 20

Midterm

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9. October 27

Dependent Sample t-test
Chapter 10

Learning Objectives

10.1 Differentiate between the independent-samples t test and the dependent-sample t test

10.2 Conduct hypothesis tests on dependent-sample t tests

10.3 Describe three approaches you can use to conduct a hypothesis test

10.4 Describe what is meant by counterbalance as a step when conducting a dependent-sample t test and explain why it is important

10.5 Describe the process of calculating the effect size for a dependent-sample t test

Ewing, Reid (2013). Quasi-Experimental Study of Traffic Calming Measures in New York City, *Transportation Research Record* (0361-1981), (2364), p. 29. Read the section on Simple Before–After Comparison and be able to interpret Table 2.

HW 4 handed out

Lab 4: Dependent sample test of hypotheses in SPSS

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10. November 10

Correlation
Chapter 11

Learning Objectives

11.1 Define and explain the purpose of Pearson's product moment correlation

11.2 Conduct a hypothesis test on Pearson's r

11.3 Explain the coefficient of determination

11.4 Explain Spearman's rank correlation (will only mention)

11.5 Describe how to purify the relationship between two primary variables by keeping the third variable constant using partial correlation (will only mention)

11.6 Describe point biserial correlation (will make comparison back to 2-sampe t-test)

11.7 Distinguish among different types of correlation methods: Pearson's correlation, Spearman's rank correlation, partial correlation, and point biserial correlation

Final project discussed

HW 4 due

Lab 5: Correlation in SPSS

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11. November 17

Quiz 3

Simple Regression
Chapter 12

Learning Objectives

12.1 Describe how the slope and Y-intercept are mathematically determined

12.2 Explain how to identify the regression equation by calculating slope and Y-intercept

12.3 Identify the four-step hypothesis test for the significance of a simple regression

12.4 Describe the statistical assumptions for regression

12.5 Distinguish and explain the differences between correlations and regression

Final project data collection

HW 5 handed out

Lab 6: Correlation and introduction to regressions in SPSS

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12. November 24

One Way Analysis of Variance
Chapter 13

Learning Objectives

13.1 Define one-way analysis of variance (ANOVA)

13.2 Describe the sources of between-group variance and within-group variance

13.3 Calculate sum of squares total (SST), sum of squares between (SSB), and sum of squares within (SSW)

13.4 Construct and interpret an ANOVA summary table

13.5 Conduct the hypothesis test for ANOVA

13.6 Conduct post hoc comparisons after a significant ANOVA result with three or more groups

13.7 Calculate and interpret the effect size for ANOVA

Multiple Regression
No Chapter Assignment

HW 5 due
HW 6 handed out

Lab 7: Multiple regressions in SPSS

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13. December 1

Quiz 4

Chi-Square Tests for Goodness-of-fit and independence
Chapter 14

Learning Objectives

14.1 Describe the difference between parametric statistics and nonparametric statistics

14.2 Describe the formula for calculating expected frequencies for one-way frequency tables and two-way contingency tables

14.3 Identify the degrees of freedom for chi-square tests

14.4 Describe how to use the Chi-square Table to identify the critical values of chi-square

14.5 Conduct goodness-of-fit tests using one-way frequency tables

14.6 Conduct independence tests using two-way contingency tables

14.7 Conduct hypothesis tests using chi-square

HW 6 due

Lab 8: More on multiple regressions in SPSS

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14. December 8

Final Exam Review

Lab 9: Chi-squared applications in SPSS

December 15

Official university study day

December 22

Final Exam

December 22

Final project due by 5:00 pm