

Statistics 121: Principles of Statistics

Lecture sections

Fall 2021 Syllabus

MWF Schedule

General Education Learning Outcomes:	This course is certified to fulfill the GE Advance Language requirement. As students progress through the General Education program at Brigham Young University, they will be able to: <ul style="list-style-type: none">• Demonstrate foundational knowledge and skills in the methods of investigating, expressing, and evaluating concepts in the discipline of Mathematics.• Demonstrate the ability to use numerical tools to explain the world in quantitative terms, interpret numerical data, and evaluate arguments that rely on quantitative information and approaches.• Identify and intelligently face problems they encounter later in life that require quantitative reasoning.• Actively apply their learning to contribute to the common good of society in solving family, professional, religious, and social problems.
Course Learning Outcomes:	A student completing Statistics 121 will be able to: <ol style="list-style-type: none">1. Describe key features of valid methods of data collection.2. Generate graphical displays of a given data set.3. Make appropriate conclusions from plots of data.4. Describe distributions of random variables.5. Describe the sampling distributions of means and proportions.6. Calculate probabilities associated with statistics using properties of their sampling distributions.7. Estimate population parameters using confidence and prediction intervals.8. Examine the relationship between two quantitative variables.9. Examine the relationship between two categorical variables.10. Assess claims about population parameters (means, proportions, and regression slope) using tests of significance.11. Determine the appropriate statistical procedure to use for a given research problem or data set.
Prerequisite:	Mathematics 110 or equivalent
Instructors:	William Christensen, wiliam@stat.byu.edu Office Hours: 12-1 MW, 2:30-3:30 Th in 2197 WVB P. Lynne Nielsen, nielsen@stat.byu.edu Office Hours: 10-11 T, 1-3 Th in 2176 WVB
	Contact the instructors for course, exam, and quiz contents and TA concerns. Response may take one or two school days.
Course Coordinator:	For quiz and exam due date exemptions, accommodations, and other administrative issues, email Duncan Cole at statca@stat.byu.edu Response may take one or two school days.
Teaching Assistants:	For questions about labs and grading of exam essays and writing assignments, contact your TA directly.
Class Protocol:	The University requires all students to wear masks when in class and unable to social distance. The only exceptions are students who have presented the instructor with an accommodation letter from the University Accessibility Center allowing them an exception. Otherwise, students who are unwilling or unable to wear a mask to class should sign up for either the BYU Online section of the course or the Live-remote delivery section taught by Professor Nielsen via Zoom at 1:00 pm MWF.
Recommended Materials:	<ul style="list-style-type: none">• Access to the <i>CMU OLI Statistical Reasoning</i> courseware. You may purchase access to the CMU eBook by registering through booklist.byu.edu or by purchasing it directly for \$25.00 at community.oli.cmu.edu/.

- Register and create an account. When you register, the name of the listed instructor will be **Lynne Nielsen**, the course manager. You are in the right course, even if your instructor's name does not appear. PLEASE bookmark the page to make it easy to return to.
 - Sign-in to the "BYU Stat 121 Fall 2021" course using the key "121-Fa-2021"
 - If you encounter technical difficulties, use the Help link on the CMU website.
- A basic calculator with a square root function. For quizzes and labs, you can use any computational device like your cell phone. For exams, it is recommended you use a scientific calculator. You are NOT allowed to use your cell phone or a graphing calculator.
- Statistics 121 Lecture Notes, 8th Edition, 2021-2023. Published by Hayden McNeil ISBN: 9781533919526. Available at the BYU Bookstore and on Learning Suite.
- Access to a Spreadsheet program (Excel, Google, Open Office, etc.)

Learning Suite:

Use the Chrome browser when accessing Learning Suite. Select “Stat 121: MWF Lectures” for fall 2021. Sign in with your net ID and password. Check **daily** for announcements. **Important note:** **Messages sent to the instructors or course coordinator through Learning Suite are not responded to. Please email them directly.**

Student Learning:

Ultimately, you are responsible for your own learning. You can take charge of it by staying current with assigned readings and homework, attending the TA or instructor’s office hours, and asking questions. You need to let your instructor or TA know what you don’t know or understand. Learning Statistics requires focus, concentration, and practice.

Students are accountable for learning the assigned materials. We recommend that you spend at least six hours of personal study per week.

TA office hours:

TA office hours will start on Tuesday, September 7th, in room 1151 WVB. Stat 121 TA hours are from 12-5 PM, Mondays and Fridays. Virtual office hours on Zoom will be posted on the second week of class. They are for one-on-one help on quizzes and writing assignments. They are not meant for checking your answers.

Grades:

Midterm exams: 55%

Final Exam: 30%

Credit quizzes & writing assignments: 15%

Lecture quizzes (Extra-credit): 2%

A 94-100

A- 90-93.9

B+ 87-89.9

B 83-86.9

B- 80-82.9

C+ 77-79.9

C 73-76.9

C- 70-72.9

D+ 67-69.9

D 63-66.9

D- 60-62.9

E 0-59.9

You can check your grades at any time on Learning Suite.

Exams:

All exams are comprehensive and emphasize concepts and definitions. There are three midterm exams and a final exam which are all administered at the Testing Center. Exam dates are given in the class schedule on Learning Suite. Midterm exams have multiple choice and written portions. The final exam has no written portion. Statistical tables and formulas are included in the exam, but you must provide your own scientific calculator and scratch papers. Notes are not allowed. There is no time limit for the exam, but plan on at least 2 hours for the midterms and 3 hours for the final. **The last two days of the midterms are \$5 and \$8 fee days, respectively.** The last midterm test is handed out at **4:00 PM. on the last day.** Exams are not returned to students but the most frequently missed questions are discussed in the instructor and TA office hours after the exam deadline.

A \$10 late fee and penalty points (20% off the first day and 10% off each day afterwards) will be applied to late exams unless all the following conditions are met: (1) an emergency has occurred, (2) you have sent an email to the course coordinator at statca@stat.byu.edu as soon as possible, (3) documentation has been provided, and (4) the exception has been approved by the course coordinator.

If you have a university-excused absence during the entire time the exam is open, you need to contact the course coordinator as soon as possible to set up a time to take the exam **early**.

If you do not meet these qualifications for an exception, contact the course coordinator as soon as possible to set up a time to take the exam late for a penalty.

Late exams are only available for five school days after the last scheduled day. Do not discuss anything on the exam with anyone except your instructor or the course coordinator. Discussing an ongoing exam with another student is a violation of the Honor Code. NOTE: Exam retakes are not allowed.

Credit quizzes, Practice quizzes, and Writing assignments:

Credit quizzes are due before 11:59 PM on Learning Suite according to the quiz schedule on the syllabus and on Learning Suite. In addition, there are two writing assignments: #1 is due on Tuesday, October 19, and #2 is due on Tuesday, November 9, **before 11:59 PM MDT on Learning Suite**. Details for these writing assignments are found on Learning Suite under Path.

Practice quizzes are not graded but prepare you to take the credit quizzes. To take a credit or practice quiz, go to the corresponding Path lesson or Exams tab of Learning Suite. To save your answers and exit before submitting, you must click the “Next” button at the bottom of the quiz. To submit your completed quiz, not only must you click the “Next” button, but you must also click the “Submit all and Finish” button. Failure to do so will result in no credit. Furthermore, once you have submitted your quiz, you cannot return and work on it. Consider writing down your answers before submitting in case there is a problem. If you do not submit a quiz before the deadline, you will not be able to view the questions afterwards. **After submission, your quiz score will be immediately posted but credit quiz feedback will only be given after the deadline.** If parts of tables and graphs are missing from the quizzes, pdf files of these quizzes are posted on Learning Suite.

All credit quizzes and writing assignments are open book and open notes. However, taking a quiz for someone else, using answers provided by another student or a website, having a tutor-type person help you take any quiz, etc. is cheating. Writing assignments with plagiarized answers will receive no credit. **NOTE: Uploading quiz questions on websites like Quizlet or CourseHero is a violation of the Honor Code.**

NO LATE CREDIT QUIZ OR WRITING ASSIGNMENT IS ACCEPTED. However, the four lowest quiz scores will be dropped at the end of the semester, **except** for Credit quiz 01 (Syllabus quiz) and the two writing assignment scores.

To earn extra credit points, take the iClicker quizzes given in lectures and complete the Student Ratings on myBYU at the end of the semester.

iClicker quizzes:

At least one iClicker quiz will be given sometime during each class and can add up to 2% extra credit points to your overall course grade. You need to use a functioning and registered iClicker at the time of the quiz to receive credit. Only iClicker devices are accepted. You *cannot* make up quizzes for *any* reason, including University-excused absences. You cannot bring another Stat 121 student's iClicker to class—that is a violation of the Honor Code. See “Getting Started” on *Learning Suite* for instructions on how to register your iClicker. You must register with your NetID, NOT your 9-digit BYU ID number. **The deadline for iClicker registration is Thursday, September 9.** If you cannot decipher your iClicker number, visit the Textbook Department at the BYU Bookstore. iClicker scores are uploaded on Learning Suite every two weeks. For other iClicker issues, email the Course Coordinator.

General Policies:	Students experiencing extended difficulties (e.g., prolonged illness, death in the family, etc.) should consult with their professor. The Department of Statistics is willing to work with these students.	
Preventing & Responding to Sexual Misconduct:	<p>In accordance with Title IX of the Education Amendments of 1972, Brigham Young University prohibits unlawful sex discrimination against any participant in its education programs or activities. The university also prohibits sexual harassment—including sexual violence—committed by or against students, university employees, and visitors to campus. As outlined in university policy, sexual harassment, dating violence, domestic violence, sexual assault, and stalking are considered forms of "Sexual Misconduct" prohibited by the university.</p> <p>University policy requires all university employees in a teaching, managerial, or supervisory role to report all incidents of Sexual Misconduct that come to their attention in any way, including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Incidents of Sexual Misconduct should be reported to the Title IX Coordinator at t9coordinator@byu.edu or (801) 422-8692. Reports may also be submitted through EthicsPoint at https://titleix.byu.edu/report or 1-888-238-1062 (24-hours a day).</p> <p>BYU offers confidential resources for those affected by Sexual Misconduct, including the university's Victim Advocate, as well as a number of non-confidential resources and services that may be helpful. Additional information about Title IX, the university's Sexual Misconduct Policy, reporting requirements, and resources can be found at http://titleix.byu.edu or by contacting the university's Title IX Coordinator.</p>	
Students With Disabilities:	BYU is committed to providing reasonable accommodation to qualified persons with disabilities. If you have any disability that may adversely affect your success in this course, please contact the Services for Students with Disabilities Office at (801) 422-2767. Services deemed appropriate will be coordinated with the student and the professor or course manager by that office.	
Mental Health Services:	Barriers to learning are created by stress, anxiety, family and relationship concerns, and personal crises. If stressful life events or mental health concerns are inhibiting your ability to participate in daily activities or leading to diminished academic performance, please contact the BYU Counseling and Psychological Services (CAPS) (1500 WSC, (801) 422 3035 , caps.byu.edu). CAPS provides individual, couples, and group counseling to students. These services are confidential and are provided by the university at no added cost to you. Professional psychologists and counselors who specialize in helping college students are available 24-hours a day to assist students in crisis; if you have an emergency during non-business hours (5 PM - 8 AM), please contact BYU Police Dispatch (801) 422 2222 who will put you in touch with a counselor.	
Important Websites:	When accessing any of these websites, open the link in a new tab or window.	
Learning Suite	<u>http://learningsuite.byu.edu</u>	Sign in with your net ID and password
iClicker:	<u>ctl-clicker.byu.edu</u>	Sign in with your net ID and iClicker #
CMU courseware:	<u>https://community.oli.cmu.edu/</u>	Course name: BYU Stat 121 Fall 2021 Course key: 121-Fa-2021

The deadline for CMU and iClicker registrations is Thursday, September 9.

NOTE: The lesson, quiz, and exam schedules are posted on Learning Suite.

Statistics 121 Fall 2021 MWF Lecture Schedule:

Schedule subject to change—please check Learning Suite daily

Monday, August 30 Lesson 1: Course introduction, Syllabus, and Learning Strategies First Day of Semester	Tuesday, August 31 <div style="border: 1px solid black; padding: 5px;"> NOTE: Each lesson has a corresponding reading assignment, Practice quiz and Credit quiz. For example, Practice quiz 2 and Credit quiz 2 cover topics discussed in Lesson 2. </div>	Wednesday, September 1 <u>Lesson 2: The Big Picture and Exploratory Data Analysis</u> Credit quiz 01 (Syllabus quiz) due on or before September 8 on Learning Suite	Thursday, September 2 <u>Lesson 3: Producing data—Sampling</u> Credit quiz 02 due on or before September 8 on Learning Suite	Friday, September 3
Monday, September 6 Labor Day—No class	Tuesday, September 7 <u>Add/Drop Deadline</u> TA office hours begin in room 1155 WVB	Wednesday, September 8 <u>Lesson 4: Cautions in sample surveys</u> <u>Credit quizzes 01- 03 due by 11:59 PM MT on Learning Suite</u>	Thursday, September 9 <i>iClicker and CMU registration deadline</i> <u>Credit quiz 04 due by 11:59 PM MT on Learning Suite</u>	Friday, September 10
Monday, September 13 <u>Lesson 6: Design of experiments</u> Open labs start today via Zoom	Tuesday, September 14 <u>Lesson 7: Examining distributions of quantitative variables with graphs</u> <u>Credit quiz 05 due by 11:59 PM MT on Learning Suite</u>	Wednesday, September 15 <u>Lesson 8: Examining distributions with numerical measures Part 1</u> <u>Credit quiz 07 due by 11:59 PM MT on Learning Suite</u>	Thursday, September 16 <u>Lesson 8: Examining distributions with numerical measures Part 1</u> <u>Credit quiz 07 due by 11:59 PM MT on Learning Suite</u>	Friday, September 17
Monday, September 20 <u>Lesson 9: Examining distributions with numerical measures Part 2</u> <u>Credit quiz 08 due by 11:59 PM MT on Learning Suite</u>	Tuesday, September 21 <u>Lesson 10: Introduction to Probability</u> <u>Credit quiz 09 due by 11:59 PM MT on Learning Suite</u>	Wednesday, September 22 <u>Lesson 11: Random variables and probability distributions</u> <u>Credit quiz 10 due by 11:59 PM MT on Learning Suite</u>	Thursday, September 23 <u>Lesson 11: Random variables and probability distributions</u> <u>Credit quiz 10 due by 11:59 PM MT on Learning Suite</u>	Friday, September 24

<p>Monday, September 27</p> <p><u>Lesson 12: Normal probability distributions and standard scores</u></p> <p>Credit quiz 11 due by 11:59 PM MT on Learning Suite</p>	<p>Tuesday, September 28</p> <p><u>Lesson 13: The standard normal distribution and its applications</u></p> <p>End of material for Exam 1</p> <p>Credit quiz 12 due by 11:59 PM MT on Learning Suite</p>	<p>Wednesday, September 29</p> <p>Credit quiz 13 due by 11:59 PM MT on Learning Suite</p>	<p>Thursday, September 30</p> <p><u>Exam 1 Review</u></p> <p>Exam 1: October 1-7</p> <p>Covers Lessons 1-13</p> <p><u>Details in Learning Suite</u></p> <p>First day of Exam 1</p>	<p>Friday, October 1</p>
<p>Monday, October 4</p> <p><u>Lesson 14: Sampling distribution of x-bar and the Central Limit Theorem</u></p>	<p>Tuesday, October 5</p> <p>Third day of Exam 1</p> <p><u>Lesson 15: Calculating probabilities associated with x-bar</u></p> <p>Fourth day of Exam 1 (\$5 fee day)</p>	<p>Wednesday, October 6</p> <p>Credit quiz 14 due by 11:59 PM MT on Learning Suite</p>	<p>Thursday, October 7</p> <p>Last day of Exam 1 (Ends at 4:00 PM at the Testing Center; \$8 fee day)</p> <p>Credit quiz 15 due by 11:59 PM MT on Learning Suite</p>	<p>Friday, October 8</p> <p><u>Lesson 16: Statistical Process Control</u></p>
<p>Monday, October 11</p> <p><u>Lesson 17: Introduction to inference</u></p> <p>Credit quiz 16 due by 11:59 PM MT on Learning Suite</p>	<p>Tuesday, October 12</p> <p><u>Lesson 18: One-sample t-confidence interval for means</u></p> <p>Credit quiz 17 due by 11:59 PM MT on Learning Suite</p>	<p>Wednesday, October 13</p> <p>Credit quiz 18 due by 11:59 PM MT on Learning Suite</p>	<p>Thursday, October 14</p> <p><u>Lesson 19: Margin of error and sample size calculation</u></p> <p>Credit quiz 19 due by 11:59 PM MT on Learning Suite</p>	<p>Friday, October 15</p>
<p>Monday, October 18</p> <p><u>Lesson 20: Overview of hypothesis testing</u></p> <p>Credit quiz 19 due by 11:59 PM MT on Learning Suite</p>	<p>Tuesday, October 19</p> <p>Writing Assignment #1 due by 11:59 PM MT on Learning Suite. Pertains to lessons 18 and 19.</p>	<p>Wednesday, October 20</p> <p><u>Lesson 21: One-sample t-test for means</u></p> <p>Credit quiz 20 due by 11:59 PM MT on Learning Suite</p>	<p>Thursday, October 21</p> <p><u>Lesson 22: Hypothesis tests and Confidence intervals</u></p>	<p>Friday, October 22</p> <p>Credit quiz 21 due by 11:59 PM MT on Learning Suite</p>

<p>Monday, October 25</p> <p><u>Lesson 23: Error probabilities and power of a test</u></p> <p>End of material for Exam 2</p> <p>Credit quiz 22 due by 11:59 PM MT on Learning Suite</p>	<p>Tuesday, October 26</p> <p><u>Exam 2 Review</u></p> <p><u>Exam 2:</u> Oct. 27 – November 1 Covers Lessons 1-23 Details posted on Learning Suite</p> <p>First day of Exam 2</p> <p>Credit quiz 23 due by 11:59 PM MT on Learning Suite</p>	<p>Wednesday, October 27</p> <p><u>Second day of Exam 2</u></p> <p>Third day of Exam 2</p> <p>Saturday, October 30</p> <p>Credit quiz 24 due by 11:59 PM MT on Learning Suite</p>	<p>Thursday, October 28</p> <p><u>Lesson 24: EDA for categorical variables and the sampling distribution of p-hat</u></p> <p>Fourth day of Exam 2 (\$5 fee day)</p>	<p>Friday, October 29</p> <p><u>Lesson 24: EDA for categorical variables and the sampling distribution of p-hat</u></p> <p>Third day of Exam 2</p> <p>Saturday, October 30</p> <p>Credit quiz 25 due by 11:59 PM MT on Learning Suite</p>
<p>Monday, November 1</p> <p><u>Lesson 25: One-sample z-confidence interval for proportions</u></p> <p>Last day of Exam 2 (ends at 4:00 PM at the Testing Center; \$8 fee day)</p> <p>Credit quiz 24 due by 11:59 PM MT on Learning Suite</p>	<p>Tuesday, November 2</p> <p><u>Lesson 26: One-sample z-test for proportions</u></p> <p>Credit quiz 25 due by 11:59 PM MT on Learning Suite</p>	<p>Wednesday, November 3</p> <p><u>Lesson 27: Role-type classification: EDA for C to Q relationship</u></p> <p>Credit quiz 26 due by 11:59 PM MT on Learning Suite</p>	<p>Thursday, November 4</p> <p><u>Lesson 27: Role-type classification: EDA for C to Q relationship</u></p> <p>Credit quiz 27 due by 11:59 PM MT on Learning Suite</p>	<p>Friday, November 5</p> <p><u>Lesson 28: Analysis of variance</u></p> <p>Credit quiz 28 due by 11:59 PM MT on Learning Suite</p>
<p>Monday, November 8</p> <p><u>Lesson 28: Matched pairs t-procedures</u></p> <p>Credit quiz 27 due by 11:59 PM MT on Learning Suite</p>	<p>Tuesday, November 9</p> <p><u>Writing Assignment #2 due before 11:59 pm on Learning Suite. Pertains to lessons 25 and 26.</u></p> <p>Credit quiz 28 due by 11:59 PM MT on Learning Suite</p>	<p>Wednesday, November 10</p> <p><u>Lesson 29: Two-sample t-procedures</u></p> <p>Credit quiz 29 due by 11:59 PM MT on Learning Suite</p>	<p>Thursday, November 11</p> <p><u>Lesson 30: Analysis of variance</u></p> <p>Credit quiz 30 due by 11:59 PM MT on Learning Suite</p>	<p>Friday, November 12</p> <p><u>Lesson 31: EDA for C to C relationships: Two-way tables and conditional distributions</u></p> <p>Credit quiz 31 due by 11:59 PM MT on Learning Suite</p>

Monday, November 22	Tuesday, November 23 Friday Instruction Day <u>Exam 3 Review</u> Exam 3: November 22 – Dec. 1 Covers Lessons 1-33 Details posted on Learning Suite First day of Exam 3 Credit quiz 33 due by 11:59 PM MT on Learning Suite	Wednesday, November 24 No Classes <u>Lesson 34: EDA for Q to Q relationships:</u> <u>Scatterplots and Correlation analysis</u> Second day of Exam 3	Thursday, November 25 Thanksgiving Holiday	Friday, November 26 Thanksgiving Holiday
Monday, November 29	Tuesday, November 30 <u>Lesson 35: Linear regression and r-squared</u> Third day of Exam 3 Credit quiz 34 due by 11:59 PM MT on Learning Suite	Wednesday, December 1 <u>Lesson 36: Cautions in correlation and regression analyses</u> Last day of Exam 3 (ends at 4:00 PM at the Testing Center; \$8 fee day) Credit quiz 35 due by 11:59 PM MT on Learning Suite	Thursday, December 2 <u>Lesson 37: Inference for slope of regression line</u> Credit quiz 36 due by 11:59 PM MT on Learning Suite	Friday, December 3 Exam Preparation Day
Monday, December 6	Tuesday, December 7 <u>Lesson 38: Inference for regression predictions : CI and PI</u> Credit quiz 37 due by 11:59 PM MT on Learning Suite	Wednesday, December 8 <u>Final Exam Review</u> Credit quiz 38 due by 11:59 PM MT on Learning Suite	Thursday, December 9 Last day of class Credit quiz 39 (post-course survey) due by 11:59 PM MT on Learning Suite.	Friday, December 10 Exam Preparation Day Final Exam: December 13-17 Covers Lessons 1-38 Details posted on Learning Suite
Monday, December 13	Tuesday, December 14 First day of Final exam	Wednesday, December 15 Second day of Final exam	Thursday, December 16 Fourth day of Final exam	Friday, December 17 Last day of Final exam (Try to be at the Testing Center before 7:00 PM) HAPPY HOLIDAYS - STAY SAFE!

BYU Statistics 121 Formula Sheet

$$\bar{x} = \frac{1}{n} \sum x_i \quad s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$$

Observation < $Q1 - (1.5 \times IQR)$
Or
Observation > $Q3 + (1.5 \times IQR)$

$$z = \frac{x - \mu}{\sigma} \quad x = \mu + z\sigma$$

Means (check conditions)

$$z = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} \quad \bar{x} \pm z * \frac{\sigma}{\sqrt{n}} \quad n = \left(\frac{z * \sigma}{m} \right)^2$$

$$t = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}} \quad \bar{x} \pm t * \frac{s}{\sqrt{n}}$$

with df = $n - 1$ with df = $n - 1$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\frac{s_p}{\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}} \quad \bar{x}_1 - \bar{x}_2 \pm t * s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}} \quad \text{where } s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

with df = $n_1 + n_2 - 2$ with df = $n_1 + n_2 - 2$

Proportions (check conditions)

$$z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} \quad \hat{p} \pm z * \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \quad n = \left(\frac{z * \sigma}{m} \right)^2 p * (1 - p)$$

$$z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\hat{p}(1-\hat{p}) \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}} \quad \hat{p}_1 - \hat{p}_2 \pm z * \sqrt{\left(\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2} \right)}$$

Chi-square (check conditions)

$$\chi^2 = \sum \frac{(\text{observed count} - \text{expected count})^2}{\text{expected count}} \quad \text{expected count} = \frac{\text{row total} \times \text{column total}}{\text{table total}}$$

with df = $(r - 1)(c - 1)$

Slope (check conditions)

$$t = \frac{b}{SE_b} \quad b \pm t * SE_b$$

with df = $n - 2$ with df = $n - 2$

BYU Stat 121 Statistical Tables

Table entry for z is the area under the standard normal curve to the left of z.

Table of Standard normal probabilities

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002	
-3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0003	
-3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	
-3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0007	.0007	
-3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	
-2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0014	.0014	
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
-2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
-2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
-2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
-2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
-2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
-2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
-2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
-1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
-1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
-1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
-0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
-0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
-0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
-0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
-0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
-0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
-0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
-0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
-0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9933	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9980	.9981	
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9990	.9990	
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9993	.9993	
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9997	
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998	

Table entry for p and C is the critical value t* with probability p lying to its right and probability C lying between -t* and t*.

Table of t distribution critical values

df	Confidence level C											
	50%	60%	70%	80%	90%	95%	96%	98%	99%	99.5%	99.8%	99.9%
1	1.000	1.376	1.963	3.078	6.314	12.71	15.89	31.82	63.66	127.3	318.3	636.6
2	0.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.09	22.33	31.60
3	0.765	0.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.21	12.92
4	0.741	0.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.610
5	0.727	0.920	1.156	1.476	2.015	2.571	2.757	3.404	4.032	4.773	5.893	6.869
6	0.718	0.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	0.706	0.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	0.703	0.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.781
10	0.700	0.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	0.697	0.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	0.695	0.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	0.694	0.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	0.692	0.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	0.691	0.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.328	3.755	4.073
16	0.690	0.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.105
17	0.689	0.863	1.069	1.333	1.734	2.100	2.217	2.552	2.898	3.222	3.646	3.965
18	0.688	0.862	1.067	1.330	1.724	2.091	2.214	2.552	2.878	3.197	3.611	3.922
19	0.688	0.859	1.065	1.328	1.716	2.074	2.205	2.539	2.861	3.174	3.579	3.883
20	0.687	0.860	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552	3.850
21	0.686	0.859	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527	3.819
22	0.686	0.858	1.062	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.792
23	0.686	0.857	1.061	1.320	1.713	2.069	2.177	2.500	2.807	3.104	3.485	3.768
24	0.685	0.856	1.060	1.319	1.709	2.064	2.150	2.462	2.756	3.038	3.396	3.659
25	0.684	0.856	1.058	1.316	1.708	2.060</						