

# COLLEGE STATISTICS

*With Option to Dual Enroll at SCC*

Instructor: David Hartman, Ph.D.

Email: [david.hartman@district145.org](mailto:david.hartman@district145.org)

Website: <https://drdhartman.com/>

**Welcome** to College Statistics! I am so excited to have the opportunity to work with you in conjunction with this NEW course here at Waverly High School. Naturally with the word “college” out front, college stats will likely be a more rigorous course than most other courses you have taken in the past. While I am here to facilitate, **you** will be the one working hard, studying, preparing, and learning statistics. I will provide opportunities; however, you and your peers will determine how much you invest into the learning. I am confident each and every one of you will go above and beyond and help make this class one of the best you’ve ever taken. (We’ll even talk about class T-shirts as the fall progresses ☺)

**Basic Description:** College statistics allows for examination of the practical application of statistical thinking to contemporary issues, the collection and organization of data, probability distributions, statistical inference, estimation, and hypothesis testing.

## **Student Learning Outcomes:**

- Basic statistics concepts (sampling methods, types of data)
- Descriptive statistics (frequency distributions and graphs, measures of center, measures of variation, measures of position)
- Linear correlation and regression
- Probability (basic concepts, addition rule, multiplication rule, conditional probability, counting techniques)
- Random variables and applications (probability distributions, binomial distribution, normal distribution, sampling distributions and the Central Limit Theorem)
- Inferential statistics – one sample confidence intervals for means (normal and t-distribution) and proportions
- Inferential statistics – one sample hypothesis testing for means (normal and t distribution) and proportions

**Text:** You will NOT need to go to SCC to purchase your textbook for this class. WHS will provide it. As an added bonus, we will be using a brand new book this year: *STATS—Modeling the World—AP Edition (4<sup>th</sup> Edition—2015)*. These are brand new books with many *relevant* applications to world we live in. You will be expected to have your stats book with you at home and at school. This will likely be the first math text that you actually read. The book is a great a resource for you to use as you learn stats in addition to the overabundance of online support on the web (including my own website). My goal is to save the “paper” I plan use for in-class activities and tests. Thus, I will not assign as many worksheets as you have experienced with some teachers in the past. SINCE the textbooks are new, I will also expect a good “paper sack” book cover to protect the book at all times! This is not an option. You will be responsible to keeping this book in great condition! Also know these books cost over \$100.00. Students are accountable for the replacement cost should it be lost or damaged!

**It is my desire for you to be successful and I am here to help as well as promote peer collaboration.** Students who work hard on assignments, study, are engaged in class activities, and who collaborate with peers increase their potential to succeed. You should not be afraid to make mistakes; it is a part of learning. If you find yourself struggling:

- Utilize peer support during class.
- Utilize peer support during A&P.
- Utilize peer support before school in pod 2000 (8:00-8:30).
- Utilize the math support room during A&P. (This is a work in progress; we likely will be tapping into the open part of pod 2000 as well!)
- Come in to my room before/after school. (Please know that I do have meetings and other commitments on some days.)
- Send me an email. (Email is the best way to communicate with me.)
- Access some of 42,450,101 resources on the internet!

**Leadership:** Mr. Ricenbaw shared a vision with me last year. I have spent a considerable amount of time reflecting on it: “Helping kids to better help themselves...everyday!” Learning college statistics, the nature of working hard at the college level, and further developing problem-solving skills are all important goals of this course. In addition, building your capacity as a math leader in and out of my classroom is just as important. In my classroom, I want you to become part of a collaborative learning team. I don’t want to be the only teacher in the room. I want you to help your fellow peers learn. Out of the classroom, I also want you to help any and all of your peers. Being in College Statistics, it’s clear that you are one of the strongest math students at WHS. Some of you have worked very hard to get to this point; others have found that math just comes pretty easy to them. In pushing you to broaden your capacity as a math leader, I want you to help your peers learn math. I have two ideas that I’m working through:

**First, A&P.** There will most likely be a few of you in each of the 12<sup>th</sup> grade A&P classrooms. I desire for each of you to offer up your “services” and help your fellow peers learn geometry, algebra 3-4, and pre-calculus at least once a week. Be there to answer questions. Be there to push for a deeper understanding. Be there to help your peers become more confident learners! I will have a form for you document this process. We will spend some time in our class talking about what it looks like to help a peer...and that is not just giving them the answer or doing it for them! Further, we need to address the reality of “cheating” and moving towards 100% academic integrity! As seniors, I want your help in creating the an amazing learning culture here at WHS. Let’s live above the line and let our school become a model for other schools to emulate!

**Second, Before School.** My plan is to turn pod 2000 into the math study pod in the morning. Eventually we may even “better” furniture to meet this plan (e.g., study lounge furniture like in a college setting)! Of course students can study other subjects in pod 2000; yet math will be the focal point as all of the math teachers now reside in this pod. Students who plan to access pod 2000 in the morning will be expected to focus on academics and not just be there to hang out. While I will monitor this from time to time, I am asking you to sign up to be a “peer helper” at least once a month in the morning from 8:00-8:30. I recognize that many of you will have conflicts at different times (e.g., marching band). I’m just asking for once a month for you to be in the pod offering help.

If we can turn these ideas into a reality, and enlist the help of more students every year, we will go a long way in “Helping kids to better help themselves...everyday!” I do have a vision for transforming learning at WHS. I want long-term, sustainable growth. It begins now & with you!!

<b>WHS Grading:</b>	100% - 94%	A
	93% - 86%	B
	85% - 78%	C
	77% - 70%	D
	69% - 0%	F

**Breakdown:** 80% Summative (*“of” learning...demonstrating what you have learned*)

70%: tests and projects\*

10%: semester final exams.

20% Formative (*“for” learning...the process along the way*)

10%: quizzes and projects\*

10%: homework, and “leadership” requirements (helping others!)

**Tests:** Tests are purposely designed to include some problems where you must apply what you have learned in class in a slightly different situation. This is a college level course now and the expectations/rigor are high. I will make sure you know in advance all the necessary elements/ideas, but you will need to determine an appropriate approach and apply it to solve problems. It is expected that all summative tests will be completed in one class period. I will use my professional judgment concerning providing individual students additional time to complete tests. You can meet with me individually to discuss your testing habits and options. With this being a college level course and beyond the scope of what is required to graduate from high school, there will be no retake opportunities.

**Projects:** There will be a few chapter projects assigned in conjunction with chapter tests and possibly in lieu of chapter tests. These projects, which you will complete outside of class, will afford you time to put together your best effort towards demonstrating an understanding of the concepts found in the chapter. Some projects will be more formative, considered “for learning,” and *act* like a quiz. These formative projects will fall under the 10% quiz/project grade. Other projects will be more summative, considered “of learning,” and *act* more like a test. These summative projects will fall under the 70% test/project grade. Projects must be completed and submitted on time. There will be deductions for late projects. Also, students will not be allowed to “re-do” a project.

**Semester finals:** There will be a summative final representing bits and pieces of an entire semester that will be given on the day of finals. Yes, there will be a final given in May before seniors leave! These semester finals will fall under the 10% summative-final grade. A considerable amount of the semester finals will be multiple choice.

NOTE: All students will also take the SCC final late in the spring. This final, addressed in the appendix at the end of this syllabus, will cover material from the entire course. I will look over the “work” on this test from all students; however I will only send the tests to SCC for those who are dual enrolled. While the purpose of this exam is for SCC faculty to keep students accountable for learning the college material and impact their SCC grade, I am planning to include my own scoring of this exam for all students as part of their second semester WHS grade...albeit a small percentage. This test is a big deal regardless if the student is dual enrolled or not! This test at the end of the year is only a preview of what most students will be experiencing in college over the next few years!

**Quizzes:** There will be a mix of traditional in-class quizzes, pop quizzes, partner quizzes, homework quizzes, take-home quizzes, etc. to gauge your level of understanding throughout the quarter. There will be no retakes on quizzes.

**Homework:** You will have an assignment almost every night. Putting forth effort on each problem is more important than getting every problem correct. I, and your fellow peers, will help you with the ones you did not understand, but you need to try every problem so you know what your questions are. Homework will be graded a variety of ways, including turning it in, self-grading, peer grading, posting a solution/work on the board, or a mere completion grade. There will be times only a couple problems will be graded out of the entire assignment. Note: several assignments will include “odd” numbered problems. The answers to most “odd” numbered problems are in the back of the book. I am more concerned with the work and reasoning behind those answers. There may even be times where I post all of the answers on my website; I am looking for you to go deeper than the answers! Please know that merely copying the answers from the back of the book will not count as a grade. You need to use the homework as an opportunity to practice and figure out what you are “C” confident in, “S” shaky on, or need to “R” relearn.

**Leadership:** Document that you have helped peers at least once a week in A&P and offer your time at least once a month in pod 2000 from 8:00-8:30 and you will meet the leadership expectation!

---

*For those dual enrolling:*

<b>SCC Grading:</b>	100% - 95%	A+	74% - 70%	C
	94% - 90%	A	69% - 65%	D+
	89% - 85%	B+	64% - 60%	D
	84% - 80%	B	59% - 0%	F
	79% - 75%	C+		

**Breakdown:** 80% WHS Grade I provide to SCC (overall total from August – May)  
20% SCC Final Exam score (graded by SCC faculty)

\*Note: Please see the appendix at the end of this syllabus regarding SCC Final Exam information!

---

**Grading in a College Level Course:** I have taught statistics for both the NWU Advantage program and NWU Graduate Nursing program. I have taught mathematics and education courses for UNL Graduate programs. I have taught education method courses for Union College’s undergraduate programs. The ideas of grading in a college course continue to “evolve” in my mind and naturally flow into my work with high schools students. I like to consider several perspectives/images of grading. As many are taking this course as part of the Dual Credit opportunity at SCC, let’s first consider SCC’s perspective:

## **Southeast Community College**

### **Grading philosophy for dual-credit mathematics courses**

In many cases, the only available measurement of a student's readiness for a math course is the student's grade in a prerequisite course. With this in mind, each student's course grade should reflect his or her **mastery** of the **central concepts** and **procedures** of that course. Grades should never be adjusted due to students' effort or personal circumstances! Certainly effort should be encouraged, but if the effort does not result in the mastery required by the course, then it should not be a factor in determining the course grade. Likewise, there are certainly times in which it is appropriate to extend deadlines or otherwise offer a student additional opportunities due to the student's personal circumstances. But the grade should be based only on the student's mastery and should not be influenced by those circumstances.

This philosophy should apply not only to the course as a whole, but also to grades for assignments and to scores for individual exercises or tasks. Specifically, it is reasonable to assign partial credit for an incorrect answer if the student makes some progress toward the correct answer and demonstrates understanding of at least some of the principles involved. However, if a student makes no progress toward a correct answer and shows no relevant mathematical understanding, then no partial credit should be assigned, regardless of how hard the student worked or any other consideration.

#### **SCC Perspective on Scoring:**

- Minor mechanical error (1-2 points deducted).
  - o Arithmetic/calculation error.
  - o Dropped negative sign.
  - o Rounding incorrectly or rounding to the wrong number of places.
- Minor conceptual error (2-3 points deducted).
  - o Miscopying a formula.
  - o Using an incorrect table entry in a formula.
  - o Giving an incorrect or incomplete interpretation of a correctly calculated value (instructor's judgment).
- Major conceptual error (half credit or less earned).
  - o Using an incorrect, but related, formula or procedure (some specific examples follow):
    - Assuming events are independent when they are actually dependent (or vice versa).
    - Forgetting to divide the standard deviation by the square root of  $n$  when the Central Limit Theorem applies.
    - Using the  $t$  distribution to find a confidence interval for a mean when the normal distribution should be used (or vice versa).
  - o Giving an incorrect or incomplete interpretation of a correctly calculated value (instructor's judgment).
- Catastrophic error (very little credit or no credit earned)
  - o Using an unrelated formula or procedure.
  - o Making no mathematical progress toward the correct solution.

A second scoring perspective Dr. Hartman is reflecting on:

**Problem Scoring:**

<b>Grading (on a <b>5</b> point scale)</b>		
Code*	Gradebook Value	Code Explanation (WHS Grading)
5	A (100%)	Proficiency (College Preparation)
4	B (90%)	Minimum Proficiency (College Preparation)
3	C (80%)	Proficiency (Graduation Requirement)
2	D (70%)	Minimum Proficiency (Graduation Requirement)
1	F (60%)	Below Proficiency
0	F (50%)	Missing (Cannot be Made Up)

<b>Grading (SAME as before...just on a <b>10</b> point scale)</b>		
Code*	Gradebook Value	Code Explanation (WHS Grading)
10	A (100%)	Proficiency (College Preparation)
9	B (90%)	Minimum Proficiency (College Preparation)
8	C (80%)	Proficiency (Graduation Requirement)
7	D (70%)	Minimum Proficiency (Graduation Requirement)
6	F (60%)	Below Proficiency
5	F (50%)	Missing (Cannot be Made Up)

\* Note: A + or - (plus or minus) may be assigned to the code which will either add or subtract 5% from the gradebook value.

A third scoring perspective Dr. Hartman is reflecting on:

**Generic Rubric:** At each course level I teach and for each problem I assign, I seek to assess your content knowledge and problem solving as well as the justification of the solution provided by you. In assigning scores to your work, I hold this image for scores based on a your overall percentage of progress toward a correct answer with sufficient justification.

10%	30%		80%	95%
1	2	3	4	5

Image of Scores based on Percentage of Work's Correctness & Completeness

**Level 5 – A correct answer.** The solution is correct and the work shown is sufficient to demonstrate the answer is correct. The justification is satisfactory given your grade level (and course) and the explanation requested. Any errors or shortcomings in the correctness or completeness of the justification are so minor that in comparison with the quality of the solution, it is appropriate to ignore them.

**Level 4 – Errors are minor.** There is much of value in your solution and justification that merits the assessment that the solution is close to being correct and the justification appropriate. The work does include some minor errors (in the solution or the logic of the justification) or is incomplete in some way that results in the work falling short of being a completely correct answer.

**Level 3 – Major errors.** Some part of the solution or justification offers work that demonstrates that you have reasonable knowledge of the mathematics that needs to be used to solve the problem or to provide a justification, but at the same time the work (solution or justification) has major errors or (in the case of the justification) is missing.

**Level 2 – Minimal progress in solving the problem (and justifying the answer).** Answers (solution and justification) are incorrect but the work provided indicates that you have some understanding of the mathematics needed to solve the problem or explain your work. The work clearly falls short of offering evidence that “you have reasonable knowledge of the mathematics that needs to be used to solve the problem or provide a justification.”

**Level 1 – No mathematical work of value is included.** The work provided offers no evidence that you have an understanding of the mathematical work needed to solve the problem and explain a solution. Numbers may be written or a diagram drawn, but no important part of the work is correct.

**Level 0 – Problem was not attempted / is missing.**

Note: Your **justification** should be consistent with the wording in the problem.

- Show all work; (No explicit explanation is needed as your work should justify your answer.)
- Show how you found your answer. Be more explicit...use words, diagrams, etc.
- How do you know this (i.e., your answer) is correct? Without a doubt use words, etc.
- Explain your reasoning. Ditto.
- Justify your answer. Ditto but start to be more formal.
- Prove that your answer is correct. Be formal whether 2-column, paragraph, flowchart.

Scoring bottom line: I try to be very purposeful and intentional as I score student's work. Mathematics is not always that proverbial "black or white" / "right or wrong" subject. I want students to grow. I want students to succeed. I want a student's grade to be a more accurate snapshot of success in the class. Grading will continue to be a work in progress throughout my career!

*If you compare and contrast the three images provide (i.e., SCC's and my two perspectives), they all really represent the same ideas.*

---

Moving on... "other" details about class!

---

**Late to Class?** You must either have a pass from a teacher or a tardy slip from the office. You are expected to arrive to class on time and begin the activity of the day AT the bell.

**Missing Class:** You are expected to attend all classes and the entirety of ALL classes. Recognizing that "life happens" and especially at the 12<sup>th</sup> grade level, you should be aware that the class does move on even if you are not in class! When you are gone, (a) check my website to find out if there is an assignment posted and (b) contact a peer in the class to find out what you missed. Send me an email if you need clarification.

**Making up work:** If you are gone for a school-related activity (e.g., sports, clubs, meetings, etc.), you are expected to make up the work BEFORE you miss. Further, you should make arrangements for making up a quiz or test BEFORE you miss. There will be a deduction if you are not proactive regarding school-related absences. You cannot come into class following a school-related activity and ask me, "Did we do anything yesterday?" Also, if you missed a review day due to a school-related activity, you will still be expected to take the exam on the day you return.

If you are gone for an illness or parent excused reason, you will have TWO days to make up what missed (e.g., assignment, quiz, test). I will expect you to make up quizzes and tests before/after school or during A&P/lunch.

**Phones:** This is a sensitive topic. I have witnessed too many students (and adults) abusing their phones during learning opportunities for years now. I expect for phones to not be out unless we need them for an activity. What a student puts into learning is what they are going to get out of it. When a student is focused on their phone (for non-academic purposes), that student compromises many, many things. This is a college level course. From my experience teaching at the college level, most students want success in the class and are willing to "ignore" their phone for 50 minutes! Naturally if the phone becomes a distraction to other students' learning opportunities and my own instructional opportunities, I will address the issue with the student. A second time? I will address the issue with the parent. A third time? I will turn things over to administration. I need to protect the learning environment in my classroom. In my 22 years in education, phones have become the biggest obstacle I've faced as a teacher. Note: you cannot use your phone as your calculator in this class.



## **Classroom Rules:**

## **S.O.A.R.**

S – Safety (this is #1)

O – Opportunity (for you to learn and me to teach!)

A – Attendance (be here and on time)

R – Respect &

Responsibility (these two are big in life)

**Calculator:** This is a (soft) requirement. I want you to have a graphing calculator and preferably at TI-84+ color edition, TI-84+ regular edition, or even an older TI-83+. I have some to use in class, but having access to your own calculator both in and out of class (as well as in college) will be an advantage for you, especially if you REALLY learn how to use all of the bells and whistles! If you have an older sibling who an old one, then use theirs! I wish I had enough to check out to you and let you use all year. I did when I taught in LPS; it's a work in progress here.

I need to win a small lottery and use the money to purchase a couple hundred graphing calculators for WHS to use! At SCC a scientific or graphing calculator is required for this college stats class. (Note: at SCC a graphing calculator is required for calculus.) As a student I had a graphing calculator starting my senior year in high school back in 1990. I had my first "TI" graphing calculator during my freshman year in college in 1991. I cannot imagine going through college without my "TI" graphing calc! I've used them as part of my instruction for 22 years now!!! (Note: If you do purchase one, please bring me the 'points' on the package! AND if you happen to have any extra ones laying around home due to older siblings or parents not needing them anymore, consider donating them to my classroom for other to use!)

**Weekly Updates:** I like to periodically send out an overall update on how things are going in class as well as upcoming events (i.e., tests). For this first one, clearly I'm using "paper!" For future updates, I plan to send out an email update on most Fridays of the school year. (The email will be generated from powerschool; it automatically sends it to a parent email(s) that has/have been provided to District 145.)

## **Course Requirements:**

- \* Spiral notebook for notes (which can be used on some quizzes and tests.)
- \* Separate spiral notebook for homework assignments out of the book.
- \* Folder with your name on it (which tests and test corrections will go in.)
- \* 3-ring binder (for handouts, worksheet, quizzes, etc.)
- \* 3-hole punched, lined notebook paper in the binder.
- \* Scientific or graphing calculator (one in the family of the TI-84+)
- \* Plenty of pencils and erasers (as well as a few pens)

**REQUESTED Materials:** I am requesting a **4-pack or Larger of AAA Batteries** to be collected during the week of August 29 – September 2. I am asking each of my classes to "donate" a different type of item that helps my instruction. Thank-you in advance for your support.

**Additional Requested Materials:** As I have prepared my classroom last year and again this year, I have made several trips to the store to “build” the classroom I long to have as I work with the youth of District 145. There are still some items I would like to have on “stock” to use with my classes.

24-packs of water bottles

Granola bars

Snacks (e.g, fruit snacks, goldfish, etc)

Reams of white paper

Boxes of manila folders

Paper sacks (grocery bags) to help cover books

*This is only a request. If you are in the position that you are able to send one or more of the items with your student, I would greatly appreciate it. Please send an email so I can monitor any donations. Thank-you.*

#### Dr. Hartman’s Final “6” Comments:

There are some very important things that I need to share with you regarding my life as well as your students’ opportunity in my class.

1. My oldest child started 9th grade this fall at Waverly High School; my youngest started 6th grade at the middle school. While I am so excited for both of them, I am nervous like any parent. Lauren and Brianna mean the world to me! I want both to have a safe and meaningful experience each and every day. I expect nothing less than the best from their schools, the staff members that will work with them, and their fellow classmates. I know you love your children as much as I love mine. You expect the best for them at school at all times. I keep this in mind everyday.

2. WHS is still a bit new to me! I left my 20-year career in Lincoln Public Schools (including 13 years at Lincoln Southwest and a position as department chair) to invest into District 145 last school year. While I spent more time and energy investing into students last year than any previous year in my career, I loved every minute of it. It is a privilege for me to work with your student! Please continue to offer grace and patience as I continue to adjust!

3. The best way to reach me is via email: [David.Hartman@District145.org](mailto:David.Hartman@District145.org). Again, I try to send out updates, kind of like a class newsletter, every week or so. I will not, however, "push" grades. I am asking you that you periodically review your student's grade on PowerSchool.

4. Some of your children are involved in a lot! Balance seems to be a challenge (and goal) for most teenagers. From sports and clubs to work and family time, keeping a healthy balance is a necessity for all of us! Being a husband, father, teacher, student council co-sponsor, and NWU Advantage statistics instructor, I also struggle with balance every week. I understand when your child feels a bit overwhelmed during various times of a course.

5. My **WEBSITE**: [drdhartman.com](http://drdhartman.com) I usually post assignments daily. This is helpful for students, especially when they miss class. My website also gives you the opportunity to know what we are doing in class. I encourage you to take the time to bookmark my website; also spend some time getting to know more about my personal and professional background.

6. Videos: I use my iPad from time-to-time to create “help” videos. My goal is to have a help video for every review assignment handed out. I go through each and every problem on the review...sometimes I even offer more than one approach. There are times I create a “help” video for a concept that students struggle with. There are also times that I create a “lesson” video, created during the time I am actually teaching. I have made these in the past when large numbers of students are absent or the content is just of that “critical” type. These videos have helped so many students in the past. Students will find the links to my videos on the assignment log on the website. (There are even times when a student emails me...asking for help...I use my iPad to create a video that I can send back to that student within a matter of minutes!)

*Thank-you for taking the time to read this,*

*Dr. Hartman*

Note: I would appreciate if you would be willing to send me an email and share some of the strengths of your son/daughter as well as any other information that will help me as I work to maximize their success in this course!

# Semester 1

Big Ideas—Chapter Topics—Descriptors	Chapter	2016-17 Date
<b>Unit Ia: Exploring and Understanding Data</b>		
Intro: Stats Starts Here ( <i>Who, What, When, Why, Where, and How; Categorical &amp; Quantitative Variables</i> )	1	
Displaying and Describing <b>Categorical</b> Data ( <i>Frequency Tables; Bar &amp; Pie Charts; Contingency Tables; Conditional Distributions; Segmented Bar Charts; Misleading Graphs, Simpson's Paradox</i> )	2	
Displaying and Summarizing <b>Quantitative</b> Data ( <i>Histograms; Relative Frequency Histograms; TI-Activity; Stem-and-Leaf Plots; Dot Plot; "Shape-Center-Spread" of a Distribution and all that goes with those three ideas; 5-Number Summary; Boxplots (i.e., Box-and-Whisker Plot); Mean; Standard Deviation; TI-Activity</i> )	3	
Major Quiz		
Understanding and Comparing Distributions ( <i>Comparing Groups with Histograms and Boxplots; Outliers; TI-Activity</i> )	4	
Selected Review from Unit Ia		
<b>Unit Ia Exam</b>		
Likely Begin Semester 1 Project...Set the Stage 1		
<b>Unit Ib: Exploring and Understanding Data</b>		
The Standard Deviation as a Ruler and the Normal Model ( <i>Standardizing with "z-scores"; Normal Models including the Standard Normal Model; 68-95-99.7 Rule; Pictures-Pictures-Pictures!!!; Percentiles; TI-Activity</i> )	5	
Major Quiz		
<b>Unit II: Exploring Relationships Between Variables</b>		
Scatterplots, Associations, and Correlation ( <i>Direction &amp; Form of Scatterplots; Correlation; Correlation Properties; Caution: Correlation vs. Causation!; TI-Activity</i> )	6	
Linear Regression ( <i>Basics of Residuals and "Best Fit" in terms of Least Squares; Regression Equations; Step-By-Step Calculating a Regression Equation; R vs. R<sup>2</sup>; TI-Activity</i> )	7	
Major Quiz		
(Limited) Regression Wisdom ( <i>Non-linear Residuals; Extrapolation; Influence of Outliers; Leverage; Influence; TI-Activity</i> )	8	
Optional: Likely NO Coverage or Limited Coverage in 2016-17...Re-expressing Data: Get It Straight!	9	
Selected Review from Unit Ib & II		
<b>Unit Ib &amp; II Exam</b>		
Likely More Work on Semester 1 Project...Set the Stage 2		
<b>Unit III: Gathering Data</b>		
Understanding Randomness ( <i>Random Numbers; Simulations; TI-Activity</i> )	10	
Sample Surveys ( <i>Population vs. Sample; Parameters vs. Statistics; Sample Size; Census; Sampling Designs; Validity; Bias; Types of Mistakes in Sampling</i> )	11	
Possible Quiz / Possible Activity		
Experiments and Observational Studies ( <i>Observational Studies including Retrospective and Prospective; Randomized, Comparative Experiments; Four Principles of Experimental Design Influence of Outliers; Sampling in Experiments</i> )	12	
Selected Review from Unit III		
<b>Unit III Exam</b>		
Roll Out Official Semester Project; Back up and Clean Up Stages 1 & 2		
<b>Unit IV: Randomness and Probability</b>		
(Note: We will likely begin Unit IV during Semester 1. Part, if not most, of Unit IV will be covered during Semester 2. We will need to pause the unit to prepare for and then take the Semester 1 final exam)		
From Randomness to Probability ( <i>Laws of Probability?; Theoretical vs. Experimental vs. Personal Probability; Pictures, Pictures, Pictures!; Formal Probability Including the Complement Rule / Addition Rule / Multiplication Rule</i> )	13	
Probability Rules! ( <i>General Addition Rule; Conditional Probability; Independence; Use of Tables / Venn Diagrams; General Multiplication Rule; With or Without Replacement; Tree Diagrams</i> )	14	
Major Quiz		
Random Variables ( <i>Discrete and Continuous Random Variables; Expected Value; Standard Deviation of a Random Variable;</i> )	15	
Probability Models ( <i>Bernoulli Trials; 10% Condition; Geometric Probability Model; Binomial Probability; Connection Back to the Normal Curve; First Look at Statistical Significance; TI-Activity; Observational Studies including Retrospective and Prospective; Randomized, Comparative Experiments; Four Principles of Experimental Design Influence of Outliers; Sampling in Experiments</i> )	16	
Major Quiz		
Selected Review from Unit IV		
<b>Adjusted Unit IV Exam Based on the "Span" from S1 to S2 and Given the S1 Final (more info to come)</b>		

## Semester 2

Big Ideas—Chapter Topics—Descriptors	Chapter	2016-17 Date
<b>Unit IV: Randomness and Probability (Continued)</b>		
(The part of Unit IV we have not covered yet.)		
Selected Review from Unit IV		
<b>Adjusted Unit IV Exam Based on the “Span” from S1 to S2 and Given the S1 Final (more info to come)</b>		
<b>Unit Va: From the Data at Hand to the World at Large</b>		
Sampling Distribution Models ( <i>Sampling Distribution of a Proportion; Normal Model; Assumptions and Conditions; Sampling Distribution Model for a Proportion; Simulating the Sampling Distribution of a Mean; Central Limit Theorem; More Assumptions and Conditions</i> )	17	
Major Quiz		
Confidence Intervals for Proportions ( <i>Standard Error; Confidence Intervals; 1-Proportion z-interval; What does “95% Confidence” Really Mean?; Margin of Error; Critical Values; Assumptions and Conditions; Sample Size; TI-Activity</i> )	18	
Major Quiz		
Selected Review from Unit Va		
<b>Unit Va Exam</b>		
<b>Unit Vb: From the Data at Hand to the World at Large</b>		
Testing Hypotheses About Proportions ( <i>Null and Alternative Hypotheses; P-values; The Steps of Hypothesis Testing; One vs. Two Tailed Tests; P-values and Decisions: What to Tell About a Hypothesis Test; TI-Activity</i> )	19	
Major Quiz		
More About Tests and Intervals ( <i>One-sided vs. Two-sided Tests; What to Do with SMALL or LARGE P-values; Alpha Levels; Significance Levels; Practical vs. Statistical Significance; Confidence Intervals and Hypothesis Tests; Type I and Type II Errors; Power; Effect Size; Reducing Type I and Type II Errors</i> )	20	
Optional: Likely NO Coverage or Limited Coverage in 2016-17...Comparing Two Proportions	21	
Major Quiz		
Selected Review from Unit Vb		
<b>Unit Vb Exam</b>		
<b>Unit VI: Learning About the World</b>		
Inferences About Means ( <i>Revisiting the Central Limit Theorem; Student's t-distribution; Degrees of Freedom; Confidence Interval for Mean; One-Sample t-Interval; Assumptions and Conditions; Again Making Pictures; Using a Table to find t-Values; Hypothesis Testing for Mean; Sample Size; TI-Activity</i> )	22	
Major Quiz		
Cleaning up the Course ( <i>e.g., revisit using z- vs. t- based on the given information</i> )		
Selected Review from VI		
<b>Unit VI Exam</b>		
Prepare for the SCC Final Exam		
<b>SCC Final Exam</b>		
<b>Additional Selected Topics (TBA) to Finish the Year</b>		
Topic A		
Topic B		
Topic C		
Possible Quiz		
Topic D		
Topic E		
Topic F		
Possible Quiz		
Review for Additional Selected Topics Unit		
<b>Additional Selected Topics Exam</b>		
Review for the WHS Semester 2 Final Exam		
<b>WHS Semester 2 Final Exam</b>		

# Appendix: SCC Final Exam

## General Info:

All high school students taking Elementary Statistics for dual credit through Southeast Community College will take a comprehensive exam toward the end of the term. The exam will be taken at the high school and supervised by the high school statistics teacher. The exam will be based roughly on SCC's final exam for Elementary Statistics (MATH 1180), but will be adjusted for the length of the high school class period. The student will be allowed to use a calculator and a formula sheet (provided by the high school teacher). In addition, if students regularly use tables (normal distribution table, etc.) in class, then students will be allowed to use those tables on the exam as well. After the exams have been taken, they will be mailed to SCC and graded by the SCC instructor. The SCC exam score will count for 20% of each student's SCC grade; the grade for the high school class will count for the other 80%.

## Topics:

The following topics could appear on the SCC exam:

- Appropriate/inappropriate sampling methods.
- Descriptive statistics:
  - o Frequency distributions and graphs.
  - o Measures of center (mean, median, mode, weighted mean).
  - o Measures of variation (variance, standard deviation, Empirical rule).
  - o Measures of position (standard score, quartiles, box plot).
  - o Measures of linear correlation (correlation coefficient, slope and y-intercept of regression line).
- Probability:
  - o Addition Rule and disjoint events.
  - o Multiplication Rule.
  - o Conditional probability and independent/dependent events.
  - o Counting techniques (fundamental counting principle, permutations, combinations).
- Random variables and applications:
  - o Probability distributions.
  - o Binomial distribution.
  - o Normal distribution.
  - o Central Limit Theorem.
- Inferential statistics:
  - o One-sample confidence intervals for mean (normal distribution).
  - o One-sample confidence intervals for mean (t distribution).
  - o One-sample confidence intervals for proportion.
  - o One-sample hypothesis test for mean (normal distribution).
  - o One-sample hypothesis test for mean (t distribution).
  - o One-sample hypothesis test for proportion.

For all topics, be prepared to interpret the results of a calculation in real-world terms!

Due to time restrictions, not all of the topics listed above will appear on the exam. However, students should be prepared for **all** of them.

## Grading Rubric:

The following general rubric will be used to score the exercises on the exam. Some general examples are given for each type of error.

- Minor mechanical error (1-2 points deducted).
  - o Arithmetic/calculation error.
  - o Dropped negative sign.
  - o Rounding incorrectly or rounding to the wrong number of places.
  
- Minor conceptual error (2-3 points deducted).
  - o Miscopying a formula.
  - o Using an incorrect table entry in a formula.
  - o Giving an incorrect or incomplete interpretation of a correctly calculated value (instructor's judgment).
  
- Major conceptual error (half credit or less earned).
  - o Using an incorrect, but related, formula or procedure (some specific examples follow):
    - Assuming events are independent when they are actually dependent (or vice versa).
    - Forgetting to divide the standard deviation by the square root of  $n$  when the Central Limit Theorem applies.
    - Using the  $t$  distribution to find a confidence interval for a mean when the normal distribution should be used (or vice versa).
  - o Giving an incorrect or incomplete interpretation of a correctly calculated value (instructor's judgment).
  
- Catastrophic error (very little credit or no credit earned)
  - o Using an unrelated formula or procedure.
  - o Making no mathematical progress toward the correct solution.

## Show your work!

It is not necessary to show every single step of a solution, but students should show enough work to demonstrate that they have used the correct formula/procedure and that they understand the mathematics behind the correct answer. In general, it will be sufficient to show clearly which formula(s) or procedure(s) the student is using, how they plug values into the formula(s), and the answer.

If students use a TI-83/84 calculator command (normalcdf, invNorm, Z-Test, etc.), show that work by writing the entire command that was entered into your calculator, along with any other values that was entered.

Here are some sample exam exercises, along with work that could be shown to justify the solutions:

---

1. At last night's basketball game, 2530 fans had general admission tickets, 720 had non-midcourt floor tickets, and 125 had midcourt floor tickets. General admission tickets to that game cost \$8, midcourt floor tickets cost \$42, and non-midcourt floor tickets cost \$30. Find the mean ticket price for last night's fans. Round to two decimal places.

Solution: Since there were different numbers of fans who bought each type of ticket, we need to use a weighted mean.

$$\mu = \frac{\sum x \cdot w}{\sum w} = \frac{8(2530) + 42(125) + 30(720)}{2530 + 125 + 720} = \frac{47090}{3375} \approx \$13.95$$

---

2. One in five people in the U.S. own individual stocks. In a random sample of 12 people, what is the probability that the number owning individual stocks is at least 4? Round to 4 places.

Solution: Binomial probability formula:  $P(x) = {}_n C_x p^x q^{n-x}$

$$n = 12$$

$$p = \frac{1}{5} = 0.2$$

$$q = 1 - 0.2 = 0.8$$

$$\begin{aligned} P(x \geq 4) &= 1 - (P(x = 0) + P(x = 1) + P(x = 2) + P(x = 3)) \\ &= 1 - ({}_{12}C_0(0.2)^0(0.8)^{12} + {}_{12}C_1(0.2)^1(0.8)^{11} + {}_{12}C_2(0.2)^2(0.8)^{10} + {}_{12}C_3(0.2)^3(0.8)^9) \\ &\approx 1 - (0.0687 + 0.2062 + 0.2835 + 0.2362) \\ &= 0.2054 \end{aligned}$$

OR

(using a TI-83/84 calculator)

$$\begin{aligned} P(x \geq 4) &= 1 - P(x < 4) \\ &= 1 - \text{binomcdf}(12, 0.2, 3) \\ &\approx 1 - 0.7946 \\ &= 0.2054 \end{aligned}$$

---

3. In a survey of 3462 randomly selected U.S. adults, 1004 felt that education should be the highest priority for future economic growth. A researcher needs to find a 99% confidence interval for the proportion of all U.S. adults who feel this way. Does this sample satisfy the requirements for finding a confidence interval for a proportion? If it does, find the desired confidence interval (round confidence interval values to 3 decimal places).

Solution: In order to find a confidence interval for a proportion, the following requirements must be met:

- The sample must be a simple random sample. Since the adults were randomly selected, this requirement is satisfied.
- The sample must either be selected with replacement OR must consist of no more than 5% of the population. Since 3462 adults is clearly less than 5% of all U.S. adults, this requirement is satisfied.

(Note: some textbooks require the sample to be no more than 10% of the population, rather than 5%.)



- Both  $n\hat{p} \geq 5$  and  $n\hat{q} \geq 5$ . For this sample,  $n = 3462$  and  $\hat{p} = \frac{1004}{3462}$ , so  $n\hat{p} = 3462 \left(\frac{1004}{3462}\right) = 1004 \geq 5$ . Similarly,  $\hat{q} = 1 - \frac{1004}{3462} = \frac{2458}{3462}$ , so  $n\hat{q} = 2458 \geq 5$ . Thus, this requirement is satisfied.
- (Note: some textbooks require  $n\hat{p} \geq 10$  and  $n\hat{q} \geq 10$ , rather than 5.)

Confidence interval for a proportion:  $\hat{p} - z_{\alpha/2} \cdot \sqrt{\frac{\hat{p}\hat{q}}{n}} < p < \hat{p} + z_{\alpha/2} \cdot \sqrt{\frac{\hat{p}\hat{q}}{n}}$

$$n = 3462$$

$$\hat{p} = \frac{1004}{3462} \approx 0.290$$

$$\hat{q} = 1 - \hat{p} \approx 0.710$$

For a 99% confidence interval,  $z_{\alpha/2} = 2.576$  (from normal distribution table).

$$0.290 - 2.576 \cdot \sqrt{\frac{(0.290)(0.710)}{3462}} < p < 0.290 + 2.576 \cdot \sqrt{\frac{(0.290)(0.710)}{3462}}$$

$$0.270 < p < 0.310 \quad \text{or} \quad (0.270, 0.310) \quad \text{or} \quad 0.290 \pm 0.020$$

(Any of the three formats given above are acceptable.)

We can be 99% confident that between 27.0% and 31.0% of all U.S. adults feel that education should be the highest priority for future economic growth.

OR

(using a TI-83/84 calculator)

1-PropZInt

$$x = 1004$$

$$n = 3462$$

C-Level: 0.99

(0.270, 0.310)

We can be 99% confident that between 27.0% and 31.0% of all U.S. adults feel that education should be the highest priority for future economic growth.

---

Please note: Student work is NOT expected to be identical to the work shown above; it just needs to allow the grading instructor to be able to follow a student's reasoning.