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COLLEGE STATISTICS 2019-2020

With Option to Dual Enroll at SCC (MATH 2170 or BSAD-2170)

3 Credits

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Welcome to College Statistics! I am so excited to have the opportunity to work with you in learning statistics at Waverly High School. Naturally with the word "college" out front, college stats should be a more rigorous course than most other courses you have taken in the past. Yet, there will be many times that it doesn't feel as rigorous because of time. We have time to develop a deep understanding of statistics. Within the traditional college setting, most students spend three instructional hours per week for fifteen weeks. That is 45 hours of class time. We have all year. Yet you will be expected to work hard both in and out of the classroom setting. 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.

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
- Additional topics time permitting!

Text: You will NOT need to go to SCC to purchase your textbook for this class. WHS will provide it. *STATS—Modeling the World—AP Edition (4th Edition—2015)*. These books are filled 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. Since the textbooks are still pretty 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!

WHS Grading:

100% - 90%	A
89% - 80%	B
79% - 70%	C
69% - 60%	D
59% - 0%	F

Semester 1: 90% Summative *("of" learning…demonstrating what you have learned)*

70%: semester 1 tests and projects

20%: semester 1 final exam. (This is the SCC midterm)

10% Formative *("for" learning…the process along the way)*

homework, quizzes, and projects

Semester 2: 90% Summative *("of" learning…demonstrating what you have learned)*

70%: tests and projects

20%: end of the course final exam. (This is the SCC final)

10% Formative *("for" learning…the process along the way)*

homework, quizzes, and projects

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. *And be ready for many multiple choice question that PUSH you to think!!!*

Projects: There will be a couple projects assigned in this course. 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 chapters. Some projects will be more formative, considered "for learning," and *be considered* a quiz grade. Other projects will be more summative, considered "of learning," and *be considered* a test 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: Naturally there will be a semester 1 final given in December. (We will consider this as the midterm for SCC). Then there will be the SCC final given near May. The SCC final will count as the semester 2 final. Semester finals will fall under the 20% summative-final grade. A considerable amount of the first semester final will be multiple choice whereas as considerable amount of the second semester final will not be multiple choice. PLEASE NOTE: All students take the SCC final, even those not taking the course for college credit.

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 most every night. Some of this includes reading the text and taking notes and some includes "doing" problems. Putting forth effort on each problem is more important than getting every problem correct. Homework and note-taking will be graded via a completion grade. Most of the assigned problems will be the "odd" problems. This is on purpose, as the solutions to "odd" numbered problems are in the back of the book. I am more concerned with your reasoning behind those answers. I want you to use support from your text, peers, the internet, and from me. You need to view homework as an opportunity to practice and figure out what you are "C" confident in, "S" shaky on, or need to "R" relearn.

Extra Credit: There will be no extra credit opportunities for this course.

For Those Dual Enrolling*:* Statistics is coded as MATH-2170. If students plan to attend UNL's College of Business – we change the code to: BSAD-2170 (same course and syllabi, but transfers as an ECON course to UNL). Note: The last day to add the class is August 30. The last day to drop dual enrollment with a refund is September 19. The last day to drop the class with a "W" is March 4.

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

To Calculate the SCC grade:

30% S1 pre-final grade (roughly mid-December WHS grade)

10% S1 final (e.g., SCC midterm)

40% S2 pre-final grade (roughly end of April grade)

20% S2 final (e.g., SCC final)

Grading in a College Level Course: I teach/have taught statistics for the NWU Advantage and Graduate Nursing programs and now Bryan College. I have taught mathematics and education courses for UNL Graduate programs. I have taught methods courses for Union College's undergraduate programs. The ideas of grading in a college course continue to "evolve" in my mind and naturally flows into my work with high schools students. I like to consider several perspectives/images of grading. Let's first consider an SCC perspective:

SCC 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).
  - Arithmetic/calculation error.
  - Dropped negative sign.
  - Rounding incorrectly or rounding to the wrong number of places.
- Minor conceptual error (2-3 points deducted).
  - Miscopying a formula.
  - Using an incorrect table entry in a formula.
  - Giving an incorrect or incomplete interpretation of a correctly calculated value (instructor's judgment).
- Major conceptual error (half credit or less earned).
  - 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).
  - Giving an incorrect or incomplete interpretation of a correctly calculated value (instructor's judgment).
- Catastrophic error (very little credit or no credit earned)
  - Using an unrelated formula or procedure.
  - Making no mathematical progress toward the correct solution.

A second scoring perspective Dr. Hartman often uses:

Grading (on a 5 point scale)			
Code*	Gradebook Value		Code Explanation (SCC Grading)
5	A (100%)	Mathematically Sound	College Proficiency
4	B (87%)	Minor Error(s)	College Proficiency
3	C (72%)	Gray Area--some Major *minor* error(s) or some Minor *major* error(s)	Approaching Basic Proficiency
2	F (56%)	Major Error(s)	Below Basic Proficiency
1	F (36%)	Minimal Progress	Below Basic Proficiency
0	F (0%)	Nothing of Mathematical Value / Blank / Missing	

A third scoring perspective Dr. Hartman reflects 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.

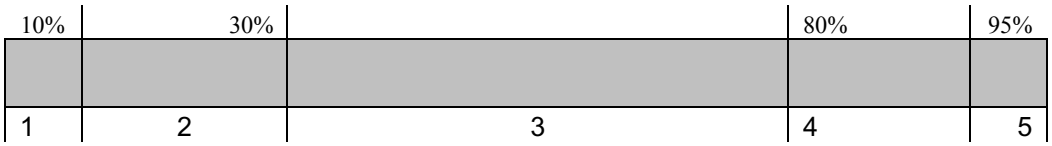

Image of Scores based on Percentage of Work's Correctness & Completeness

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.

Course Timeline and Out of Class Time Requirements: According to the U.S. Department of Education, 1 hour of classroom time requires 2 hours of independent study by the student each week (i.e., a 3 credit hour class requires at least 6 hours of student study each week). Thus, a total of 90 hours of student study is needed for this course. The time allotments below are approximations; it may take you less or more time depending on your study habits. The schedule is also tentative; it may change depending on how the course is progressing.

Fall		
Week	Chapter	Reading / Homework / Study Out of Class Time (approx.)
1	N/A	N/A
2	1	3 hrs
3	2	2.5 hrs
4	2	2 hrs
5	3	2.5 hrs
6	4	2.5 hrs
7	5	3.5 hrs
8	5	2.5 hrs
9	10	2.5 hrs
10a		Fall Break
10b	11	1.5 hrs
11	11	2.5 hrs
12	11/12	2 hrs
13	12	4 hrs
14	6	4 hrs
15a	6	0.5 hrs
15b		Thanksgiving Break
16	7	3 hrs
17	7/13	4 hrs
18	14	3.5 hrs
19	Prep Finals	3 hrs
Total Hours for Fall		49

Spring		
Week	Chapter	Reading / Homework / Study Out of Class Time (approx.)
1	15	3.5 hrs
2	16	3 hrs
3	16	1.5 hrs
4	16	4 hrs
5	17	3 hrs
6	17	2.5 hrs
7	18	1.5 hrs
8	18	3 hrs
9a	18	2.5 hrs
9b		Spring Break
10a		
10b	18/22	1 hr
11	22/19	2 hrs
12	19	2 hrs
13	19	2.5 hrs
14	22/20	2.5 hrs
15	21	2.5 hrs
16	Review	4 hrs
17	SCC final / start project	3 hrs
18	Project	2 hrs
Total Hours for Spr		46

Moving on… "other" details about class!

Classroom Rules: **S.O.A.R.**

S – Safety (this is #1)

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

A – Attendance (be here and on time)

R – Respect &
Responsibility (these two are big in life)

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 (illness, etc.): Recognizing that "life happens," students should be aware that the class does move on even if they are not in class! When they are gone, (a) students should 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. Students can always send me an email if they need clarification.

Missing Class (sports, clubs, school related activities, etc.): This is a different story. Students need to communicate with me ahead of time. Work should be completed and turned in before a student is gone. If a student is going to miss a test or quiz, they need to make it up in advance (or have an approved plan set up with me.) It is not acceptable to show up that day following a school-related activity and say, "what did I miss yesterday?" There will be a deduction if you are not proactive regarding school-related absences.

Phones: We all know that phones are both amazing and problematic (and addicting) at the same time. I have witnessed too many students (and adults) abusing their phones during learning opportunities for years now…and driving...and the movies…etc. It really is an addiction for too many in life, teens and adults. (What does your screen time say???) We are dealing with many consequences as a society due to this "addiction." I expect for phones to not be out unless we need them for an activity. 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, then I will have to address it. Also, you cannot use your phone as your calculator in this class. You need a separate calculator for class!

Calculator: This is a (soft) requirement. I want you to have a graphing calculator and preferably at TI-84+ or even an older TI-83+. I don't have many to share. 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!

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 23 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!)

Textbook: Students are responsible for taking care of their school-provided text. Students should have access to their book in class and at home. There are no extra books in the classroom.

Course Requirements:

* 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)

Communication: Email is the best way! David.Hartman@District145.org. I also am diligent about using a website.: drdhartman.com I usually post assignments daily. This is helpful for students, especially when they miss class. My website also allows parents and guardians the opportunity to know what we are doing in class. I encourage all involved to take the time to bookmark my website; also spend some time getting to know more about my personal and professional background.

Final Comment #1: My oldest daughter started her senior year this fall at WHS; my youngest started 9th grade. My daughters and all of their Waverly peers are the reason I came to this district five years ago. I'm so excited for this year. Yet while I am so excited for both of them, I continue to be 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 this school, my fellow staff members that will work with them, and their fellow classmates who interact with them more than I do. I know you love your children as much as I love mine. You expect the best for them in my classroom at all times. I keep this in mind everyday.

Final Comment #2: Balance! Some of us are involved in a lot! Balance seems to be a challenge for most teenagers (and adults). From sports and clubs to work and family time, keeping a healthy balance is a necessity for all! Being a husband, father, teacher, department chair, student council co-sponsor, quiz bowl sponsor, marching band "watcher," NWU stats instructor, Bryan stats instructor, and multi-dog owner, I also struggle with balance every week. I understand when your child feels a bit overwhelmed during various times of a course.

Semester 1

Big Ideas—Chapter Topics—Descriptors	Chapter	2019-20 Date
Unit Ia: Exploring and Understanding Data		
Intro: Stats Starts Here *(Who, What, When, Why, Where, and How; Categorical & Quantitative Variables)*	1	
Displaying and Describing **Categorical** Data *(Frequency Tables; Bar & Pie Charts; Contingency Tables; Conditional Distributions; Segmented Bar Charts; Misleading Graphs, Simpson's Paradox)*	2	
Displaying and Summarizing **Quantitative** Data *(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)*	3	
Major Quiz		
Understanding and Comparing Distributions *(Comparing Groups with Histograms and Boxplots; Outliers; TI-Activity)*	4	
Selected Review from Unit Ia		
Unit Ia Exam		
Likely Begin Semester 1 Project…Set the Stage 1		
Unit Ib: Exploring and Understanding Data		
The Standard Deviation as a Ruler and the Normal Model *(Standardizing with "z-scores"; Normal Models including the Standard Normal Model; 68-95-99.7 Rule; Pictures-Pictures-Pictures!!!; Percentiles; TI-Activity)*	5	
Major Quiz		
Unit II: Exploring Relationships Between Variables		
Scatterplots, Associations, and Correlation *(Direction & Form of Scatterplots; Correlation; Correlation Properties; Caution: Correlation vs. Causation!; TI-Activity)*	6	
Linear Regression *(Basics of Residuals and "Best Fit" in terms of Least Squares; Regression Equations; Step-By-Step Calculating a Regression Equation; R vs. R^2; TI-Activity)*	7	
Major Quiz		
(Limited) Regression Wisdom *(Non-linear Residuals; Extrapolation; Influence of Outliers; Leverage; Influence; TI-Activity)*	8	
Optional: Likely NO Coverage or Limited Coverage in 2016-17…Re-expressing Data: Get It Straight!	9	
Selected Review from Unit Ib & II		
Unit Ib & II Exam		
Likely More Work on Semester 1 Project…Set the Stage 2		
Unit III: Gathering Data		
Understanding Randomness *(Random Numbers; Simulations; TI-Activity)*	10	
Sample Surveys *(Population vs. Sample; Parameters vs. Statistics; Sample Size; Census; Sampling Designs; Validity; Bias; Types of Mistakes in Sampling)*	11	
Possible Quiz / Possible Activity		
Experiments and Observational Studies *(Observational Studies including Retrospective and Prospective; Randomized, Comparative Experiments; Four Principles of Experimental Design Influence of Outliers; Sampling in Experiments)*	12	
Selected Review from Unit III		
Unit III Exam		
Roll Out Official Semester Project; Back up and Clean Up Stages 1 & 2		
Unit IV: Randomness and Probability (Note: We will likely begin Unit IV during Semester 1. Much 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 *(Laws of Probability?; Theoretical vs. Experimental vs. Personal Probability; Pictures, Pictures, Pictures!; Formal Probability Including the Complement Rule / Addition Rule / Multiplication Rule)*	13	
Probability Rules! *(General Addition Rule; Conditional Probability; Independence; Use of Tables / Venn Diagrams; General Multiplication Rule; With or Without Replacement; Tree Diagrams)*	14	
Major Quiz		
Random Variables *(Discrete and Continuous Random Variables; Expected Value; Standard Deviation of a Random Variable;)*	15	
Probability Models *(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)*	16	
Major Quiz		
Selected Review from Unit IV		
Adjusted Unit IV Exam Based on the "Span" from S1 to S2 and Given the S1 Final (more info to come)		

Semester 2

Big Ideas—Chapter Topics—Descriptors	Chapter	2019-20 Date
Unit IV: Randomness and Probability (Continued)		
(The part of Unit IV we have not covered yet.)		
Selected Review from Unit IV		
Adjusted Unit IV Exam Based on the "Span" from S1 to S2 and Given the S1 Final (more info to come)		
Unit Va: From the Data at Hand to the World at Large		
Sampling Distribution Models *(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)*	17	
Major Quiz		
Confidence Intervals for Proportions *(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)*	18	
Major Quiz		
Selected Review from Unit Va		
Unit Va Exam		
Unit Vb: From the Data at Hand to the World at Large		
Testing Hypotheses About Proportions *(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)*	19	
Major Quiz		
More About Tests and Intervals *(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)*	20	
Optional: Likely NO Coverage or Limited Coverage in 2016-17…Comparing Two Proportions	21	
Major Quiz		
Selected Review from Unit Vb		
Unit Vb Exam		
Unit VI: Learning About the World		
Inferences About Means *(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)*	22	
Major Quiz		
Cleaning up the Course *(e.g., revisit using z- vs. t- based on the given information)*		
Selected Review from VI		
Unit VI Exam		
Additional Selected Topics (TBA) to Finish the Year		
Topic A		
Topic B		
Topic C		
Possible Quiz		
Topic D		
Topic E		
Topic F		
Possible Quiz		
Review for Additional Selected Topics Unit		
Additional Selected Topics Exam		
Review for the WHS Semester 2 Final Exam		
WHS Semester 2 Final Exam		

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.

Topics:

The following topics could appear on the SCC exam:

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

SCC 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).
    - Arithmetic/calculation error.
    - Dropped negative sign.
    - Rounding incorrectly or rounding to the wrong number of places.

- Minor conceptual error (2-3 points deducted).
    - Miscopying a formula.
    - Using an incorrect table entry in a formula.
    - Giving an incorrect or incomplete interpretation of a correctly calculated value (instructor's judgment).

- Major conceptual error (half credit or less earned).
    - 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).
    - Giving an incorrect or incomplete interpretation of a correctly calculated value (instructor's judgment).

- Catastrophic error (very little credit or no credit earned)
    - Using an unrelated formula or procedure.
    - 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:

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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.

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

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

$n = 12$

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

$q = 1 - 0.2 = 0.8$

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

OR

(*using a TI-83/84 calculator*)

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

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

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).
$0.290 - 2.576 \cdot \sqrt{\frac{(0.290)(0.710)}{3462}} < p < 0.290 + 2.576 \cdot \sqrt{\frac{(0.290)(0.710)}{3462}}$
$0.270 < p < 0.310$ or $(0.270, 0.310)$ or 0.290 ± 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.