

**Core Course Assessment Plan, 2019-20**  
**Element 2: Mathematics**

**Please complete all sections; do not delete section information. Submit to Pilot when complete.**

**SECTION 1: GENERAL INFORMATION**

Course Dept. Prefix:   STT   Course #:   1600  

Semester when assessment will occur:  Spring       Summer       Fall Year: 2020

Course Title:   Statistical Concepts  

Section Types and number of sections offered in 2019-20. Complete all that apply.

<u>  3  </u> Dayton face-to-face	<u>  3  </u> Lake face-to-face
<u>  1  </u> Dayton online	<u>      </u> Lake online
<u>      </u> Dayton Honors	<u>      </u> Lake Honors

Attributes:             Integrative Writing in Core  
                          Multicultural Competency in Core  
                          Service Learning in Core

Dept. Core Assessment Lead:    Glenn Dahl                      glenn.dahl@wright.edu

List at least two assessors; this may include course instructor only if there are multiple sections and multiple instructors of the course. Note - The instructor may not assess his/her students' papers.

- Karen Brackenridge
- Glenn Dahl

**SECTION 2: ASSESSMENT PLAN**

**It is preferable to have the assessment plan for all sections of a course. If not feasible, please complete an assessment plan for separate sections.**

Course Outcomes.        Check here if Outcomes have been modified.

The course must address all 5 outcomes but must assess a minimum of 1 outcome. Highlight in yellow the outcome(s) you will assess. If you have modified the outcomes, please insert here in place of standard outcomes.

1. Identify the various elements of a mathematical or statistical model;
2. Determine the values of specific components of a mathematical/statistical model or relationships among various components;
3. Apply a mathematical/statistical model to a real-world problem;
4. Interpret and draw conclusions from graphical, tabular, and other numerical or statistical representations of data; and
5. Summarize and justify analyses of mathematical/statistical models for problems, expressing solutions using an appropriate combination of words, symbols, tables or graphs.

Assignments. Select one of the options below for assessment of one or more outcomes

Written assignment(s) that addresses/address outcome(s). Include outcome #, title and description for each assignment.

Outcome #: \_\_\_\_\_ Title:

Description of assignment:

X Essay question(s). Provide the question(s) and outcome(s) below.

- 1. Outcome #: 3
- 2. Outcome #: 4
- 3. Outcome #: 5

Outcomes 3, 4, and 5 will all be assessed using the question below.

Problem: In a certain rural county, birth weights of babies are normally distributed with mean  $\mu = 7.3$  pounds and standard deviation  $\sigma = 1.3$  pounds. Use this information to answer the following questions:

- a) Is it unusual for a newborn baby to have a birth weight of 6 pounds? To answer this question, compute the z-score for a baby with a weight of 6 pounds and interpret the value you obtain.
- b) Draw the normal curve for the birth weights and shade the area under the curve corresponding to babies weighing more than 8 pounds. What is the probability that a baby has a birth weight exceeding 8 pounds?
- c) A study was done using a random sample of  $n = 25$  expectant mothers to see if an experimental supplemental diet for the mothers will increase birth weights on average. The average birth weight of the  $n = 25$  babies whose mothers participated in the study was  $\bar{x} = 8$  pounds. Find the probability that the sample mean has a value of 8 or greater?
- d) Use the probability you obtained in part c to explain whether or not there is evidence that the new diet increases the birth weights of newborn babies.

Pilot asynchronous written discussion that addresses outcome(s). Provide the outcome # and question(s).

- 1. Outcome #: \_\_\_\_\_ Discussion Question: \_\_\_\_\_
- 2. Outcome #: \_\_\_\_\_ Discussion Question: \_\_\_\_\_
- 3. Outcome #: \_\_\_\_\_ Discussion Question: \_\_\_\_\_

Multiple Choice or T/F Marker questions – 3 to 4 questions per outcome. List the outcome and question numbers. A rubric is not used for Marker questions. "All the above" should not be used as the correct answer more than once. **Courses that are IW or SRV/SRVI must use written assignments for those attributes.** Complete the benchmark: We expect \_\_\_\_\_% of students to answer \_\_\_\_\_% of the question(s) correctly.

- 1. Outcome #: \_\_\_\_\_
  - a) Question: \_\_\_\_\_
  - b) Question: \_\_\_\_\_
  - c) Question: \_\_\_\_\_
  - d) Question: \_\_\_\_\_
- 2. Outcome #: \_\_\_\_\_

- a) Question: \_\_\_\_\_
- b) Question: \_\_\_\_\_
- c) Question: \_\_\_\_\_
- d) Question: \_\_\_\_\_

3. Outcome #: \_\_\_\_\_

- a) Question: \_\_\_\_\_
- b) Question: \_\_\_\_\_
- c) Question: \_\_\_\_\_
- d) Question: \_\_\_\_\_

Collecting and submitting the student assignment(s)

\_\_\_\_\_ Will upload assignment(s) to Pilot

\_\_\_\_\_ Will give access to assignment(s) on Pilot

Other: Will place question on the final exam of each student in all sections of STT 1600.

Rubric Selection (A, B). Select the items you feel best match your assignment(s) in the rubric(s) on the next pages. Please highlight in yellow. **If this course has an IW attribute, please also see section B.**

**A. Element 2 Rubric.** Select the item(s) you will use in your rubric by highlighting in yellow the item(s). You may select one or more of them. As there is overlap, choose the items that best fit the assignment you select for assessment. The items below are taken from the Association of American Colleges and Universities (AACU) Value Rubrics for Math Literacy.

**IF YOU ARE USING MARKER QUESTIONS FOR THE OUTCOME, DO NOT USE THIS RUBRIC.**

	Capstone 4	3	Milestones 2	Benchmark 1
<b>Interpretation</b> <i>Ability to explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words)</i>	Provides accurate explanations of information presented in mathematical forms. Makes appropriate inferences based on that information. <i>For example, accurately explains the trend data shown in a graph and makes reasonable predictions regarding what the data suggest about future events.</i>	Provides accurate explanations of information presented in mathematical forms. <i>For instance, accurately explains the trend data shown in a graph.</i>	Provides somewhat accurate explanations of information presented in mathematical forms, but occasionally makes minor errors related to computations or units. <i>For instance, accurately explains trend data shown in a graph, but may miscalculate the slope of the trend line.</i>	Attempts to explain information presented in mathematical forms, but draws incorrect conclusions about what the information means. <i>For example, attempts to explain the trend data shown in a graph, but will frequently misinterpret the nature of that trend, perhaps by confusing positive and negative trends.</i>
<b>Representation</b> <i>Ability to convert relevant information into various mathematical forms (e.g., equations, graphs, diagrams, tables, words)</i>	Skillfully converts relevant information into an insightful mathematical portrayal in a way that contributes to a further or deeper understanding.	Competently converts relevant information into an appropriate and desired mathematical portrayal.	Completes conversion of information but resulting mathematical portrayal is only partially appropriate or accurate.	Completes conversion of information but resulting mathematical portrayal is inappropriate or inaccurate.

	<b>Capstone 4</b>	<b>Milestones</b>		<b>Benchmark 1</b>
		<b>3</b>	<b>2</b>	
<b>Calculation</b>	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem. Calculations are also presented elegantly (clearly, concisely, etc.)	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem.	Calculations attempted are either unsuccessful or represent only a portion of the calculations required to comprehensively solve the problem.	Calculations are attempted but are both unsuccessful and are not comprehensive.
<b>Application / Analysis</b> <i>Ability to make judgments and draw appropriate conclusions based on the quantitative analysis of data, while recognizing the limits of this analysis</i>	Uses the quantitative analysis of data as the basis for deep and thoughtful judgments, drawing insightful, carefully qualified conclusions from this work.	Uses the quantitative analysis of data as the basis for competent judgments, drawing reasonable and appropriately qualified conclusions from this work.	Uses the quantitative analysis of data as the basis for workmanlike (without inspiration or nuance, ordinary) judgments, drawing plausible conclusions from this work.	Uses the quantitative analysis of data as the basis for tentative, basic judgments, although is hesitant or uncertain about drawing conclusions from this work.
<b>Assumptions</b> <i>Ability to make and evaluate important assumptions in estimation, modeling, and data analysis</i>	Explicitly describes assumptions and provides compelling rationale for why each assumption is appropriate. Shows awareness that confidence in final conclusions is limited by the accuracy of the assumptions.	Explicitly describes assumptions and provides compelling rationale for why assumptions are appropriate.	Explicitly describes assumptions.	Attempts to describe assumptions.
<b>Communication</b> <i>Expressing quantitative evidence in support of the argument or purpose of the work (in terms of what evidence is used and how it is formatted, presented, and contextualized)</i>	Uses quantitative information in connection with the argument or purpose of the work, presents it in an effective format, and explicates it with consistently high quality.	Uses quantitative information in connection with the argument or purpose of the work, though data may be presented in a less than completely effective format or some parts of the explication may be uneven.	Uses quantitative information, but does not effectively connect it to the argument or purpose of the work.	Presents an argument for which quantitative evidence is pertinent, but does not provide adequate explicit numerical support. (May use quasi-quantitative words such as "many," "few," "increasing," "small," and the like in place of actual quantities.)

**B. If this is an IW course, you will use the items on this page. You may select one or more of them. Please highlight in yellow.**

Item	Mastery 4	Partial Mastery 3	Progressing 2	Emerging 1
<b>Includes considerations of audience, purpose, and the circumstances surrounding the writing task(s).</b>	Demonstrates a thorough understanding of context, audience, and purpose that is responsive to the assigned task(s) and focuses all elements of the work.	Demonstrates adequate consideration of context, audience, and purpose and a clear focus on the assigned task(s) (e.g., the task aligns with audience, purpose, and context).	Demonstrates awareness of context, audience, purpose, and to the assigned tasks(s) (e.g., begins to show awareness of audience's perceptions and assumptions).	Demonstrates minimal attention to context, audience, purpose, and to the assigned tasks(s) (e.g., expectation of instructor or self as audience).
<b>Content Development</b>	Uses appropriate, relevant, and compelling content to illustrate mastery of the subject, conveying the writer's understanding, and shaping the whole work.	Uses appropriate, relevant, and compelling content to explore ideas within the context of the discipline and shape the whole work.	Uses appropriate and relevant content to develop and explore ideas through most of the work.	Uses appropriate and relevant content to develop simple ideas in some parts of the work.
<b>Formal and informal rules inherent in the expectations for writing in particular forms and/or academic fields (please see glossary).</b>	Demonstrates detailed attention to and successful execution of a wide range of conventions particular to a specific discipline and/or writing task (s) including organization, content, presentation, formatting, and stylistic choices	Demonstrates consistent use of important conventions particular to a specific discipline and/or writing task(s), including organization, content, presentation, and stylistic choices	Follows expectations appropriate to a specific discipline and/or writing task(s) for basic organization, content, and presentation	Attempts to use a consistent system for basic organization and presentation.
<b>Sources and Evidence</b>	Demonstrates skillful use of high-quality, credible, relevant sources to develop ideas that are appropriate for the discipline and genre of the writing	Demonstrates consistent use of credible, relevant sources to support ideas that are situated within the discipline and genre of the writing.	Demonstrates an attempt to use credible and/or relevant sources to support ideas that are appropriate for the discipline and genre of the writing.	Demonstrates an attempt to use sources to support ideas in the writing.
<b>Control of Syntax and Mechanics</b>	Uses graceful language that skillfully communicates meaning to readers with clarity and fluency, and is virtually error-free.	Uses straightforward language that generally conveys meaning to readers. The language in the portfolio has few errors.	Uses language that generally conveys meaning to readers with clarity, although writing may include some errors.	Uses language that sometimes impedes meaning because of errors in usage.

Faculty Senate CORE Oversight Committee

Assessment Plan Review

Element: 2

Course: STT 1600

Review 1

Item	Complete / NA / Revision Requested	Comments
Learning Outcomes for Element 2 Mathematics	Complete	
Assignments matched to Element 2 LOs	Revision Requested	On p. 3, under "Collecting and Submitting the student assignment", Change "Other: Will place question on 'the final exam' to 'an exam'. Add, "Student workers will copy the assignment before any grading begins and scan a separate pdf of every students' assignment. The student worker will then create a zip file of the separate, ungraded exams to be sent to Carl Brun for entry into Aqua Watermark".
Rubric for LOs	Complete	
Rubric for IW Attribute	N/A	
Assigned Approved Reviewers	Revision Requested	Coordinate with Lake Campus the assessment of this course, including the possibility of at least 1 assessor from Lake Campus. (Nate Tymes has agreed to serve as an assessor.)
Other	Revision Requested	On Page 1, Courses must be assessed in 2019-2020 academic year; Fall 2020 is not within that range.

**Review Status: Revision Requested**

Committee Chair Signature                     MH:bfm                     Date           5/1/2019

The next section is for the University Core Oversight Committee (UCOC) Review only.

**UCOC Review**

Item	Complete/NA	Revision Requested	Comments
Learning Outcomes for Global Traditions	XX		
Rubric for LOs	XX		
Rubric for MC Attribute	N/A		
Rubric for IW Attribute	N/A		
Rubric for SRV/SRVI Attribute	N/A		
Assigned Departmental Reviewers	XX		

Committee Review Completed

Committee Chair Signature Dr. Ann M. Bowling Date 4/10/2020

## Core Assessment Report for STT1600

Classes: Fall 2021, STT1600 sections 02, 03, 05, 07, 13, Dayton Campus, and STT1600 section W01, Lake Campus

### Assessment Plan

#### I. Assess these course outcomes (Core learning Outcomes):

1. Apply a mathematical / statistical model to real-world problem
2. Interpret and draw conclusions from graphical, tabular, and other numerical or statistical representations of data
3. Summarize and justify analyses of mathematical/statistical models for problems, expressing solutions using an appropriate combination of words, symbols, tables, or graphs

Here is the question used:

**Problem:** In a certain rural county, birth weights of babies are normally distributed with mean  $\mu = 7.3$  pounds and standard deviation  $\sigma = 1.3$  pounds. Use this information to answer the following questions:

- a) Is it unusual for a newborn baby to have a birth weight of 6 pounds? To answer this question, compute the z-score for a baby with a weight of 6 pounds and interpret the value you obtain.
- b) Draw the normal curve for the birth weights and shade the area under the curve corresponding to babies weighing more than 8 pounds. What is the probability that a baby has a birth weight exceeding 8 pounds?
- c) A study was done using a random sample of  $n = 25$  expectant mothers to see if an experimental supplemental diet for the mothers will increase birth weights on average. The average birth weight of the  $n = 25$  babies whose mothers participated in the study was  $\bar{x} = 8$  pounds. Find the probability that the sample mean has a value of 8 or greater?
- d) Use the probability you obtained in part c to explain whether or not there is evidence that the new diet increases the birth weights of newborn babies.

#### II. Procedure Used for Assessment

The question was placed on the final exam of the course. The question was analyzed using the highlighted categories - Representation, Calculation, and Application / Analysis - from the following rubric.



	Capstone 4	Milestones		Benchmark 1
		3	2	
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<b>Calculation</b>	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem. Calculations are also presented elegantly (clearly, concisely, etc.)	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem.	Calculations attempted are either unsuccessful or represent only a portion of the calculations required to comprehensively solve the problem.	Calculations are attempted but are both unsuccessful and are not comprehensive.
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	Capstone 4	Milestones		Benchmark 1
		3	2	
<p><b>Assumptions</b> <i>Ability to make and evaluate important assumptions in estimation, modeling, and data analysis</i></p>	Explicitly describes assumptions and provides compelling rationale for why each assumption is appropriate. Shows awareness that confidence in final conclusions is limited by the accuracy of the assumptions.	Explicitly describes assumptions and provides compelling rationale for why assumptions are appropriate.	Explicitly describes assumptions.	Attempts to describe assumptions.
<p><b>Communication</b> <i>Expressing quantitative evidence in support of the argument or purpose of the work (in terms of what evidence is used and how it is formatted, presented, and contextualized)</i></p>	Uses quantitative information in connection with the argument or purpose of the work, presents it in an effective format, and explicates it with consistently high quality.	Uses quantitative information in connection with the argument or purpose of the work, though data may be presented in a less than completely effective format or some parts of the explication may be uneven.	Uses quantitative information, but does not effectively connect it to the argument or purpose of the work.	Presents an argument for which quantitative evidence is pertinent, but does not provide adequate explicit numerical support. (May use quasi-quantitative words such as "many," "few," "increasing," "small," and the like in place of actual quantities.)

**III. Summary of Results**

For this assessment,  $n = 169$ . The online section is not represented since that instructor did not put the assessment question on their final. Here are the results:

	section	section	section	section	section	section			
REP	A	B	C	D	E	F		total	percent
total	66	41	59	114	124	115		519	
n	27	18	29	30	33	32		169	
mean	2.44	2.277	2.03	3.8	3.75	3.59		3.071006	76.775
CALC									
total	63	43	56	86	92	83		423	
n	27	18	29	30	33	32		169	
mean	2.33	2.388	1.93	2.866	2.78	2.59		2.502959	62.574
APPLY									
total	59	24	42	66	70	62		323	
n	27	18	29	30	33	32		169	
mean	2.185	1.33	1.44	2.2	2.12	1.94		1.911243	47.781

Total means the total points awarded to the students for that category.  
n is the number of students in the section. Mean is total divided by n.

Representation: on a 4-point scale, 3.071006 out of 4 is approximately 76.77%. This is an above average score (70% = "C"), so one could reasonably conclude that this benchmark IS met.

Calculation: on a 4-point scale, 2.502959 out of 4 is approximately 62.57%, which is below average (70% = "C"), so one could reasonably conclude that this benchmark is NOT being met.

Application / Analysis: on a 4-point scale, 1.911243 out of 4 is approximately 47.78% which is below average (70% = "C"), so one could reasonably conclude that this benchmark is NOT being met.

### Assessment Results

This problem required the students to recognize that they needed the normal distribution to solve the problem. The students had to compute a z-score and consider whether or not it was "unusual". The students then had to find the area under the curve associated with another score which would require the use of Table A-2 from the text. Next, students consider a sample of  $n=25$  scores to determine whether the mean of that sample has a high or low chance of being at or above a certain value. This new sample size required a new formula, one that students had to recall and utilize. Lastly, students had to consider whether or not the low probability from the last analysis indicates evidence for or against an event in order to determine its statistical significance.

Students generally seemed confident with graphing and using the z-score formula. The scores for Representation and Calculation were 'high'. Their mean score for Representation was above the standard 70% for a "C".

Also, a small percent of students did not make a graph at all. They did make mistakes during Calculation the most frequent being switching the places of the two means in the numerator of the z-score, and forgetting that the denominator for the samples where  $n=25$  required the standard deviation to be divided by the square root of  $n$ , and not multiplied. The 'low' score in Application / Analysis indicates the misinterpretation of a low probability. When the z-score has a corresponding probability, or p-value, that is smaller than the significance level, this indicates a statistically significant event which should not happen, but it did, so it is out of the ordinary. In that case, the null hypothesis is rejected, and many students did not do so.

#### IV. Actions for Improved Student Learning

##### Assessment Feedback

These results will be shared with course instructors and other faculty especially the department chair directly.

There is a sense in which the Representation and Calculation categories can overlap in that an error in representing the problem scenario with an equation could perpetuate mistakes in computation even if the ensuing calculations are done correctly.

#### V. Assessment Administration Feedback

The assessment seems well-organized and thought out. It would, however, be time-consuming to do this assessment every academic year considering all the core classes taught through the Mathematics & Statistics Department. Perhaps it might be more feasible logistically to assess classes on a rotating basis.

#### UCOC Final Report Review

Item	Complete/NA	Revision Requested	Comments
Identified Outcome Assessed	XX		
Identified Procedure for Assessment	XX		
Summary of Results	XX		
Results Shared with Instructor, Dept Curriculum Committee, etc.	XX		
Plan for Improvements	XX		

Committee Review Completed

Committee Chair Signature Dr. Anne M. Bowling \_\_\_\_\_ Date 12/6/2022 \_\_\_\_\_