Math 091	**Math 093**
Math 092	**Math 136**
Math 136	

The above courses replace Intermediate Algebra: Math 098 (Intermediate Algebra) at Seattle Central Community College and Math 095 (Intermediate Algebra) at Tacoma Community College and a standard introductory college survey course in Statistics(Math&146) for Transfer students.

Council of Presidents

Representing Washington's Public Baccalaureate Institutions

Agreement among the Public Baccalaureate Institutions Regarding the Carnegie Foundation-funded Statistics Pathway (*STATWAY*) Pilot Project

1. Notwithstanding the established and continuing general requirement that to be eligible for consideration for admission to a Washington public baccalaureate institution, applicants must have completed a standard intermediate algebra course, the undersigned baccalaureate institutions agree to participate in a time-limited pilot program designed to enable more students to move beyond developmental courses to succeed in completing college-level math.

2. Between fall 2012 and spring 2015, the public baccalaureate institutions will not disqualify transfer applicants on the basis of having completed the STATWAY course sequences, rather than the standard intermediate algebra pathway, at Seattle Central Community College or Tacoma Community College

3. The SBCTC, and the colleges involved in the pilot project, will share with COP, JAOG, and the baccalaureate institutions, ongoing evaluation data and analysis that will help to create a mutual understanding about the process and outcomes of the pilot project. The participants will review the status of the project on an annual basis.

4. In order to give students timely information about transfer requirements, after two years of student enrollments in the STATWAY courses, and based on the results of the project up to that time, each baccalaureate institution reserves the right, individually, to announce that it will not participate in extending the project beyond the three-year pilot.

5. By the end of the three-year pilot period, the participants will agree either to incorporate the basics of this agreement into regular policy, to continue the project as a lengthier pilot with the same and/or additional participants, or to terminate the agreement.

7/22/11
Eastern Washington University Date

7/18/11
Central Washington University Date

18 JULY 2011
The Evergreen State College Date

7/18/11
University of Washington Date

6.30.11
Washington State University Date

7.12.11
Western Washington University Date

410 11th Ave SE, Suite 101
Olympia, WA 98501

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THE CARNEGIE FOUNDATION
for the ADVANCEMENT *of* TEACHING

Statway Statistics and Mathematics
Student Learning Goals and Outcomes

Philosophical Design, Content, and Instructional Paradigm

Statway is a one-year experience of college-level statistics melded with necessary mathematics topics. The pathway is designed for non-STEM students who desire a college-level statistics course and place into Beginning Algebra (or higher).

The statistics outcomes in Statway are as rigorous as those in a first course of college-level statistics. The statistics content is transferrable, college-level content that meets the requirements of various academic programs and careers. Thus, students who successfully complete the sequence receive credit for a college-level statistics course. The mathematics content in Statway is based on the mathematics needed for statistics and the mathematics students need broadly for success in their academic programs and to be productive citizens. The essential mathematics concepts are introduced in the context of statistics, or other appropriate contexts, and integrated throughout.

The fundamental mathematical concepts are presented within statistical situations that adult students can relate to and are experienced through various instructional approaches. As a result, students see mathematics as a tool to understand and use statistics in a variety of real-world, quantitative scenarios as opposed to mathematics being a set of numerous and discrete procedures and tasks that need memorizing. The goal is for students to be able to apply mathematics and statistics to investigate, explain, and solve problems that are real world based.

Some algebraic skills and concepts generally thought to be prerequisite to College Algebra or other college-level mathematics courses are not included in the Statway experience. This does not mean that the mathematical preparation in Statway is not thorough or rigorous. Rather, Statway promotes deep learning of concepts that allows students to select and integrate appropriate mathematical and statistical approaches to solve nonroutine problems. If a student chooses to pursue a STEM course or program, some additional mathematics concepts may need to be developed after Statway through a follow-up bridge course.

Within Statway, the mathematics experience and the methods employed by faculty engage students in mathematics and statistical situations that motivate learning. Critical knowledge and concepts are assessed at the entry point of each major topic, and students are provided with the means to remediate targeted prerequisite material, as needed.

The overarching goal of the Statway experience is that students will be more successful in mathematics, will be motivated to study more mathematics, will develop better problem-solving skills, and will be more confident and competent in quantitative situations.

Statistics Student Learning Goals and Outcomes for Statway

Consistent with the American Statistical Association's Guidelines for Assessment and Instruction in Statistics Education, the Statway learning outcomes center around providing students with a firm conceptual understanding that allows them to use statistical tools intelligently and to be sophisticated consumers of information from studies whose conclusions are based on data.

Students completing the Statway course will understand that data analysis is a process that begins with the formulation of a question that can be addressed with appropriate data, followed by the development of a thoughtful plan for identifying and collecting the necessary data. Students will know how data can be displayed and summarized in informative ways, and they will understand how the data can be used to draw conclusions in the presence of uncertainty.

The following goals and learning outcomes have been chosen to enable students to achieve this overarching vision of what it means to be statistically literate.

Goal S.1: Students will understand the data analysis process and the characteristics of well-designed statistical studies.

Learning Outcomes for Goal S.1
Students should be able to:

- S.1.1 Develop a plan for a statistical study.
    a. Given a real-world problem, formulate a question that can be addressed by data.
    b. Identify appropriate data that can be used to address the question.
    c. Select an appropriate data collection strategy to address a question of interest.
- S.1.2 Know the type and scope of conclusions that can be drawn from different types of statistical studies (e.g., surveys, other observational studies, experiments).
- S.1.3 Know the characteristics of good sampling plans (e.g., representative of larger population, minimize sources of bias and variability), well-designed experiments (e.g., random assignment, replication, control, blocking), and well-designed observational studies (e.g., recognizing potential sources of bias).
- S.1.4 Critically evaluate all aspects of a study.

Goal S.2: Students will demonstrate the use of distributional thinking to reason about the data in order to describe and summarize distributions of data, identify trends and patterns, judge the fit of a model to a distribution, and describe similarities and differences in comparing distributions.

> **Distributional thinking involves the ability to consider a collection of individual observations as an entity (instead of focusing on individual observations) and to consider characteristics of the distribution to reason about the data.**

Learning Outcomes for Goal S.2
Students should be able to:

- S.2.1 Given a data set of a particular type (i.e., numerical, categorical, bivariate numerical, bivariate categorical, or time series).
    a. Display the data using appropriate graphical displays.

b. Summarize the data using appropriate numerical summaries.
c. Describe the data distribution in context.
d. Viewing data as a model plus error, assess the appropriateness of potential models (e.g., normal distribution as a model for numerical data, the least squares regression line as a fit to bivariate numerical data, independence as a model for bivariate categorical data, linear or exponential growth as a model for time series data).

- S.2.2 Recognize different representations of the same data distribution (e.g., dotplot, boxplot, histogram) and understand how numerical summaries are related to characteristics of the data distribution (e.g., extreme left skew tends to have mean < median; the effect of outliers and influential observations).
- S.2.3 Make meaningful and appropriate comparisons of distributions of data collected from two or more different groups.

Goal S.3: Students will demonstrate an ability to use appropriate statistical evidence to reason about population characteristics and about experimental treatment effects.

Learning Outcomes for Goal S.3
Students should be able to:

- S.3.1 Demonstrate a basic understanding of probability.
    a. Interpret a probability.
    b. Estimate probabilities (including conditional probabilities) empirically and using simulation.
    c. Understand how a probability distribution models the behavior of a variable.
    d. Understand how sampling distributions model the behavior of a sample statistic (e.g., a sample mean or sample proportion).
- S.3.2 Understand how sampling distributions and probability support drawing conclusions based on data and assessing the associated risks.
- S.3.3 Understand the logic and reasoning used to interpret results from different types of statistical studies, including surveys, other observational studies, and experiments.
- S.3.4 Determine what statistical methods are appropriate in a given situation based on the goal of the analysis and the data available, and know and assess the conditions required for appropriate use of a given statistical method.
- S.3.5 Critically evaluate whether conclusions based on data are reasonable.
- S.3.6 Compute confidence interval estimates and interpret confidence intervals, confidence level, and margin of error in context.
- S.3.7 In a given context, determine appropriate null and alternative hypotheses and understand what conclusions reasonably follow from a decision to reject the null hypothesis and from a decision not to reject the null hypothesis.
- S.3.8 Understand the concept of statistical significance, including significance levels and *P*-values.
- S.3.9 Carry out hypothesis tests to reach a conclusion and communicate the conclusion in context.

Mathematics Student Learning Goals and Outcomes for Statway

To best serve the diverse audience, the mathematics component of Statway focuses instruction and assessment on key concepts that support statistical thinking and data analysis.

Broad Objectives

- Students will be able to effectively use the language of mathematics to communicate ideas.
- Students will be proficient in procedural fluency, conceptual understanding, strategic competence, adaptive reasoning, and productive disposition.
- Students will be engaged in quantitative problems and investigations where they discover ideas and gain insights that develop questioning and solution-building skills.
- Students will use mental strategies and technology accurately and appropriately.

M.1. Numeracy Goal: Students will develop and apply the concepts of numeracy to investigate and describe quantitative relationships and solve problems in a variety of contexts.

Learning Outcomes for Goal M.1
Students will deepen their ability to reason and use numbers and be able to:

- M.1.1 Demonstrate number sense.
- M.1.2 Display proficiency in making calculations with rational numbers; know how and when to estimate results and round results.
- M.1.3 Create multiple representations of rational numbers and be able to recognize which representation is most useful for addressing a problem or to convey quantitative information.

M.2. Proportional Reasoning Goal: Students will represent proportional relationships and solve problems that require an understanding of ratios, rates, proportions, and scaling.

Learning Outcomes for Goal M.2
Students will be able to:

- M.2.1 Compare proportional relationships that may be represented in different ways and understand the role and function of k in the relationship $y = kx$.
- M.2.2 Distinguish between absolute difference and relative difference, and use percentages to describe changes in a quantity or the error of an estimate given the exact value of the quantity.
- M.2.3 Apply quantitative reasoning strategies to proportional relationships in real-world problems using units effectively and precisely.

M.3. Algebraic Reasoning Goal: Students will reason using the language and structure of algebra to investigate, represent, and solve problems.

Learning Outcomes for Goal M.3
Students will be able to:

- M.3.1 Use variables, evaluate expressions, and solve for unknown quantities and for quantities that may vary.

- M.3.2 Represent real-world and quantitative relationships with equations, inequalities, expressions, tables, verbal descriptions, symbols, and graphs.
- M.3.3 Solve equations and inequalities and explain how results relate to the original context.

M.4. Functions and Modeling Goal: Students will understand functions as a way of modeling a correspondence between two variables. Students will be able to represent functions in various ways: verbally, algebraically, and graphically.

Statway focuses on linear and exponential functions.

Learning Outcomes for Goal M.4

Students will be able to:

- M.4.1 Represent a function algebraically and be able to compute values of a function.
- M.4.2 Describe a function verbally, algebraically, graphically, and in a table of values, and make connections among representations.
- M.4.3 Make conjectures about the behavior of a function given several values of the function and a given context.
- M.4.4 Model situations with linear, quadratic, and exponential functions, inequalities and equations.
- M.4.5 Be able to investigate graphically and numerically (with technology) the effect of changing a parameter within a model.

For linear functions

- **M.4.6 Students will be able to:**
    a. Use linear functions to model situations involving constant rates of change.
    b. Describe the constant of proportionality, *slope*, as the rate of change of the function using appropriate units.
    c. Given the graph, an equation, or two or more points on a line, determine and interpret the intercept(s) and slope.
    d. Given a set of points that exhibit a linear trend, determine the line of best fit.
    e. Compute and interpret the errors or deviation from a line of best fit that is used to model a data set with a linear trend.

For exponential functions

- **M4.7 Students will be able to:**
    a. Identify and quantify exponential growth or decay in formulas, graphs, tables, and applications.
    b. Characterize and describe exponential models and compare them to other models.
    c. Use exponential functions to represent relationships between variables in involving exponential growth and decay.
    d. Describe transformations of the graphs of exponential functions.

MATHEMATICAL ASSOCIATION OF AMERICA

Macalester College ■ 1600 Grand Avenue ■ Saint Paul, MN 55105-1899

David M. Bressoud
President

August 23, 2010

Dr. Anthony Bryk, President
The Carnegie Foundation for the Advancement of Teaching
51 Vista Lane
Stanford, CA 94305

Dear Dr. Bryk,

On behalf of the Mathematical Association of America (MAA), I am pleased to offer our support and encouragement for the work that the Carnegie Foundation for the Advancement of Teaching has undertaken in developing alternate pathways to and through college mathematics, specifically addressed to the needs of community colleges. I also wish to express our appreciation for the opportunity to review the preliminary work on the *Statway* program undertaken by the Carnegie Foundation and the Charles A. Dana Center at the University of Texas, Austin.

The MAA's Association Review Group (ARG) has examined this preliminary work and stated that "The MAA ARG supports the intent of creating a pathway through Statistics for non-STEM students intended to accelerate their progress through the course and to provide the algebraic and numeracy concepts and skills necessary for success." We consider the goals and learning outcomes of this program to be consistent with good undergraduate education in the mathematical sciences and comparable to the learning outcomes of introductory college-level Statistics as taught across the United States.

I, personally, am pleased by the involvement of MAA members in the development of these goals and learning outcomes and am impressed by the care with which plans for continuing assessment and constant re-evaluation of the effectiveness of the program have been laid out.

Sincerely,

David M. Bressoud, President
Mathematical Association of America

cc: Bernadine Chuck Fong

Telephone: (651) 696-6559 ■ Fax: (651) 696-6518 ■ Email: Bressoud@macalester.edu ■ www.maa.org

American Statistical Association

732 North Washington Street, Alexandria, Virginia 22314 USA
(703) 684-1221 ● Fax: (703) 683-2307 ● Email: asainfo@amstat.org
Web site: http://www.amstat.org/

Dear Dr. Bishop,

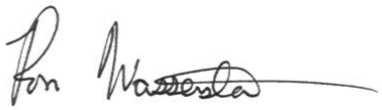
On behalf of the American Statistical Association (ASA), I am pleased to offer support for the excellent work of the Carnegie Foundation for the Advancement of Teaching toward this initiative to strengthen pathways to and through college mathematics in community colleges. I also wish to express appreciation for the opportunity to offer feedback on the preliminary work of the Carnegie Foundation and the Charles A. Dana Center at The University of Texas at Austin on the *Statway* component of the initiative.

The ASA put together a review group consisting prominent statisticians, statistics educators, authors of the *Guidelines for Assessment and Instruction in Statistics Education (GAISE) Report* and members of the ASA Committee on Statistics in Two-Year Colleges. Members of the group included Martha Aliaga, Carolyn Cuff, Beth Chance, Jacquelin Dietz, Chris Franklin, Rob Gould, Katherine Halvorsen, Julie Hanson, Sterling Hilton, Sue Schou, Milo Schield, Mary Sullivan and Jessica Utts. The group synthesized their recommendations for this one year program that includes both developmental level algebra and introductory statistics and provided them in the online survey. A narrative containing additional suggestions and comments is attached there.

The ASA is pleased to offer its endorsement of the *Statway* sequence . We are pleased by the attention given to supporting community college students advance their career goals in areas such as allied health or public safety or continue their education in non-STEM fields. We are enthusiastic about the goals and objectives that, for the most part, echo similar objectives in the GAISE. We are excited by the prospect of large numbers of two-year college students learning statistics from a course based on these solid foundations.

Thank you for the opportunity to partner with you on this important project. We look forward to continued collaboration.

Sincerely,



Ron Wasserstein, Executive Director

AMATYC
American Mathematical Association
of Two-Year Colleges

July 15, 2010

Dr. Anthony Bryk
President
The Carnegie Foundation for the Advancement of Teaching
51 Vista Lane
Stanford, CA 94305

Dear Dr. Bryk,

On behalf of the American Mathematical Association of Two-Year Colleges (AMATYC), I am pleased to offer support for the excellent work of the Carnegie Foundation for the Advancement of Teaching toward this initiative to strengthen pathways to and through college mathematics in community colleges. I also wish to express appreciation for the opportunity to offer feedback on the preliminary work of the Carnegie Foundation and the Charles A. Dana Center at The University of Texas at Austin on the *Statway* component of the initiative.

AMATYC is pleased to offer its support of the *Statway* sequence. AMATYC has been involved in the development of the Carnegie Statway initiative and supports the goals and outcomes of the Statway experience. In addition, the AMATYC Statistics Committee has reviewed the Statway Student Outcomes and finds them consistent in philosophy and practice with the AMATYC Standards *Beyond Crossroads* and parallel with the learning outcomes of an introductory college-level Statistics course offered across the country.

Thank you for the opportunity to partner with you on this important project. We look forward to continued collaboration.

Sincerely,

Robert A. Farinelli
President

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Statway

findings by the Chancellor's General Education Advisory Committee
Meeting of December 2, 2010

The Chancellor's General Education Advisory Committee ("GEAC") has received recommendations on the Statway curriculum from CSU faculty in the disciplines of mathematics, sociology, business, and psychology. At its meeting of December 2, GEAC unanimously agreed to the following findings:

1. To students who complete the Statway curriculum as reviewed, community colleges that participate in GE Breadth may award three semester units (or the equivalent in quarter units) of baccalaureate credit, all of which may be applied to Area B4 Quantitative Reasoning.

2. This authority is granted as a limited exemption to the requirement that any course approved for Area B4 Quantitative Reasoning carry a prerequisite of Intermediate Algebra.

3. This Statway exemption applies only to the six California Community College Districts now participating in Statway:
   Foothill-DeAnza Community College District
   Los Angeles Community College District
   Mount San Antonio Community College District
   Los Rios Community College District
   San Diego Community College District
   San Francisco Community College District

4. This exemption period is limited to three years, to begin with the term Statway is first offered (Fall, 2011) and continue until Fall, 2014.

5. Four members of GEAC will stay in close contact with the organizers of this pilot project, to provide advice and oversight for the collection of research data. GEAC expects the project to produce data such as rates of persistence, course completion and GPA, and graduation, to the extent possible, so it may later evaluate the success of the project. The faculty named to this research advisory group are:
   Kathleen Kaiser/California State University, Chico (Sociology)
   Catherine Nelson/Sonoma State University (Political Science)
   John Tarjan/California State University, Bakersfield (Business)
   Mark Van Selst/San José State University (Psychology)

6. The Academic Senate CSU may elect to pass a formal resolution in support of these findings. In the meantime the CSU Office of the Chancellor and department of Academic Programs and Policy are charged with administering the recognition of Statway as described here, and California Community Colleges may rely on this memo in preparing GE Breadth certifications that include Statway coursework.

FLORIDA DEPARTMENT OF EDUCATION

November 23, 2010

Dr. Karen Borglum
Assistant Vice President for Curriculum and Articulation
Valencia Community College
Post Office Box 3028
Orlando, Florida 32802

Dear Dr. Borglum:

I have been following the Statway discussion with interest and I appreciate your responses to our inquiries. At this time, I am willing to approve the Statway pilot for Miami Dade College, Tallahassee Community College and Valencia Community College. While there is no standard procedure for requesting approval from the Division of Florida Colleges for a new course, you have also requested permission to deviate from the statewide policy of administering the Basic Skills Exit Test to students at the end of a developmental education course sequence. For the purposes of determining the potential for implementation statewide, the Statway pilot colleges may develop an end-of-course examination based on the Statway course competencies that will be administered to all pilot participants at all three colleges. The same passing score must be used by all three colleges for allowing students to transition to Statistical Methods I, STA 2023. Since this is a pilot, I understand the student progression details are still being considered. It is critical that participating students continue to receive direct advising and are monitored beyond their enrollment in STA 2023. As you and the other pilot colleges make decisions regarding student progression beyond STA 2023, please let me know. I will be interested to follow their education progression to degree completion.

Per the Statewide Course Numbering System protocol, you will receive notification, if you have not already, regarding the official Statway course number assignment. As communicated previously, we understand your rationale for requesting MAT 0029 and I do not oppose its use for the purposes of this pilot.

As mentioned before, I am very excited about the statewide implications and I fully support your efforts in finding innovative strategies for improvements in instruction that lead to student success.

Sincerely,

Dr. Judith Bilsky
Executive Vice Chancellor

JB/jal

CC: Julie Alexander, Division of Florida Colleges (DFC)
John Hughes, DFC
Melinda Milles, DFC
Matthew Bouck, Office of Articulation
Frank Brown, Tallahassee Community College
Lenore Rodicio, Miami Dade College
Henri Sue Bynum, Indian River State College, Chair, Council of Instructional Affairs