GBC Class/Course Assessment Report

Course Prefix, Number, and Title: SUR 330 Introduction to Least Squares Adjustment
Section Number(s): 1001
Department: Computer Technologies

Instructor: Byron Calkins
Academic Year: 2020-2021
Semester: Spring 2021
Is this a GenEd class? Yes___ No_x__

Complete and submit your assessment report electronically to your department chair. As needed, please attach supporting documents and/or a narrative description of the assessment activities. You may use as many or as few outcomes as necessary.

Class/Course Outcomes	Assessment Measures	Assessment Results	Outcome Results Analysis
In the boxes below, summarize the outcomes assessed in your class or course during the last year.	In the boxes below, summarize the methods used to assess course outcomes during the last year. Assessment of outcomes need to be based on student work that directly demonstrates achievement of outcomes. Also include the criterion to judge whether or not students have achieved the expected outcome.	In the boxes below, summarize the results of your assessment activities during the last year.	In the boxes below, please reflect on this outcome's results and summarize how you plan to use the results to improve student learning.
Note: If this is a GenEd class, include the appropriate GenEd objectives at the beginning of the course assessment report.	*Note: Any assessment reporting for GenEd courses should provide a clear explanation of the assessment methodology (how performance was assessed) as well as how the work being assessed meets Gen. Ed. outcomes.*	Notes: *For GenEd courses, in the boxes below, summarize the results of your assessment activities during the last year.*	*Note: Completed assessment reporting for GenEd courses should include data generated from assessment as well as discussion and interpretation of its meaning and should include detail on how the instructor/department will incorporate and utilize data in course design and planning moving forward.*

Revised 4/17

GBC Class/Course Assessment Report

Course Outcome #1:	Course Assessment Measure	Course Results	Course Analysis
Formulate and solve survey adjustment problems using matrices	Assessment Overview: *HW 2 Systems of Linear Equations* In order to evaluate the inputs and outputs of a typical least squares adjustment, students will solve and describe a linear system of equations using Gaussian Elimination by the following means: Put a system of linear equations in an augmented matrix Put a system of linear equations in echelon form using elementary row operations. Put a system of linear equations in reduced row echelon form (row canonical form) using elementary row operations. Define a Homogeneous system of linear equations Identify trivial solution Identify nontrivial solution Assessment Methodology: *HW 2 Systems of Linear Equations* 1)a) Place into an augmented matrix; b) Use elementary row operations to determine whether the system has/is: 1) An unique solution --if so state solution. 2) An undetermined system--state general solution and one possible particular solution. 3) No solution--stop where you are using elementary row operations and explain why the system is inconsistent with no solution. c) Analyze the system: State the value of n, m, and n-r (number of free variables) for each system. Is the system of equations consistent or inconsistent; (b) If the system is consistent, does it have a unique solution or many solutions; (c) If the system has many solutions, give its general solution and one particular solution. Criterion for achievement: *HW 2 Systems of Linear Equations* 70% of students will score above 80% on Course Outcome #1 in HW 2 Systems of Linear Equations.	Results: *HW 2 Systems of Linear Equations* 8/11 students scored 80% or higher on HW 2 Relief Displacement and Ground Coordinates. Criterion Met: *Yes/No* Yes	Analysis: The criterion for achievement developed for the SUR HW 2 Systems of Linear Equations states that 70% of the students will score 80% or greater on HW 2 Systems of Linear Equations to meet course outcome number one, which requires the learner to solve and describe a linear system of equations using Gaussian Elimination. The criterion for course outcome one was met, as 72% of the learners in the SUR 330 class earned an 80% or greater on HW 2 Systems of Linear Equations. Action Plan: Please see course overview report and notes for discussion, interpretation, and how the instructor/department will incorporate proficiency data results from the course outcome number one: formulate and solve survey adjustment problems using matrices.

GBC Class/Course Assessment Report

Course Outcome #2:	Course Assessment Measure	Course Results	Course Analysis
Identify direct and indirect survey measurements	Assessment Overview: *HW 3 Linearization* Historically, the term function was first used by Leibniz in 1673 to denote the dependence of one quantity on another. A typical function is an algebraic or trigonometric formula that relates your survey measurements to the computational product you wish to compute with your measurements. Assessment Methodology: *HW 3 Linearization* HW 3 Linearization is measured by the learner's ability to use the truncated Taylor series to linearize each of the following functions at the appropriate point of linearization given in each problem. Then use the linearized function to gain its value at the point of use given for each problem. Compare this value given by the linearized function to the true value given by the original function at the point of use. Show the difference to as many decimal places as necessary to show the difference. Criterion for achievement: *HW 3 Linearization* 70% of students will score above 80% on Course Outcome #2 in HW 3 Linearization.	Results: *HW 3 Calculations on the Tilted Photograph* 9/11 students scored 80% or higher on HW 3 Linearization. Criterion Met: *Yes/No* Yes	Analysis: The criterion for achievement developed for the HW 3 Linearization states that 70% of the students will score 80% or greater on HW 3 Linearization to meet course outcome number two, which requires the learner to identify direct and indirect survey measurements. The criterion for course outcome two was met, as 81% of the learners in the SUR 330 class earned an 80% or greater on HW 3 Linearization. Action Plan: Please see course overview report and notes for discussion, interpretation, and how the instructor/department will incorporate proficiency data results from the course outcome number two: identify direct and indirect survey measurements.

GBC Class/Course Assessment Report

Course Outcome #3:	Course Assessment Measure	Course Results	Course Analysis
Perform simple statistical testing	Assessment Overview: *HW 7 Method of Obs* Model, Setup, and Perform LS Adjustments Assessment Methodology: *HW 7 Method of Obs* Apply the least squares criterion to fit data to mathematical and survey models. Compute the degrees of freedom for a particular data set and model. Evaluate the inputs and outputs of a typical least squares adjustment. For example, three angular measurements taken at different times with different instruments close the horizon plane, and each setup involved different instruments, different crews, using different measurement techniques, and the measurements span a period of over 25 years - obviously the measurements are independent of each other. The learner will successfully estimate the precision of each measurement. Criterion for achievement: *HW 7 Method of Obs* 70% of students will score above 80% on Course Outcome #3 for "HW 7 Method of Obs."	Results: *HW 7 Method of Obs* 6/11 students scored 80% or higher on HW 7 Method of Obs. Criterion Met: *Yes/No* No	Analysis: The criterion for achievement developed for HW 7 Method of Obs states that 70% of the students will score 80% or greater on HW 7 Method of Obs to meet course outcome number three, which requires the learner to perform simple statistical testing. The criterion for course outcome three was not met, as 55% of the learners in the SUR 330 class earned an 80% or greater on HW 7 Method of Obs. Action Plan: Please see course overview report and notes for discussion, interpretation, and how the instructor/department will incorporate proficiency data results from the course outcome number three, (perform simple statistical testing) in course design and planning moving forward.

GBC Class/Course Assessment Report

Course Overview Report

SUR 330 (Introduction to Least Squares Adjustment) course outcomes are measurable and consistent with the course-level objectives. The module/unit-level learning objectives describe outcomes that are measurable and consistent with the course-level objectives. Learning objectives are stated clearly in the syllabus, are written from the learner's perspective, but are not prominently located in each module/unit overview. The relationship between learning objectives and learning activities is not stated in each module/unit overview. The learning objectives are suited to the level of the course as 100% of 2021 learners earned a 70% or greater overall versus 2020, when 85% earned a 70% or greater overall.

SUR 330 (Introduction to Least Squares Adjustment) course assessments (HW 2 Systems of Linear Equations, HW 3 Linearization, and HW 7 Method of Obs) measure the achievement of the stated learning outcomes. The course grading policy is stated clearly at the beginning of the course in the course syllabus and specific and descriptive criteria are provided for the evaluation of learners' work, and their connection to the course grading policy is clearly explained. The SUR 330 (Introduction to Least Squares Adjustment) assessments used are sequenced, varied, and suited to the level of the course. The course provides learners with multiple opportunities to track their learning progress with a timely feedback policy, automated quiz grading, online class meetings, and instructor comments.

SUR 330 (Introduction to Least Squares Adjustment) instructional materials contribute to the achievement of the stated learning objectives. The relationship between the use of instructional materials in the course and completing learning activities is not clearly explained in the module overview or on the assessment activity page. The course does not model the academic integrity expected of learners by providing both source references and permissions for use of instructional materials, except in the syllabus. The instructional materials are comprised of dated and current versions, and mostly represent up-to-date theory and practice in the discipline. A variety of instructional materials (Textbook, Video, Big Blue Button, Industry Publications) are used in the course

Notes: How will the instructor/department incorporate proficiency data results from the general education technological proficiency outcomes and course outcomes in course design and planning moving forward.

Course Outcome #1:
Formulate and solve survey adjustment problems using matrices

Action Plan: HW 2 Systems of Linear Equations
The criterion for course outcome one was met, as 72% of the learners in the SUR 330 class earned an 80% or greater on HW 2 Systems of Linear Equations. Course level objectives such as, apply the least squares criterion to fit data to mathematical and survey models are assessed via learning activities from our class text, *Ghilani, Charles D. Adjustment Computations: Spatial Data Analysis. Sixth Edition. John Wiley and Sons, 2017* and supplementary readings. Ironically, I spent considerable time going over slope, graphing the intersections of linear functions, and solving systems of equations, yet the mean hwk score dropped 20%. The main reason I spent a considerable amount of time on these concepts was based on feedback from the 2020 spring student evaluations from SUR 330. Some students expressed the desire for more live lectures. I will continue with these expanded lectures to determine if they have an impact in future classes. There are no current action items for course outcome one, other than continuing enhanced lectures, and adopting the most current edition of the text, when it becomes available.

Course Outcome #2:
Identify direct and indirect survey measurements

Action Plan: HW 3 Linearization
The criterion for course outcome two was met, as 81% of the learners in the SUR 330 class earned an 80% or greater on HW 3 Linearization. Course level objectives such as discriminating between a linear and non-linear Least Squares problem, and applying the Taylor Series to linearize non-linear equations are assessed via learning activities from our class text, *Ghilani, Charles D. Adjustment Computations: Spatial Data Analysis. Sixth Edition. John Wiley and Sons, 2017* and supplementary readings. Student success rose

slightly over the 2020 average. Attribution to enhanced lectures may have increased this score. There are no current action items for course outcome two, other than continuing enhanced lectures, and adopting the most current edition of the text, when it becomes available.

Course Outcome #3:
Perform simple statistical testing

Action Plan: HW 7 Method of Obs
The criterion for course outcome three was not met, as 55% of the learners in the SUR 330 class earned an 80% or greater on HW 7 Method of Obs. The course level objectives such as identify the proper model for a data set, compute the degrees of freedom for a particular data set and model, evaluate the inputs and outputs of a typical least squares adjustment, and apply the principles of error propagation are assessed via learning activities from our class text, *Ghilani, Charles D. Adjustment Computations: Spatial Data Analysis. Sixth Edition. John Wiley and Sons, 2017* and supplementary readings. Student success rose slightly over the 2020 average. Attribution to enhanced lectures may have increased this score. Excel was used in the lecture demonstration to create a best fit line to series of points. All formulas and procedures required to complete the hwk exercise were demonstrated during lecture. There are no current action items for course outcome three, other than continuing enhanced lectures, and adopting the most current edition of the text, when it becomes available.

I have reviewed this report:

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Department Chair   Dean

Date_____   Date_____

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GBC Class/Course Assessment Report

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Vice President of Academic Affairs and Student Services

Date_____