

Course Assessment Document for CS 251

Departmental Outcomes

1. Proficiency in computational thinking
2. Ability to analyze systems at the three levels of computer science: theory, software, and hardware
3. Proficiency in the design and implementation of algorithms using multiple programming languages
4. Ability to apply computational thinking to a diverse set of problems and disciplines
5. Ability to communicate effectively and collaborate with others
6. Ability to adapt to new challenges and computational environments

Course Description

Prepares students to apply computational data analysis and visualization approaches to real information from a variety of disciplines and applications. Data visualization is the interactive visual exploration of 2-D and 3-D graphic information using techniques that highlight patterns and relationships. Data analysis incorporates data management, data transformations, statistical analysis, data mining, and machine learning. Through programming projects, students will gain hands-on experience with the fundamentals of data analysis and visualization using data from active research projects at Colby and other institutions.

Prerequisites: CS 231

Rationale for prerequisites: The students need experience with programming language classes, basic data structures, and algorithms.

Desired Course Outcomes

- A. Students understand and can write programs to store and manipulate data and measurements.
- B. Students understand and can implement the fundamental concepts of interactive visualization of data.
- C. Students understand and can implement common data transformations and statistical analysis.
- D. Students understand and can make appropriate use of current machine learning techniques for prediction and knowledge discovery.
- E. Students present methods, algorithms, results, and designs in an organized and competently written manner.
- F. Students gain experience working with real data from disciplines outside computer science.

We will disseminate the desired course outcomes to students via the course web page, syllabus and in class.

Course Matrix

Outcome	Activities	Method of Assessment	Departmental Outcome
A	Lectures, Projects	Exams, graded assignments	1, 3, 4
B	Lectures, Projects	Exams, graded assignments presentations	1, 2, 3
C	Lectures, Projects	Exams, graded assignments	1, 3, 4
D	Lectures, Projects	Exams, graded assignments presentations	1, 2, 3, 4
E	Projects, Meetings	Graded projects, presentations	5
F	Meetings with clients	Graded projects, presentations	4, 5

Grade Calibration Matrix

Outcome	Meaning of the grade A
A	The student writes programs for robustly reading and parsing data and storing it efficiently in memory. The programs are modular, well-organized, and robust to failures.
B	The student implements multiple interactive visualizations using their data. The visualizations are complete, informative, and enable interaction with the data values.
C	The student implements algorithms for multiple transformations and analyses, including analysis in addition to means, standard deviations, and clustering. The data is organized to make adding new capabilities straightforward.
D	The student makes use of machine learning tools to develop multiple analyses of their data. The student also implements multiple machine learning methods integrated with their overall project.
E	Reports are well-written, concise, and clear. The reports clearly describe the project and use example code to demonstrate concepts and design decisions. The reports are written so that students outside the course could understand them.
F	The student finds an appropriate data set, meets several times with the client, and provides a useful visualization and analysis tool at the end of the semester.

Outcome	Meaning of the grade B
A	The student writes programs that read and parse a particular type of data file and store it in memory. The programs are modular and well organized.
B	The student implements the required visualizations using their data. The visualizations are functional and informative, but may be missing some features and may not permit interaction with the data values.
C	The student implements the required transformation and analysis algorithms, including means, standard deviations, and clustering. The data is organized so that adding new capabilities is possible.
D	The student makes use of machine learning tools to do the required analysis on the data set. The student implements the required machine learning methods and may integrate one or more of them with the overall project.
E	Reports are well written and clear. The reports describe the main points of the project, mention design issues and may make use of example code to support the text. The reports are written so that students taking the course could understand the work.
F	The student finds an appropriate data set, meets as required with the client, and provides a functional visualization and analysis program at the end of the semester.

Outcome	Meaning of the grade C
A	The student writes programs that read and parse one data file and store it in memory. The programs are not robust and do not provide error messages.
B	The student implements most of the required visualizations using one data set. The visualizations are mostly functional but are missing some features and do not implement all of the required interaction.
C	The student implements most of the required transformation and analysis algorithms. Adding new capabilities is difficult because of the code and data organization.
D	The student makes use of machine learning tools to do an analysis on the data set. The analysis may be incomplete or inappropriate. The student implements some of the required machine learning algorithms, but does not integrate them into the overall project.
E	Reports describe the work, but may take the form of a narrative of the student's difficulties rather than focusing on the results. The reports assume the reader has in-depth knowledge of the project.
F	The student obtains a data set with assistance, meets late or misses some meetings with the client, and provides somewhat useful or relevant visualization and analysis functions.

Outcome	Meaning of the grade D
A	The student writes programs that have difficulty reading and parsing a data file. The information is stored in memory, but not efficiently.
B	The student implements some of the required visualizations using one data set. The visualizations are missing features and do not implement appropriate interactivity.
C	The student implements some of the required transformation and analysis algorithms. The student may attempt to add new capabilities, but finds it difficult to do so.
D	The student attempts to make use of the machine learning tools to undertake an analysis. The analysis is incomplete or inappropriate given the data set. The student has difficulty implementing the required machine learning algorithms.
E	The student's reports are incomplete or not well written and may contain errors. The report includes some description of the student's work, but little explanation.
F	The student has difficulty obtaining a data set, meets once or not at all with the client, and provides minimally useful, possibly non-functional visualization and analysis functions.

A student who receives an F does not meet the criteria for a D or any higher grade.