William Paterson University of New Jersey
College of Science and Health
Department of Computer Science
Analysis of Course Coverage and Assessment Report Data
Fall 2015 – Spring 2017 Assessment Cycle

Course Number: CS 4800 (Computer Science Seminar)

Course Coordination Committee Members: John P. Najarian

Date: May 25, 2017

A. Course Pre-requisites/Co-Requisites

a) Problems/Issues Identified

No problem. Maturity is necessary and proficiency is required in a reasonable subset of Computer Science, so as not to duplicate learning fundamentals. Since Senior standing entails Data Structures and programming maturity (CS 2300, CS 2400, possibly more), students have sufficient preparation to handle moderate-size or robust projects, not just textbook toy programming. No change is needed for Prerequisites.

b) Suggestions for Improvement

No improvement is necessary. We don't want to overburden this course with too many prerequisites which would create serious scheduling problems with minimal benefit.

B. Course Objectives

a) Problems/Issues Identified:

No problems identified in the Objectives. The course objectives are well designed. Ethics, research, and a large project with presentation are the primary goals.

b) Suggestions for Improvement

Recommendation: please add the following as a course objective to the CS 4800 course outline:
"Demonstrate abilities to apply the Scientific Method to the discipline of Computer Science."
Reason: (cited below in the next paragraphs under Learning Outcomes)

C. Course Student Learning Outcomes

a) Problems/Issues Identified:

No problem identified with respect to the existing course. However, critical external factors citesd below under "b) Suggestions" make change necessary.

b) Suggestions for Improvement

In accordance with Improvements recommended by several constituencies and discussions with ABET reviewers (and the Dean, CS chairperson, and curriculum committee and assessment committee chairs) on Assessment of Scientific Methodology as applied to Computer Science, we need to add such a clause to the student/course learning outcomes of the CS 4800 course outline.

The syllabus of CS 4800 in Spring 2016 specifies the SLO: "Gain a deeper and more systematic understanding of scientific/research methods by carrying out a substantial research-oriented project on a current topic of interest in computer science".
This implicitly permitted Dr. Najarian to include several lectures reviewing the Scientific Method and then apply them to Computer Science, hence the topic cited above as item 3 in the topic-table "Demonstrate abilities to apply scientific methods to the discipline of Computer Science."

Further more, Dr. Najarian specifically gave an exam testing students on their ability to apply the Scientific Method to CS. This resulted in successful assessment of science in a capstone course.

We hereby are recommended to add: "Demonstrate abilities to apply the Scientific Method to the discipline of Computer Science." to the official course outline through proper channels (herewith initiated with this document, in addition to phone discussions with our ABET reviewer). As this document will be reviewed in a periodic CCAR analysis, that is the proper channel for this important improvement of both the course and program assessment of student acquisition and proficiency in Science.

D. Course Content

a) Problems/Issues Identified:

In accordance with suggestion above and in the CCAR table (of topics, rightmost suggestion box in topic #3), course content should review the Scientific method and apply it in Computer Science, in hardware, software, and other aspects of CS. At least two weeks is needed with at least one exam but it can span the full process of project development, as this provides ample opportunity for students to use the Scientific Method in a practical way, in their actual development / inquiry

process. The key to effective coverage is to use interesting, challenging problems, in the application of the Scientific Method in Computer Science (Sedgewick's notes).

The Ethics coverage is fine. No change is suggested. The textbook used is: Reynolds, George. Ethics in Information Technology. 5th ed. Cengage Learning (Course Technology /ITC Thomson), 2014. The verdict on this textbook (which occurs over three semesters) is that the contents in Reynolds is sufficient. It is the most popular and standardized text (though skewed towards corporate perspectives in IT). It is used by most faculty who teach CS 4800 (including this CCAR analyzer) for decades with continuous success.

Likewise, the project work is progressive and carefully documented, first by topic approval, then an abstract, followed by a proposal (with schedule and references), and a final report, culminating in a Presentation (Powerpoint, then demonstration of the final product, be it software, hardware, or research report). So these are no problems here; the augmented focus on the Scientific Method just serves to enhance a process working flawlessly for 20 years. The capstone really has no problems.

b) Suggestions for Improvement

The Scientific Method has been smoothly integrated into the research process. The examination is rigorous and utilizes material and questions from Sedgewick's website, discourse and problemsets. In this multi-semester time span, the improvement was implemented in the first two terms

As all parties are satisfied with this text, this text remains adopted for the course because it is so well adapted to the course. Why change (?), though Sara Baase's "A Gift of Fire" has a finer literary texture, readability, rhetorical style, and philosophical perspective.

E. Assessment of the CS Program's Student Outcomes

Student Outcome S1: Communicate effectively in a variety of professional contexts.

Ethics essays test student writing skills in terms of general prose. On a more scientific note, the abstract, proposal (with schedule and references), and a final report test student concept formulation, inquiry, and final documentation. Oral skills are evaluated by the final Presentation, giving an exposition of the nature of inquiry, the processes/procedures, and the resultant product.

Student Outcome S4: Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.

As team size increases beyond three, the probability of a slacker riding on the coat-tails of others (the actual students doing the work) increases. Detailed evaluation of the presentation is necessary, separating attributes measured for each individual student. When such a critical assessment occurs, students protested and object to individuated grading. While loyalty to a group has its place, the unethical-ness of free-rides has not been sufficiently recognized by the students. This is tragic. Knowledge and appreciation of ethics is one thing, but for all our inculcation efforts, obedience to the codes of ethics may need to be a life-long process.

Student Outcome S5: Demonstrate abilities to locate and make effective use of information.

Students effective collected supporting documentation and software (for development) from the Internet and our local library, in degrees varying upon the project. Students were required to use multiple references with comprehensive coverage and in-depth methodology/principles.

Student Outcome S9: Recognize professional responsibilities and make informed judgements in computing practice based legal and ethical principles.

Students did well in the ethics part of the course. However, while academically well versed in ethical principles, only time will tell if they are reflected in professional practices. "Knowing the law" makes for cleverer cheaters and richer lawyers, not a more ethical society (i.e. one with fewer infractions); it is a necessary condition but nowhere near a sufficient condition.
Despite this consideration, we have effectively taught th principles. Students learned the rules, how to apply them, how to reason in the models presented, appreciate their role in society, have been inculcated in proper practices (through open discussions, debates, and essays), and developed the critical thinking needed to be ethical Computer Scientists. We have done our job.

F. Analysis of the Course Learning Outcomes Assessment Data

Fall 2015

	Learning Outcomes	**Where Measured**	**Percentage of Satisfactory Results***
	L1: Ethics and Social Impact	HW and Test	100%
	L4: Code of Ethics ACM and IEEE	HW and Test	100%
	L2, L3: Research	Project & Presentation	95%
	L5 – L8: Locate/Integrate, Critical Thinking, Communications	Project & Presentation	95%
	W1 – W3: Writing Intensive	HW & Project & Presentation	95% 100%
	L9: Work in Teams (Dilemma: Of 20 students, 5 did single-person projects. How can we apply teamwork metric in case of single person projects? 100% success in the remaining 15, resulting in 75% . So 75% refers to degree of partnership, not team work (which was measured with 100% above threshold results).	Project & Presentation	75%
	L10: Applying Scientific Method to Computer Science	Test	60%

Spring 2016

	Learning Outcomes	Where Measured	Percentage of Satisfactory Results*
	L1: Ethics and Social Impact	HW and Test	90%.
	L4: Code of Ethics ACM and IEEE	HW and Test	90%.
	L2, L3: Research	Project & Presentation	100%
	L5 – L8: Locate/Integrate, Critical Thinking, Communications	Project & Presentation	100%
	W1 – W3: Writing Intensive	HW & Project & Presentation	90% 90%
	L9: Work in Teams (with a class size of 11, team formation was below normal, 70%)	Project & Presentation	70%.
	L10: Applying the Scientific Method to Computer Science (while 90% response rate is attained, 70% was well formulated and 10% satisfactory)	Test	80% .

Fall 2016

	Learning Outcomes	Where Measured	Percentage of Satisfactory Results*
	L1: Ethics and Social Impact	HW and Test	99.99%* (* one student got a 64 on the last ethics exam)
	L4: Code of Ethics ACM and IEEE	HW and Test	100%
	L2, L3: Research	Project & Presentation	91%** (** 2 students out of 22 had substandard (<70) projects)
	L5 – L8: Locate/Integrate, Critical Thinking, Communications	Project & Presentation	91%**
	W1 – W3: Writing Intensive	HW & Project & Presentation	100% 91%**
	L9: Work in Teams (18 out of 22 demonstrated effective teamwork; of the 4 who did not, 1 handed in no project, 1 was a single person team doing poorly, and the remaining 2 were in a team but contributed little in effort and presentation).	Project & Presentation	81%.
	L10: Applying the Scientific Method to Computer Science (63% = 14/22 . Students were more capable with the Scientific Method in areas of CS with which they were familiar	Test	63% .

	(often programming) but not as much in hardware.		

Learning Outcomes

Course Learning Outcomes:

L1. Articulate the impact of computers on our society in key areas including privacy, security, benefits and risks of computers, right of intellectual property and software piracy, the two sides of software ownership and the patent law, consequences of the artificial intelligence, the balance between censorship and freedom of speech in 2 cyberspace, the monopolizing and controlling information by small number of corporations. Measure: exams, surveys, and projects.

L2. Gain a deeper and more systematic understanding of scientific/research methods by carrying out a substantial research-oriented project on a current topic of interest in computer science. Measure: assignments and projects.

L3. Explain the trends in information technologies and computer science.

L4. Describe the responsibilities of expected of a computer professional and understand the code of ethics of computer professionals stipulated by computer professional organizations such as IEEE and ACM. Measure: exams, surveys, and projects.

L5. Effectively express themselves in written and oral form. Measure: exams and projects.

L6. Demonstrate ability to think critically. Measure: exams and projects.

L7. Locate and use information. Measure: exams, surveys, and projects

L8. Demonstrate ability to integrate knowledge and idea in a coherent and meaningful manner. Measure: exams and projects

L9. Work effectively with others. Measure: projects.

L10. [Added as of Fall 2015, permanently on the syllabus (instructor-specific).] Apply the Scientific Method to Computer Science.

Writing Intensive SLO's from UCC:

W1-W3. The student should be able to write a 10 page paper on their senior project, which could be on a current research topic in a journal like an encryption or a data compression algorithm. They are encouraged to do a large programming project for the senior project that might have grown out of one of their courses especially software engineering or it might be a game or an application for the IPhone or Android. If their project is a programming project, the paper might document the steps they took to

create the program or document the program so it can be used by another person. The paper will be corrected by the professor and they will be asked to revise it. It should be emphasized that English 1100 and Communications 1100 are prerequisites for the course. They must also give an oral report which gives the instructor another opportunity to see if the student really understands the material before the final submission of the written report and to make suggestions.

W1- The students should be able to write 10 short essays for the computer ethics segment of the course on such topics as privacy vs. freedom of expression, what they would include in a lecture on protecting computers from computer crime, the ways one can safeguard intellectual property, what they would do if pressured to release a buggy code, the benefits and disadvantages of outsourcing, etc. The topics of these essays are designed to stimulate critical thinking. Again students must also give oral presentations.

W3- Since this is a course in ethics, the student must use proper citations. When students lift material for their presentations from our ethics book or from the web they are publicly criticized and reminded that this is an ethics course as well as a senior project class. Early in the semester students are asked to write an abstract of one of the presentations given by faculty members and these are graded and edited. They are also instructed in how to use a typesetting language to help them write equations, label equations, figures, and graphs so they can be referred to later and develop a bibliography and a method for citing references when the list of references might be growing.

The SLO's for writing are evaluated through the 10 ethics assignments and the final paper.

Technology Intensive SLO's from UCC:

T1 All students must be able to do a senior project that can either involve researching a current topic in the journals, like a web crawling algorithm, or a large programming project that might be a game or might have grown out of their data base or software engineering course. Lately students have been creating applications for the Android and Iphone. One part of the course delves into a topic that is the choice of the professor. Currently the topic is data fitting and has included lectures in medical imaging, data mining techniques, least squares fitting through Matlab, and fitting exponential functions with multiple data sets.

T2. They currently must also show competency in Latex, a typesetting language, PowerPoint for presentation, or other expositional technologies.

T3-T4. For the third of the course on ethics for the computer professional, the students must be able to give presentations and write essays on privacy, freedom of expression, different forms of computer crime and protection from these crimes. They must be able distinguish between what is legal and what

is ethical in the workplace and discuss the legal means of protecting intellectual property. They must understand their responsibility to produce products that work as advertised, and how technology has changed the lives of people in developing countries.

The SLO's for technology are evaluated through the final project, the homework exercises in the computer science topic chosen by the professor, the 10 homework ethics

G. Course Coverage and Assessment Report Data

In section F, we have the Analysis of the Course Learning Outcomes Assessment Data. From the Assessment of Learning outcomes, we observe the success in attainment relative to he course outcomes. This can be translated to actual course content in the below tables, and therefore assess effective course coverage with comments.

Fall 2015

Topics	Course Learning Outcome	How is topic covered?		How is knowledge accessed?				Comments/Suggestions About Learning Outcome and/or Topics (please use additional sheets if necessary)
		Lecture	Hands-On	HW	Test	Lab	Project	
1. Topics on ethics of computer professionals and social impact of computers. .	L1, L2, L4, L5, L6, L7, W1-W3							I give weekly written homework assignments (30 - 90 questions each) on the roughly 10 areas of ethics and social impact. The 10 areas are then assessed by the weekly quizzes, also 10 in total.
a) ACM and IEEE code of ethics for computer professionals		X,		X,	X,			
b) Freedom of speech versus censorship in cyberspace		X,		X,	X,			
c) Privacy: controlling and potential misuse of information		X,		X,	X,			
d) Intellectual property: the implication of copyrights, and patent laws		X,		X,	X,			
e) Computer crime and the culture of the hackers								
f) Risks of large								

computer systems.								
2. Topics of current interest in computer science and new development in computing technologies	L3, L5, L6, L7	X		X				We review (expositions with subsequent discussions) current issues and research results. For example, we review the Communications of the ACM articles of the month (with thematically unified adjacent articles in periodical). Cover articles are often the most provocative. To avoid pressure / promote free speech, the discussion here is not graded. Implicitly, this is assessed in the currency/quality of the projects (item 4 in this table).
3. Demonstrate abilities to apply scientific methods to the discipline of Computer Science.	L10 *, L6	X		X	X			Several handouts on the Scientific Method and its Application to CS. Based on Sedgewick's Princeton model as applied to algorithmics but not restricted to it.
4. Complete a Seminar Project, document it, and present it publically	L3, L5, L6, L7, L9, W1-W3			X			X	This is the primary goal of the course, to produce a significant work as a project, a programming effort, or scientific inquiry. It begins as an abstract, then a schedule/plan with extended abstract, activities, project plan, research with references, followed by a report documenting results and a public presentation (either: 1. expository for research, 2. a demonstration of hardware or software developed). The grade is split between abstract, planning, project quality/ scholarship/ professionalism, report quality, command of the subject, and the presentation (including communication skills).

Spring 2016

Topics	Course Learning Outcome	How is topic covered?		How is knowledge accessed?				Comments/Suggestions About Learning Outcome and/or Topics (please use additional sheets if necessary)
		Lecture	Hands-On		Test	Homework	Project	
1. Topics on ethics of computer professionals and social impact of computers. a) ACM and IEEE code of ethics for computer professionals b) Freedom of speech versus censorship in cyberspace c) Privacy: controlling and potential misuse of information d) Intellectual property: the implication of copyrights, and patent laws e) Computer crime and the culture of the hackers f) Risks of large computer systems.	L1, L2, L4, L5, L6, L7, W1-W3	X, X, X, X, X,			X, X, X, X, X,	X, X, X, X, X,		I give weekly written homework assignments (30 - 90 questions each) on the roughly 10 areas of ethics and social impact. The 10 areas are then assessed by the near weekly quizzes, actually kept to just 8 in total (by merging some later chapters into a single quiz).
2. Topics of current interest in computer science and new development in computing technologies		X		X				We review (expositions with subsequent discussions) current issues and research results. For example, we review the Communications of the ACM articles of the month (with thematically unified adjacent articles in periodical). Cover articles are often the most provocative. To avoid pressure / promote free speech, the discussion here is not graded. Implicitly, this is assessed in the currency/quality of the projects (item 4 in this table).
3. Demonstrate abilities to apply scientific methods to the discipline of Computer Science.	L10 *, L6	X		X	X			Several handouts on the Scientific Method and its Application to CS. Based on Sedgewick's Princeton model as applied to algorithmics but not restricted to it. Some handouts were made available on the SUN UNIX server but as student accessible files, not public

								web ones.
4. Complete a Seminar Project, document it, and present it publically	L3, L5, L6, L7, L9, W1-W3			X		X	X	This is the primary goal of the course, to produce a significant work as a project, a programming effort, or scientific inquiry. It begins as an abstract, then a schedule/plan with extended abstract, activities, project plan, research with references, followed by a report documenting results and a public presentation (either: 1. expository for research, 2. a demonstration of hardware or software developed). The grade is split between abstract, planning, project quality/ scholarship/ professionalism, report quality, command of the subject, and the presentation (including communication skills).

Fall 2016

Topics	Course Learning Outcome	How is topic covered?		How is knowledge accessed?				Comments/Suggestions About Learning Outcome and/or Topics (please use additional sheets if necessary)
		Lecture	Hands-On		Test	Homework	Project	
1. Topics on ethics of computer professionals and social impact of computers. . a) ACM and IEEE code of ethics for computer professionals b) Freedom of speech versus censorship in cyberspace c) Privacy: controlling and potential misuse of information d) Intellectual property: the implication of copyrights, and patent laws e) Computer crime and the culture of the hackers f) Risks of large computer systems.	L1, L2, L4, L5, L6, L7, W1-W3	X, X, X, X, X,			X, X, X, X, X,	X, X, X, X, X,		I give weekly written homework assignments (30 - 90 questions each) on the roughly 10 areas of ethics and social impact. The 10 areas are then assessed by the near weekly quizzes, actually kept to just 8 in total (by merging some later chapters into a single quiz).
2. Topics of current interest in computer science and new development in computing technologies		X						We review (expositions with subsequent discussions) current issues and research results. For example, we review the Communications of the ACM articles of the month (with thematically unified adjacent articles in periodical). Cover articles are often the most provocative. To avoid pressure / promote free speech, the discussion here is not graded. Implicitly, this is assessed in the currency/quality of the projects (item 4 in this table).
3. Demonstrate abilities to apply scientific methods to the discipline of Computer Science.	L10 *, L6	X			X			Several handouts on the Scientific Method and its Application to CS. Based on Sedgewick's Princeton model as applied to algorithmics but not restricted to it. Some handouts were made available on the SUN UNIX server but as student accessible files, not public web ones.
4. Complete a Seminar Project,	L3, L5, L6, L7,			X			X	This is the primary goal of the course, to produce a significant work as a

document it, and present it publically	L9, W1-W3							project, a programming effort, or scientific inquiry. It begins as an abstract, then a schedule/plan with extended abstract, activities, project plan, research with references, followed by a report documenting results and a public presentation (either: 1. expository for research, 2. a demonstration of hardware or software developed). The grade is split between abstract, planning, project quality/ scholarship/ professionalism, report quality, command of the subject, and the presentation (including communication skills).