The Student Portfolio Requirement of the Computer Science Major

Each student completing a Computer Science major at Western Carolina University must develop an intermediate portfolio and a capstone portfolio that document his or her progress towards meeting the student learning objectives (SLOs) of the major in Computer Science. These portfolios will be completed as part of the coursework for select Computer Science courses. The instructor for each of those courses will provide a document supplementing this document that relates to the specifics of what will be required in that course. This document provides the requirements for the portfolios, an example rubric, an explanation of the student learning objectives, and provides a rationale for the portfolios.

Student Portfolio Requirements

Computer Science Program

Western Carolina University

You will develop two student portfolios. Your intermediate portfolio is developed during several courses in the middle of your time as a computer science major. Your capstone portfolio is developed during the capstone course.

Each of your student portfolios has a front section and then a section for each student learning objective. The section for each student learning objective has a series of representative work samples with each work sample preceded by an introduction. The section for one student learning objective has a reflection document following the subsections for each work sample.

The Requirements

Versions

Two versions of the portfolio are submitted: the draft and the final version. The student gets feedback from the instructor about ways to improve the draft version. The final version should reflect those suggestions. Whether the draft version counts as part of the grade is up to the instructor.

Format of Both Versions

- The portfolio must have an attractive appearance and be well-organized.
- All the writing in the portfolio must be well-written following standard rules of grammar, spelling, and word usage. The writing must be clear and logical.
- There must be at least two pages of front matter.
    - The first page of the front matter must include the title of the portfolio and identifying information (for which course the portfolio is a requirement, your name, and the date).
    - The second page of the front matter must include a table of contents. The table of contents must go through the subsection level of the document.
- There must be a section for each student learning objective addressed. Each section must start on a separate page and have a section title.
- The section for a particular student learning objective must have
    - A subsection for each work sample (there must be at least two work samples per student learning objective). The subsection for a work sample must contain
        - An introduction for that work sample explaining its context. The length of each introduction must be at least 50 words.
        - A link to the actual work sample.
    - A subsection for the reflection document for this student learning objective. The length of

each reflection document must be at least 500 words.

Work Samples

The work samples must address the student learning outcome addressed in the section they are located. A work sample may be used to address more than one student learning outcome. There are a range of possible work that might be included as work samples including parts of the software development process for a particular program (such as, requirements specifications, design documents, test suites, and the program code itself), papers written, and experimental or theoretical studies. The work samples need not only be from the current course. You should remember to save your work when you finish a course so that you can use that work as a work sample in your portfolio later.

Reflection Document

In the reflection document you are to explain in your own words, your view of the meaning of the student learning outcome, what aspect of each work sample addresses this student learning outcome, and an honest and accurate appraisal of your strengths and weaknesses at this point in your career with respect to this SLO. It is unlikely that you have no weaknesses and it is also is unlikely that you have no strengths with respect to the SLO being addressed.

Submission and Visibility

- What you must turn in and what will be graded as the portfolio is a copy of your document presented to the instructor on a CD or by email, or by another non-public manner.
- If the complete portfolio is less than two megabytes, then you can email it. Otherwise, you need to submit it on a CD.
- You are not required to have anything on the web. If you want to have an abridged version of your portfolio on the web, you must follow these requirements
  - the abridged version must be in a directory named portfolio inside your public_html directory on sol.cs.wcu.edu.
  - the abridged version must have no solutions for any coursework you did at Western. Thus, for example, no source code, no javadoc files, and no reports that you prepared. The one exception is that you can post the executable file version of a solution.

Sample Student Portfolio Rubric
Computer Science Program
Western Carolina University

This is an example rubric for the intermediate portfolio for CS 463 and accompanying glossary. This intermediate portfolio addresses the Software Development SLO, the Communication SLO, and the Teamwork SLO. The rubric actually used in a course is to be determined by the instructor for the course.

Glossary	
Name	Meaning
Software Development SLO	be able to use all of the steps of the software development process to create high quality software
Communication SLO	be able to express ideas effectively in oral and written form.
Teamwork SLO	be able to work well with others.

Overall Rubric			
Stated Objective or Performance	***Score***	***Weight***	***Weighted Score***
Draft Version Sub-Rubric			
Final Version Sub-Rubric			
Feedback: Does the Final version show incorporation of the improvements identified by the instructor needed in the draft version and the (possibly optional) oral presentation?			
Total Weighted Score			
Total Normalized Score (out of 100)			

Draft Version Sub-Rubric and Final Version Sub-Rubric		
Stated Objective or Performance	***Max Points***	***Earned Points***
Format		
Does the portfolio follow the format requirements (two pages of front matter		

Draft Version Sub-Rubric and Final Version Sub-Rubric		
including identifying information and table of contents, a section per SLO with a subsection per work sample (including the introduction and link to the work sample) and a subsection for the reflection document) and is it attractive and well-organized?		
Is the writing correct with respect to spelling, grammar, and punctuation?		
Software Development SLO		
Are the introductions to the work samples well-written and make clear the nature of the corresponding work sample?		
Are the work samples a good set of selections for this SLO?		
Does the reflection document make clear the student's understanding of this SLO? Does the reflection document well address how each work sample addresses this SLO? Does the reflection document make an accurate characterization of the level of mastery of this SLO demonstrated by the work samples? Does the reflection document address both the strengths and weaknesses of the student as perceived by the student?		
Is the level of mastery of this SLO as demonstrated by the work samples and the reflection document satisfactory?		
Communication SLO		
Are the introductions to the work samples well-written and make clear the nature of the corresponding work sample?		
Are the work samples a good set of selections for this SLO?		
Does the reflection document make clear the student's understanding of this SLO? Does the reflection document well address how each work sample addresses this SLO? Does the reflection document make an accurate characterization of the level of mastery of this SLO demonstrated by the work samples? Does the reflection document address both the strengths and weaknesses of the student as perceived by the student?		
Is the level of mastery of this SLO as demonstrated by the work samples and the reflection document satisfactory?		
Teamwork SLO		
Are the introductions to the work samples well-written and make clear the nature of the corresponding work sample?		
Are the work samples a good set of selections for this SLO?		
Does the reflection document make clear the student's understanding of this SLO? Does the reflection document well address how each work sample addresses this SLO? Does the reflection document make an accurate		

Draft Version Sub-Rubric and Final Version Sub-Rubric		
characterization of the level of mastery of this SLO demonstrated by the work samples? Does the reflection document address both the strengths and weaknesses of the student as perceived by the student?		
Is the level of mastery of this SLO as demonstrated by the work samples and the reflection document satisfactory?		
Late Points	-100	
Total Weighted Score		
Total Normalized Score (out of 100)		

The Student Learning Objectives

The Computer Science faculty decided it was in the best interests of the students within the program, of the faculty of the program, and of anyone interested in the nature of the program to make clear what the faculty want the students to achieve by completing the program.

The statement that we agreed upon for the computer science student learning objectives follows:

At the time of graduation, students who receive a bachelor's degree in computer science will:

- *be able to create and analyze a non-trivial algorithm*
- *be able to use all of the steps of the software development process to create high quality software*
- *when given an observed behavior of a single computer or of a distributed system, be able to identify and explain the key internal events that cause that behavior*
- *be able to articulate a well thought-out judgment on legal, social, and ethical issues associated with computing*
- *be able to express ideas effectively in oral and written form.*
- *be able to work well with others.*

Rationale for Student Portfolios

The Computer Science faculty decided to require student portfolios for several reasons:

- the student's developing of a student portfolio will help make clear to the student to what extent the student has achieved each of the student learning objectives. In other words, preparing a student portfolio is a form of self-assessment for the student.
- the student's developing of a student portfolio is a learning experience in itself for the student. This is especially true if well-thought-out and precise guidelines and a rubric are provided for the format and content of the student portfolio
- the student portfolio can be a useful asset for the student when the student seeks employment. An employer is likely to prefer an applicant who can document the work that they have accomplished during their academic career. This is especially true if the work is clearly relevant to the abilities and skills important for employment. However, posting solutions to coursework in a manner that is accessible to anyone raises potential problems with respect to other students possibly presenting those solutions as their own. We think this problem can be avoided by allowing abridged versions to be accessible and complete versions to be exchanged with employers in a private manner.
- the content and format of the student portfolio provided by a student can be a useful means for the Computer Science faculty to assess the extent to which that student has achieved the student learning objectives.
- the student portfolios of all of the students graduating within a single academic year as a group provide a means of program assessment. In other words, the nature of the group of student portfolios provides feedback to the faculty about the effectiveness of the computer science program at helping the students achieve the student learning objectives.

After deciding to incorporate student portfolios and to connect them to the student learning objectives, the next steps were for the Computer Science faculty to decide how the student portfolios are to be

related to the time the students spends within the computer science program and the nature of a student portfolio.

Relationship of Student Portfolios to the Student's Academic Career

Clearly near the end of the student's academic career, the student will need to develop a student portfolio that addresses all of the student learning objectives. Since all computer science majors take the capstone course during their Senior year, adding developing of a capstone portfolio as a requirement for that course was a natural decision.

We want the capstone portfolio to be based on the student's collecting, organizing, and reflecting on samples of their student work over their entire time as a computer science major. We made two decisions as a result.

- First,that it is important to have the student develop an earlier student portfolio that cover all of the student learning objectives. We call this the intermediate portfolio. We mapped the student learning objectives to a subset of the required courses. Those courses have developing a student portfolio as a course requirement that counts towards the grade for that course. This mapping is shown in the next section.
- Second, the syllabi of all of the computer science courses in the major will include a passage notifying the student of the intermediate portfolio and of the capstone portfolio and encouraging the student to save copies of work they think they may want to include in the portfolios.

Mapping of SLOs to Courses

CS 350

- *when given an observed behavior of a single computer or of a distributed system, be able to identify and explain the key internal events that cause that behavior*

CS 351

- *be able to create and analyze a non-trivial algorithm*

CS 463

- *be able to use all of the steps of the software development process to create high quality software*
- *be able to express ideas effectively in oral and written form.*
- *be able to work well with others.*

CS 495

- *all of the student learning objectives*

Motivation for the Student Portfolio Requirement

The following quotation motivates how the portfolio requirement was developed and is motivated. The quotation is from the Western Carolina University Handbook for Program Assessment, March 2006 edition, created by Melissa Canady Wargo, pages 39-40.

“A portfolio is a longitudinal collection of work samples that demonstrates the extent to which a student has fulfilled the intended SLO. The evaluation of student portfolios have become a commonly

employed assessment tool in higher education. Portfolios have the advantage of compiling samples of student work in a convenient package which can then be evaluated using standardized criteria derived from program learning goals and outcomes. Moreover, portfolios have the added advantage of providing students a collection of materials that demonstrate their skills and knowledge to potential employers or graduate programs. Below are some general guidelines for developing and using portfolios in program assessment.

Characteristics of portfolios designed to promote and assess student learning are:

- Student involvement in the selection of entries
- student preparation of written reflections about learning
- Continuing discussion with faculty regarding written reflections

Best practices for use of portfolios in program assessment:

- Carefully select what you choose to require in a portfolio: be sure that included materials can be used to assess the intended outcomes.
- Communicate clearly to students what you expect to see in the portfolio in terms of work products and specify the format(s) that are acceptable.
- Develop a standard rubric to use in evaluation of the portfolios and have at least two reviewers for each portfolio.
- Clearly articulate the methodology of collecting and evaluating the portfolios. Address questions of when the portfolio is due, what the consequences are for failing to provide a portfolio, is the portfolio retained in the program office or returned to the student, and whether the evaluation is for program assessment purposes only or will it be used as part of a course grade or a graduation requirement.
- Develop a process for communicating the results of the assessment to the program faculty."

Motivation for the Student Portfolio Rubric

The following quotation motivates how the student portfolio rubric was developed and is motivated. The quotation is from the Western Carolina University Handbook for Program Assessment, March 2006 edition, created by Melissa Canady Wargo, pages 35-36.

"One of the most effective ways to evaluate student work products in learning outcomes assessment is to use a standardized rubric. A rubric is simply a scoring guide used in assessment to provide an explicit description of the learning or performance being measured. Some of the benefits of using rubrics in outcomes assessment include the following:

- Expected levels of learning or qualities of performance are clearly defined on a pre-determined rating scale.
- Allows program faculty to explicitly articulate their criteria for learning to all constituents.
- Facilitates discussion of the results and their ultimate incorporation into decision-making processes regarding programmatic or curricular changes.

Best practices for developing and using rubrics in outcomes assessment are:

- Identify the skill/knowledge you are assessing.
- Break down the skill/knowledge into its characteristic parts (e.g. If you are assessing the ability to problem solve determine ideal steps a student would take to successfully demonstrate their ability to solve a problem).
- Develop a scale that would describe low, intermediate and high levels of performance for each characteristic of the skill/knowledge you are assessing ....
- Pilot the rubric on student work with several reviewers and students and obtain feedback.
- Make assessment rubrics available to students before completion of assignments.
- Allow students to use rubrics in peer and self-assessment exercises.
- Develop a process to aggregate results of assessments using standard rubrics; disseminate results to faculty and incorporate results into program decision-making processes."

Student Portfolio Consent Form

Computer Science Program

Western Carolina University

I (print name) _____, hereby, give permission to the Faculty of the Computer Science Program at Western Carolina University to maintain indefinitely a copy of any student portfolio that I develop as part of my coursework as an undergraduate in that program and to use those copies of my student portfolios for program assessment.

_____ _____

Signature Date