Institutional Effectiveness
2023-2024

Program: Computer Science BS
College and Department: College of Engineering, Computer Science
Contact: Gerald Gannod

Mission:
"Our mission is to be widely recognized for enabling students to have global impact through innovative and quality programs, through research that emphasizes collaborative partnerships, and by enabling the success of a diverse student, faculty, and alumni community."

This mission is consistent with the University's mission to "provide leadership and outstanding programs in engineering, the sciences, and related areas that benefit the people of Tennessee and the nation" and with the University's commitment to the life-long success of students and to enrich the lives of people and communities in the Upper Cumberland region of Tennessee. It is also consistent with Tech Tomorrow, the University's strategic plan, and its focus on improving student experience, transforming technology, and creating distinctive programs.

Attach Curriculum Map (Educational Programs Only):
Attached Files: See Appendix 1

SLO 1 Analyze a complex computing problem

Define Outcome:

Students can analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions.

This outcome is as defined by the Accreditation Board for Engineering and Technology (ABET) Computer Science Accreditation Commission (CAC).

Assessment Methods:

Direct Assessment. Several courses are assessed every semester. These assessments directly examine student work based on traits (performance criteria) created specifically for each student outcome. The measurement rubric used for direct assessment uses a four-level rubric: Excelling, Practicing, Apprentice, and Novice (E/P/A/N). These criteria are performed on a per student basis. An example is provided below.

Performance Criteria (Traits):

- Students can identify and define the computing requirements appropriate to its solution. (Bloom's taxonomy level: Analysis)
- Students can analyze and weigh trade-offs related to computing problems. (Bloom's taxonomy level: Analysis).

Faculty Course Reflections (all courses): Each faculty member is asked to complete a course reflection at the end of each semester. The reflection allows a faculty member to summarize the results of the course, map the appropriate objectives and outcomes to the course and identify successes from the semesters, opportunities for improvement, puzzles (i.e., questions to be resolved), suggested changes, issues with facilities, technology issues, and other reflections.

Pre-Post Surveys (Pre-Post): Pre-post surveys are conducted for courses in which a direct assessment is scheduled. The pre-post survey is administered twice: once at the beginning of a semester and again at the end of a semester.

Criteria for Success (Thresholds for Assessment Methods):

Direct Assessment

- *Summative Assessment:* 70% of students in Excelling or Practicing. Summative assessments capture the "endgame" so to speak and so we use this measure to kick-off identification of action items.
- *Formative Assessment:* 70% of students in Excelling, Practicing, or Apprentice. Formative assessments provide us with "mid-term" knowledge of attainment and provide a comparative measure by which to identify whether students are making progress in the program.

Indirect Assessment

Pre-Post Surveys (Pre-Post): Pre-post surveys are conducted for courses in which a direct assessment is scheduled. The pre-post survey is administered twice: once at the beginning of a semester and again at the end of a semester. The results of the pre-post survey are measured using a Student's T-Test to determine whether a statistically significant change in a student's perception of learning is observed. Any measurement of the T-Test that results in a p-value of 0.05 or lower is deemed as significant.

In regard to attainment levels, we expect the following: Student perceptions should exhibit a change in the aggregate mean towards "Extremely Well". Achieving a p-value of 0.05 is desirable but secondary.

Link to 'Tech Tomorrow' Strategic Plan:

2.A Technology Infused Programs

Results and Analysis:

Outcome 1: Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.

CSC 4610 Software Engineering I

Performance Criteria (Traits):

- Students can identify and define the computing requirements appropriate to its solution. (Bloom's taxonomy level: Analysis)
- Students can analyze and weigh trade-offs related to computing problems. (Bloom's taxonomy level: Analysis).

Overall Assessment Results

Values: <*number of students*> (<*percentage of total*>)

Trait 1. Students can identify and define the computing requirements appropriate to its solution.				
Assessment	Excelling	Practicing	Apprentice	Novice
Midterm: Analysis – Q1	**24 (73%)**	**6 (18%)**	**2 (6%)**	**1 (3%)**
Midterm: Analysis – Q2a-d	**1 (3%)**	**3 (12%)**	**11 (33%)**	**17 (52%)**
Project Charter Document	**6 (18%)**	**24 (73%)**	**3 (9%)**	**0**

Trait 2. Students can analyze and weigh trade-offs related to computing problems.				
Assessment	Excelling	Practicing	Apprentice	Novice

Midterm: Analysis – Q3a-d	**17 (52%)**	**8 (24%)**	**2 (6%)**	**6 (18%)**
Midterm: Short Answer – Q4	**21 (64%)**	**4 (12%)**	**2 (6%)**	**6 (18%)**

Traits

Students can identify and define the computing requirements appropriate to its solution. (Bloom's taxonomy level: Comprehension)

Exam question on stakeholders: ***Analysis - Question 1*** – this question assesses the students' ability to analyze the context of a project and to identify the relevant stakeholders for that project. The placement of a stakeholder in an interest-influence matrix exercises the students' knowledge of potential collaborators, an activity especially relevant for requirements analysis and later project management.

<u>Summary</u>: Most students did an excellent job of identifying the relevant stakeholders, with only a handful having difficulty distinguishing between the various quadrants.

Scale: Excelling (>=87.5%), Practicing (>=75%, <87.5%), Apprentice (>=62.5%, <75%), Novice (<62.5%)

Assessment	Excelling	Practicing	Apprentice	Novice
Analysis – Q1	**24 (73%)**	**6 (18%)**	**2 (6%)**	**1 (3%)**

Analysis – Q1 Text:

Consider the *Interest Influence* matrix shown below. The Chief Information Officer (CIO) for the ABC Company is a hands-on leader that generates and sponsors a large number of projects at ABC. The Chief Financial Officer (CFO), on the other hand often defers to the CIO unless a given project runs over budget. Software developers for a project are often assigned to projects at ABC; however, they all came to ABC due to the mission of the organization and have for the most part bought into the direction of the work. Likewise, end-users are often pre-ordering ABC's offerings. Finally, while ABC is a well-known organization, the local community (outside of those that are also end- users) will only follow ABC's progress through the local newspapers or media.

Identify the stakeholders described above, place them in the matrix, and then provide a description below of why each stakeholder belongs in the quadrant in which you've placed them.

Exam question on user stories: ***Analysis – Question 2a-d*** – these questions assess whether a

student can adequately understand and analyze a *user story* to determine if it is deficient. In addition, the student is asked to provide an alternate solution when the story is indeed deficient. In the context of identifying and defining requirements, user stories are the primary idiom used in software development team and is an expression of requirements with respect to target users, the desired function, and related rationale.

Summary: Students really struggle to create well-defined stories and identify the true deficiencies in poorly written user stories.

Scale: Excelling (>=85%), Practicing (>=70%, <85%), Apprentice (>=55%, <70%), Novice (<55%)

Assessment	Excelling	Practicing	Apprentice	Novice
Analysis – Q2a-d	**1 (3%)**	**3 (12%)**	**11 (33%)**	**17 (52%)**

Analysis – Q2a-d Text:
For each of the following user stories, explain why the story is deficient. Write one plausible alternate story, if one exists.

a. "As an online portal e-commerce customer, I want *a shopping cart*, so I can buy products."
b. "As a developer, I want the builds to automatically run when I check in code, so that regression errors are detected when they are introduced."
c. "As an executive, I want to generate reports that are easy to export so that we can interchange our reports with any of the other financial systems in production in the industry as well as future systems."
d. "As a salesperson, I want to view all of the company's financial information so that I can make better business decisions."

Project Charter Documents:

Students were placed on teams **to** work directly with corporate and community project sponsors to develop project charters. In these charters, teams were required to define users stories, size those stories using relative weighting, and to prioritize those user stories.

Summary: In the case of the "excelling" version, students used the prescribed user story format of "*as a <user>, I want <capability>, so that <rationale>",* identified story points and priorities (using MoSCoW), and provided solid narratives and design. In addition, these same teams also. The 'practicing" had all the components but were lacking in some aspects. The "apprentice" listed their stories but were missing some context, weightings, or priorities, or narrative was lacking in multiple parts.

Scale: Excelling (>=90%), Practicing (>=80%, <90%), Apprentice (>=70%, <80%), Novice (<70%)

Assessment	Excelling	Practicing	Apprentice	Novice
Project Charter Documents	**6 (18%)**	**24 (73%)**	**3 (9%)**	**0**

Students can analyze and weigh trade-offs related to computing problems. (Bloom's taxonomy level: Analysis)

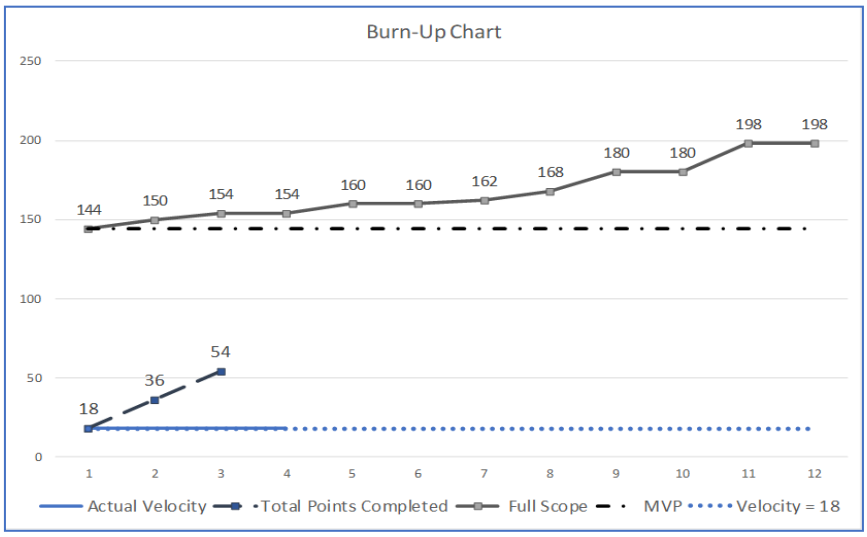
Burn-up chart question on exam: ***Analysis – Q3a-d*** – these questions assess students' ability to analyze the amount of effort needed for a project.

<u>Summary</u>: Most students were able to identify iteration lengths, but many students missed on the concept of an MVP and did not realize when they were able to complete a release.

Scale: Excelling (>=90%), Practicing (>=80%, <90%), Apprentice (>=70%, <80%), Novice (<70%)

Analysis – Q3a-d Text:

The following picture represents the data collected so far for a fictitious project. Use this chart to answer the questions listed below and on the next page. Assume the project team has just completed Iteration 3. The team has settled into a velocity of about 18 story points per iteration.



a. A manager has requested an estimate of when the team can expect to deliver the **<u>first</u>** MVP. When will that be? Show your work on the graph and your answer below.

b. How many iterations will it take to deliver the full scope of the project? Show your work on the graph and your answer below.
c. The customer has found that they are only able to support six (6) iterations of effort. How many story points can the team deliver in that period? Show your work on the graph and your answer below.
d. Given the scenario in c., what must happen in order to effectively deliver the "new" MVP WITHOUT adding new personnel?

Assessment	Excelling	Practicing	Apprentice	Novice
Analysis - Q3a-d	**17 (52%)**	**8 (24%)**	**2 (6%)**	**6 (18%)**

Business Rule Variation Question on exam: ***Short Answer - Question 4*** – this question exercises the students' ability to identify variations (i.e., alternatives) to potential features in a requested software system.

Summary: Majority of students understood the INVEST principle of developing good user stories. However, many students overanalyzed the problem, taking them down an incorrect path.

Scale: Excelling (>=90%), Practicing (>=80%, <90%), Apprentice (>=70%, <80%), Novice (<70%)

Short Answer – Q4 Text:
Consider the following user story for a travel or airline site: "**As a user, I want to receive a notification of a cancelled reservation so that I can have a confirmation of the cancellation**". Consider the pattern of the "Business Rule Variation" and the idea of "***notification of a cancelled reservation***". Write **three** (3) variations of this user story that considers different *forms* of notification. [**Hint**: The Business Rule Variation rule states that stories may seem fairly simple but that they perhaps can be broken into several stories.]

Assessment	Excelling	Practicing	Apprentice	Novice
Short Answer – Q4	**21 (64%)**	**4 (12%)**	**2 (6%)**	**6 (18%)**

Recommendation:

Each year, the number of excelling continues to increase. There are still a surprising number of students that are unable to identify issues with a story. They do fine as a Team (see the previous example), but individually, they still need to work on writing good user stories.

Optional (but highly suggested) Improvements

In previous years, it was suggested to workshop with them on story writing. However, given the size of this class this year (86), there just was not the time to work with each Team.

CSC 1300 Introduction to Problem Solving & Computer Programming

Performance Criteria (Traits)

- Students can identify and define the computing requirements that are appropriate to solve a problem. (*Bloom's taxonomy level: Comprehension*)
- Students can examine a given solution to a problem, identify errors, and fix the errors to solve the problem. (*Bloom's taxonomy level: Analyze / Evaluate*)
- Students can analyze and weigh trade-offs related to problems (*Blooms taxonomy level: Analyze/Compare)*

Overall Assessment Results

Values: <*number of students*> (<*percentage of total*>)

Trait 1. Students can identify and define the computing requirements appropriate to solve a problem.				
Assessment	Excelling	Practicing	Apprentice	Novice
Assessment	Excelling	Practicing	Apprentice	Novice
Q24: Midterm Exam (multiple choice)	89 (76.7%)	18 (15.5%)	3 (2.6%)	6 (5.2%)
Q20: Final Exam (multiple choice)	107 (78.7%)	0 (18.7%)	2 (2.7%)	2 (0%)
TOTAL	**196 (86.3%)**	**18 (7.9%)**	**5 (2.2%)**	**8 (3.5%)**

Trait 2. Students can examine a given solution to a problem, identify errors, and fix the errors to solve the problem.				
Assessment	Excelling	Practicing	Apprentice	Novice
Q10: Midterm Exam (multiple choice)	88 (38.8%)	0 (0%)	0 (0%)	28 (12.3%)

Q43: Final Exam (multiple choice)	108 (97.3%)	0 (0%)	0 (0%)	3 (2.7%)
TOTAL	**196 (86.3%)**	**0 (0%)**	**0 (0%)**	**31 (13.7%)**

Trait 3. Students can analyze and weigh trade-offs related to problem.				
Assessment	Excelling	Practicing	Apprentice	Novice
Q10: Final Exam (multiple choice)	82 (73.9%)	28 (25.2%)	1 (0.9%)	0 (0%)
Lab Assignment	131 (64%)	55 (27%)	11 (5%)	8 (4%)
TOTAL	**214 (67.5%)**	**83 (26.2%)**	**12 (3.8%)**	**8 (2.5%)**

Trait 1 Students can identify and define the computing requirements appropriate to solve a problem. (*Bloom's taxonomy level: Comprehension*)

Midterm Exam, Selected Question:

Q24: What type of loop is most suited for repeating a menu in a menu-based program?

a. for (apprentice)
b. iteration (novice)
c. while (practicing)
d. infinite (novice)
e. nested (novice)
f. do-while (excelling)

Final Exam, Selected Question:

Q20: Use the delete operator only on datathat was_____.

a. never used (novice)
b. created using the new operator (excelling)
c. not correctly initialized (novice)
d. referenced inappropriately (apprentice)

Assessment	Excelling	Practicing	Apprentice	Novice
Q24: Midterm Exam (multiple choice)	89 (76.7%)	18 (15.5%)	3 (2.6%)	6 (5.2%)

Q20: Final Exam (multiple choice)	107 (78.7%)	0 (18.7%)	2 (2.7%)	2 (0%)
TOTAL	**196 (86.3%)**	**18 (7.9%)**	**5 (2.2%)**	**8 (3.5%)**

Trait 2 Students can examine a given solution to a problem, identify errors, and fix the errors to solve the problem. (*Bloom's taxonomy level: Analyze / Evaluate*)

Midterm Exam, Selected Question:

Q10: Given the following program segment below, what would print to the screen?

```
float
y=8.0;
int z;
z =
y/x;
int
x=4;
cout << z << endl;
```

a. 2.0
b. 2
c. Z
d. Nothing

Final Exam, Selected Question

Q43: What is the error in the code segment below?

```
class Moon
{
private
double  earthWeight;
double moonWeight;
public
void setMoonWeight(double ew);
double getMoonWeight();
void setEarthWeight(double ew);
double getEarthWeight();
};
```

a. The words private and public should have colons after them.
b. The accessor function should be private, not public.
c. The class name should have a semi-colon after the name, but before the beginning curly brace.
d. There should not be a semi-colon after the class declaration.

Assessment	Excelling	Practicing	Apprentice	Novic e
Q10: Midterm Exam (multiple choice)	88 (38.8%)	0 (0%)	0 (0%)	28 (12.3%)
Q43: Final Exam (multiple choice)	108 (97.3%)	0 (0%)	0 (0%)	3 (2.7%)
TOTAL	**196 (86.3%)**	**0 (0%)**	**0 (0%)**	**31 (13.7%)**

Trait 3 Students can analyze, and weigh trade-offs related to problems (*Bloom's taxonomy level: Analyze/Compare)*

Final Exam, Selected Questions:
Q10: Out of the following choices, which is the best way to store different types of related information on dogs. For example, you want to store multiple dog names and also store those dog's ages. Choose the best answer.
two-dimensional array (practicing)
parallel arrays (excelling)
multiple string variables (apprentice)
multiple integer variables (novice) In-Class

Lab Assignment over Input Files:

Create a text file (txt extension) that contains your name on the first line and then 5 numbers (one per line) and name it mod6a.txt. Create a C++ program called mod6a.cpp that will open the text file and read the name and then print it to the screen then read each number and print them to the screen. Compile & test your code.

Excelling: students implemented a while loop to read the numbers from the file and print to the screen. *Practicing*: students successfully read the text and numbers from the file and printed to the screen. *Apprentice*: student's program successfully read from the file, but didn't have the correct output. *Novice*: student's program didn't work

Assessment	Excelling	Practicing	Apprentice	Novic e
Q10: Final Exam (multiple choice)	82 (73.9%)	28 (25.2%)	1 (0.9%)	0 (0%)
Lab Assignment	131 (64%)	55 (27%)	11 (5%)	8 (4%)
TOTAL	**214 (67.5%)**	**83 (26.2%)**	**12 (3.8%)**	**8 (2.5%)**

Use of Results to Improve Outcomes:

- Each year, the number of excelling continues to increase. There are still a surprising number of students that are unable to identify issues with a story. They do fine as a Team (see the previous example), but individually, they still need to work on writing good user stories.
- In previous years, it was suggested to workshop with them on story writing. However, given the size of this class this year (86), there just was not the time to work with each Team.

SLO 2. Design, implement, and evaluate a computing-based solution

Define Outcome:

Students can design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.

This outcome is as defined by the Accreditation Board for Engineering and Technology (ABET) Computer Science Accreditation Commission (CAC).

Assessment Methods:

***Direct Assessment*.** Several courses are assessed every semester. These assessments directly examine student work based on traits (performance criteria) created specifically for each student outcome. The measurement rubric used for direct assessment uses a four-level rubric: Excelling, Practicing, Apprentice, and Novice (E/P/A/N). These criteria are performed on a per student basis. An example is provided below.

Performance Criteria (Traits):

- The student can design a computing-based solution given a set of requirements
- The student can implement a computing-based solution given a set of requirements
- The student can evaluate/test a computing-based solution given a set of requirements

We assessed these criteria using a significant design and implementation project. The assignment description is attached.

Faculty Course Reflections (all courses): Each faculty member is asked to complete a course reflection at the end of each semester. The reflection allows a faculty member to summarize the results of the course, map the appropriate objectives and outcomes to the course and identify successes from the semesters, opportunities for improvement, puzzles (i.e., questions to be resolved), suggested changes, issues with facilities, technology issues, and other reflections.

Pre-Post Surveys (Pre-Post): Pre-post surveys are conducted for courses in which a direct assessment is scheduled. The pre-post survey is administered twice: once at the beginning of a semester and again at the end of a semester.

Criteria for Success (Thresholds for Assessment Methods):

Direct Assessment

- *Summative Assessment:* 70% of students in Excelling or Practicing. Summative assessments capture the "endgame" so to speak and so we use this measure to kick-off identification of action items.
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comparative measure by which to identify whether students are making progress in the program.

Indirect Assessment

Pre-Post Surveys (Pre-Post): Pre-post surveys are conducted for courses in which a direct assessment is scheduled. The pre-post survey is administered twice: once at the beginning of a semester and again at the end of a semester. The results of the pre-post survey are measured using a Student's T-Test to determine whether a statistically significant change in a student's perception of learning is observed. Any measurement of the T-Test that results in a p-value of 0.05 or lower is deemed as significant.

In regard to attainment levels, we expect the following: Student perceptions should exhibit a change in the aggregate mean towards "Extremely Well". Achieving a p-value of 0.05 is desirable but secondary.

Link to 'Tech Tomorrow' Strategic Plan:

2.A Technology Infused Programs

Results and Analysis:

Outcome 2: Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.

CSC 2310 Object-Oriented Programming and Design

Performance Criteria (Traits):

- Students can apply computer science theory and software development fundamentals to ***design*** computing-based solutions. (*Bloom's taxonomy level: Apply*)
- Students can apply computer science theory and software development fundamentals to ***implement*** computing-based solutions. (*Bloom's taxonomy level: Apply*)

Criterion 1 – Students can apply computer science theory and software development fundamentals to ***design*** computing-based solutions.

Students were given a description of a software development project as provided by the client and eventual end user. Students were then asked to produce the following artifacts:

Use Case Diagram – Adapting user stories and client requests, and inferring necessary features based on the project description.
Class Diagram – Depicting classes, attributes, and class relations for a potential implementation given the features expressed in the use case diagram.

The students' diagrams were evaluated according to three standards: correctness, internal consistency, and external consistency.

Correctness refers to the student's understanding and proper use of diagram notation.

Internal consistency refers to how accurately the diagrams reflect the student's personal interpretation of the project, and whether the diagrams depict a cohesive product (it is possible for students to misunderstand the project requirements but still produce an otherwise excellent and coherent solution to the project as they understood it).

External consistency refers to how accurately the diagrams reflect the project requirements as given by the client/user and in-class discussions.

A student's performance in these three categories determined their achievement for the assignment, given in five levels: excelling, practicing, apprentice, novice, and insufficient. These levels can be considered approximations of a traditional five-category grade scale.

Achievement levels for the use case diagram are shown in the following table:

Excelling	79%
Practicing	12%
Apprentice	2%
Novice	2%
Insufficient	5%

Achievement levels for the class diagram are shown in the following table:

Excelling	57%
Practicing	23%
Apprentice	7%
Novice	6%
Insufficient	7%

Criterion 2 – Students can apply computer science theory and software development fundamentals to ***implement*** computing-based solutions.

Students were assigned two development iterations, each lasting two weeks. These iterations are labelled Iteration 2 and Iteration 3 (Iterations 0 & 1 were reserved for design, rather than implementation). Over the course of these four weeks, the students were asked to implement the features depicted in the design stage and produce working software solutions.

Iteration 2 – Produce a version of the project using a terminal-based menu (non-GUI) built over the

underlying classes necessary for the program to read input data and generate appropriate objects. Users should be able to access and manipulate basic features of the project.

Iteration 3 – Using the framework crated in Iteration 2, produce a version of the project compatible with the given GUI, so that the user can more quickly and conveniently access the project's features. The underlying classes must be made to accommodate existing GUI code so that the two components can be merged.

For both iterations, student progress was evaluated as a percentage of the necessary features (correctly working) produced by the student. Achievement for these assignments is expressed in the same five levels as Criterion 1: excelling, practicing, apprentice, novice, and insufficient.

Student achievement levels for Iteration 2 are shown in the following table.

Excelling	75%
Practicing	8%
Apprentice	5%
Novice	6%
Insufficient	6%

Student achievement levels for Iteration 3 are shown in the following table:

Excelling	65%
Practicing	9%
Apprentice	8%
Novice	10%
Insufficient	8%

Observations

Students performed very highly in the first half of the ***design*** stage, with 79% receiving Excelling status and only 9% (collectively) receiving lower than Practicing status. This indicates that the students were able to easily identify the requirements of the project and depict them at a high level. This is immediately followed by the second half of the ***design*** stage (in which the students were to create class diagrams), for which the students scored the lowest of any of the iterations, with only 57% achieving Excelling status.

For the ***implement*** stage, student performance remains consistently high, with 75% and 65% at Excelling status for Iterations 2 and 3 respectively. Combined with the previous observation, this may indicate that students are proficient in both understanding requirements and implementing

actual code, but either struggle with or do not value abstract depictions of code.

Recommendations
It may be beneficial to place a greater emphasis on abstract depictions of code (e.g. class diagrams, sequence diagrams, etc.) and ensure that students understand and can articulate the value of these tools for software development.

CSC 3300 Database Management Systems

Performance Criteria (Traits):

1. Students can identify and design a computing-based solution to meet a given set of database-related computing requirements. *(Bloom's Taxonomy: Comprehension)*
2. Students can implement a computing-based solution to meet a given set of database-related computing requirements. *(Bloom's Taxonomy: Application)*
3. Students can evaluate the selection of a computing-based solution to meet a given set of database-related computing requirements. *(Bloom's Taxonomy: Evaluation / Analyze)*

Assessment Results

Trait 1. Students can identify and design a computing-based solution to meet a given set of database related computing requirements				
Assessment	Excelling	Practicing	Apprentice	Novice
Exam 1 – Q 5	46 (77.97%)	13 (22.03%)	0(0%)	0 (0%)
Exam 2 – Q 13	46(82.76%)	4 (6.9%)	2 (3.45%)	4 (6.9%)
Exam 2 – Q 18	54 (93.1%)	3 (5.17%)	0 (0%)	1(1.72%)

Trait 2. Students can implement a computing-based solution to meet a given set of database related computing requirements				
Assessment	Excelling	Practicing	Apprentice	Novice
Lab 3	49 (80.33%)	3 (4.92%)	0 (0%)	9 (14.76%)
Lab 5	47 (77.05%)	4 (6.56%)	3 (4.92%)	8 (11.48%)

Trait 3. Students can evaluate the selection of a computing-based solution to meet a given set of database related computing requirements

Assessment	Excelling	Practicing	Apprentice	Novice
Exam 1 – Q 21	59 (100%)	0 (0%)	0 (0%)	0 (0%)
Exam 1 – Q 22	31 (52.54%)	22 (37.29%)	0 (0%)	6 (10.17%)
Exam 2 - Q 2	30 (51.72%)	9 (15.52%)	3 (5.71%)	16(27.59%)
Exam 2 – Q 6	39 (67.24%)	5 (8.6%)	5 (8.6%)	9 (15.52%)

Scale: Excelling (≥90%), Practicing (≥80%, <90%), Apprentice (≥70%, <80%), Novice (<70%)

Trait 1: Students can identify and design a computing-based solution to meet a given set of database-related computing requirements. *(Bloom's Taxonomy: Comprehension)*

Exam 1– selected questions:

Exam questions to identify and design database concepts

Assessment	Excelling	Practicing	Apprentice	Novice
Exam 1– Q 5	46 (77.97%)	13 (22.03%)	0(0%)	0 (0%)

Text of selected questions from midterm exam

Q 5: Which of the following is true about the statement below?

SELECT * FROM STUDENT;

Question 5 options:

a. It creates a new schema in the database.
b. It inserts data into the database.
c. Its syntax is part of the Data Definition Language of SQL.
d. This statement deletes rows from the database.
e. Its syntax is part of the Data Manipulation Language of SQL. Exam 2– selected questions:

Exam questions to identify and design database concepts

Assessment	Excelling	Practicing	Apprentice	Novice
Exam 2– Q 13	46(82.76%)	4 (6.9%)	2 (3.45%)	4 (6.9%)
Exam 2– Q 18	54 (93.1%)	3 (5.17%)	0 (0%)	1(1.72%)

Text of selected questions from final exam

Q 13: Given the Student Data above and the following SQL query:

STUDENTS table

STUDENT_ID LAST_NAME FIRST_NAME

001 Last First

002 Doe John

003 Doe Jane

004 Last First

;

COURSES table

STUDENT_ID COURSE_NUMBER SECTION

001 CSC2100 001

003 BIO3030 003

Query:

SELECT student id from students where last name =

'Doe' UNION

SELECT student id from courses

Which of the following is the appropriate result set?

Q 18: Given the student data in the relations below, what would finish the query using an SQL set operation. The query should show all students that have taken at least one course, but that have not taken section 003 of that course.

STUDENTS table

STUDENT_ID LAST_NAME FIRST_NAME

01 Last First

02 Doe John

03 Doe Jane

04 Last First

CLASSES table

STUDENT_ID	COURSE_NUMBER	SECTION
001	CSC2100	001
003	BIO3030	003

SELECT first_name, last_name, course_number,

section FROM students NATURAL JOIN classes

BLANK

SELECT first_name, last_name, course_number, section

FROM students NATURAL JOIN classes

WHERE section = '003'

Trait 2: Students can implement a computing-based solution to meet a given set of database-related computing requirements. (Bloom's Taxonomy: Application)

Lab 3

- Lab to implement and apply database concepts

Assessment	Excelling	Practicing	Apprentice	Novice
Lab 3	49 (80.33%)	3 (4.92%)	0 (0%)	9 (14.76%)

Lab 3 is an exercise in database security. It has practice problems in which you will add constraints to ensure a database's integrity, and practice backing up your database. contains some question that you will have to answer that will require some investigation (also known as googling).

Do You Have Integrity?

In a DBMS, protecting the integrity of data against unauthorized changes is crucial. We also want to make sure that the data in our tables accurately reflect the information in the real world. Therefore, for this assignment, you will implement some integrity controls on a database.

There are three main objectives to integrity control in database management systems: control who can edit data, control what data is sent, and control the data at rest. We can control modification to data by creating user accounts and assigning each role or users account with certain privileges that can restrict what can be modified by whom and also in what way. Additionally, we can

monitor all modifications made by users and restrict their privileges if they are not acting in the interest of the system.

Integrity can also be enforced while creating the tables for the database. Options such as data types, primary and foreign keys, not null, auto increment, etc. allow the DBMS to reject data that does not adhere to its intended structure. The difficulty here is that the administrator will need to understand the security policy and the structure of the DBMS and map the security policies as database integrity constraints to the database schema carefully. For instance, every resident of the United States has a Social Security Number (SSN) and that is why it can be used to uniquely identify an individual. Therefore, an SSN column should not allow null values to be written.

Lastly, Regular backups offer extra protection. Databases can be corrupted from attacks or system errors. If the system admin has been making regularly scheduled backups, the admin should be a be able to restore the database to a previously consistent state.

In this exercise, we want to create some tables based on our data definition in security policy in an intelligent way so that the database will never allow invalid data to reach an inconsistent state.

Creating the database

Before you can begin creating tables, you must create a new database. You will do so from the command line. Run the psql PostgreSQL command line client like so (note: do not enter the '$' which is the Linux prompt):

$ psql -h localhost -U postgres

At the "postgres=#" prompt, enter the command as it appears below:

CREATE DATABASE students;

Then, at the "postgres=#", enter the command "\q" to exit the PostgreSQL command line client. Next, run the PostgreSQL command line client again, but connect to the newly create students database, like so:

$ psql -h localhost -U postgres students

Once you see the "postgres=#" prompt, you can enter commands to add tables to your database. Next, Create two tables called *student* and *takes* based on the following definition.

Table Name	Column Name	Type Info	Constraints	Notes
student	tno	fixed length string	required, uniquely identifies a student, must be "Txxxxxxxx" where x is a digit.	
	social	string	unique, not null, exactly 9 characters, each of which must be a digit.	
	fname	string	required, up to 20 characters	
	lname	string	required, up to 20 characters	
	credits	real number	required, default is 0, Up to 3 digits, with no digits after the decimal place.	
takes	tno	string	required, uniquely identifies a row when combined with course, only exists if there is a corresponding student in the student table, deleting a student should also delete the takes rows that have the same tnum	A row in this table is uniquely identified by the tnum, course, semester, and year together
	course	string	required up to 12 characters	
	semester	string	required, must be one of FALL, SPRING, or SUMMER	
	tyear	string	required, must be an number with exactly 4 digits	
	grade	single character	not required, if given, must be 'A', 'B', 'C', 'D' or 'F'.	

Required fields should use the NOT NULL constraint, and you should define default values using the DEFAULT keyword. Additionally, use a CHECK constraint and the PostgreSQL SIMILAR TO operator to validate the tno and the social. Documentation on SIMILAR TO can be found here. Use a CHECK constraints and the IN operator to validate the grade. Also, use a CHECK constraint to constrain the semester. Give the social the UNIQUE flag to ensure two students can never have the same social security number. Finally, add the ON DELETE CASCADE syntax to your foreign key in takes for the cascading delete. For questions about syntax, see the PostgreSQL documentation page for CREATE TABLE here. You should know how to do the rest as you practiced creating tables with some constraints on the previous assignment.

Take a screenshot of the statements that you use to create the tables. Make sure you show that statements being executed. Name the screenshots _student.png and _takes.png for each of the respective tables.

This easy and straightforward way of defining database schema with integrity controls in place can aid in protecting data from unauthorized changes. Restrictions placed in database schema ensure that it will never allow data to be added that violates its integrity property. The tables you just created will always ensure:

- That both tables have a primary key
- That data types follow necessary formats
- Students with duplicate socials cannot be added in *student* table.
- No student's course data can be added in *takes* table, who does not exist in *students* table.
- Critical data like the social security number and names cannot be left blank.
- If credits is left blank, it will start off with 0
- Credits can be from 0 to 999
- *takes* cannot retain student data for students removed from *takes* table.
- A student cannot take a class in that same semester more than once.

Backing up the database

Periodical backups are very useful in case of unintentional errors or intentional attacks occur. Restoring backups, brings data back to correct/valid state.

Exit psql (use the \q command). Open the command terminal and type the following (excluding the $ prompt), and when prompted for a password, enter the password for the postgres account (which is "coursework").

$ pg_dump -h localhost -U postgres -f students_bak.sql students;

This command dumps the given database (students) into the file name that we supplied (students_bak.sql). If the command succeeded, then the last five lines of the file should say "PostgreSQL database dump complete". Execute the following Linux command, which will print the last 5 lines of the students_bak.sql file, to see this result.

$ tail -n 5 students_bak.sql

Take a screenshot of this command successfully completing and save it to the file backup.png. You should be able to fit all the output from the above commands (both pg_dump and tail) in a single screenshot.

Switch back into the psql command line tool so that you can make a few changes to the database. Now, insert a row into the student table with the following command (at the "postgres=#" prompt):

INSERT INTO student(tno,social,fname,lname,credits) VALUES ('T00006879', '407225463', 'Mary', 'May',63);

Then use the following command to output all rows in the table:

SELECT * FROM student;

Next add a table to store with the command:

CREATE TABLE id(ID int);

And then show all the tables in the database with:

\dt

Take a screenshot of the output showing both the row that was added and the table that was added and name it "modified.png".

Once you have a backup you can restore it. However, you first must delete the old database and re-create it. So, run the psql command, but do not connect to the students database, like so:

$ psql -h localhost -U postgres

Next, drop the students database. You should know how to do this from class. Next re-create an empty students database the by entering the command that you used at the beginning of this assignment. Then exit psql (with \q).

Finally, restore the database with the following command.

$ psql -h localhost -U postgres students < students_bak.sql

This command will do the opposite of the previous one and restore the backup students_bak.sql to the database students.

Take a screenshot of this command successfully completing and save it to the file restore.png.

Let us look at the database and see if everything we added was dropped. Run psql and connect to the students database. Run the following command again to see if the row is still there:

SELECT * FROM student;

Is the row there? It shouldn't be, because the SQL script should have restored the database to the state it was in before the row was created.

Lastly, let's check the tables in store to see if it is still there. Run the following command again:

\dt

Is the table there? It shouldn't be, because, once again, the SQL script should have restored the database to the state it was in before the table was created.

Take a screenshot of the output showing the table and row is gone and name it "gone.png".

Lab 5

- Lab to implement and apply database concepts

Assessment	Excelling	Practicing	Apprentice	Novice
Lab 5	47 (77.05%)	4 (6.56%)	3 (4.92%)	8 (11.48%)

For this assignment, you will be writing a small Ruby program that will be communicating with the MySQL database.

I understand that you have probably had no experience with Ruby. However, this program is simple, and you should be able to implement it with a little bit of research. Make sure that you use good programming practices. This means you must handle exceptions and close any connections as necessary.

For the problems below that require you to create a table, put **ENGINE=INNODB** at the end of your **CREATE TABLE** statements so that your foreign keys work. Follow the process below to write your program:

Before you begin this exercise, install the Ruby MySQL2 library into your VM with the following command in a terminal:
$ sudo apt-get install ruby-mysql2

Next, create a database using Ruby. The database does not yet exist, so do not include a database parameter in your call to Mysql2::Client.new(). Once connected, send the "CREATE DATABASE TTU" SQL command to the MySQL server. After creating the database, send the query "USE TTU" to the MySQL server to select the newly created database.

Then use the table below to create a table called students with the proper attribute types for each description.

Column Name	Type
TNumber	String of exactly 8 characters that starts with a t.
firstname	String of up to 10 characters
lastname	String of up to 10 characters
dateofbirth	date
credits	A numeric value with up to 3 digits before the decimal.

The tnumber should be the table's primary key and first and last name are required.

Make your program so that you can run it multiple times. To do so, add a SQL command to the beginning of your program, after you connect, that drops the database: "DROP DATABASE IF EXISTS TTU".

After creating the table, insert the following rows into the table:

TNumber	FirstName	LastName	DateOfBirth	Credits
T1234567	Nathan	Summers	3/12/1990	45
T5567645	Johnny	Blaze	8/15/1972	36
T7891011	Jean	Summers	9/1/1963	120
T7654321	Peter	Parker	5/23/1962	51
T6677889	Wade	Wilson	2/11/1990	72

To show that your inserts work, query for all the rows in the table and print them in nicely aligned tables.

Next, add a new table called grades with the following columns:

Column Name	Type
TNumber	String of exactly 8 characters
CourseID	String of exactly 7 characters
Semester	String of up to 6 characters that must be ‘Winter’, ’Summer’, ‘Fall’, or ‘Spring’
Year	Numeric value with four digits
Grade	String of 1 character.

Make sure tnumber a Foreign Key that references Student. Now, insert the data from the table below:

TNumber	CourseID	Semester	Year	Grade
T1234567	CSC3040	Fall	2013	B
T7891011	MAT1910	Fall	2011	A
T5567645	CSC1300	Spring	2013	C
T6677889	MAT1910	Spring	2012	A
T7891011	CSC1300	Spring	2012	F

Query your results from this table and print them as a series of well aligned columns with headers.

Turn-in:

You will create a submission directory for this assignment will be named with your name. You will name the program lab5.rb. At the top of you program you will include a line showing how to run your program. For example, you should have something like the following:

 # run: ruby lab5.rb

Zip your program up and submit it on ilearn.

Trait 3: Students can evaluate the selection of a computing-based solution to meet a given set of database-related computing requirements. (Bloom's Taxonomy: Evaluation / Analyze)

Exam 1– selected questions:

- Exam questions to evaluate the selection of correct database concepts

Assessment	Excelling	Practicing	Apprentice	Novice
Exam 1– Q 21	59 (100%)	0 (0%)	0 (0%)	0 (0%)
Exam 1 – Q 22	31 (52.54%)	22 (37.29%)	0 (0%)	6 (10.17%)

Text of selected questions from midterm exam

Q 21: Given the course database above, which of the following queries in SQL represents the following English query: What are the last names of all the students?

STUDENTS (STUDENT_ID, LAST_NAME, FIRST_NAME)

COURSES (COURSE_NUMBER, COURSE_NAME) CLASSES

(STUDENT_ID, COURSE_NUMBER, SECTION)

Question 21 options:

a. SELECT * FROM students
b. SELECT student, class WHERE classes.student_id = (student_id);
c. SELECT last_name FROMstudents;
d. SELECT students FROMlast_name;
e. SELECT last_name FROM students WHERE {last_name}

Q 22: Consider the Library Relation in the Figure below. Give a SQL query that shows the title, author name, year.

categories (category_id, description)

books (book_id, category_id, title, author_id,
year)

authors (author_id, name, date_of_birth)

clients (client_id, client_name)

checkouts (book_id, client_id)

Exam 2 – selected questions:

- Exam questions to evaluate the selection of correct database concepts

Assessment	Excelling	Practicing	Apprentice	Novice
Exam 2 – Q 2	30 (51.72%)	9 (15.52%)	3 (5.71%)	16(27.59%)
Exam 2 – Q 6	39 (67.24%)	5 (8.6%)	5 (8.6%)	9 (15.52%)

Text of selected questions from midterm exam

Q 2: Consider the following query carefully. Which of the following statements is true about the query?

```
SELECT job_code, avg_salary
  FROM (SELECT emp_no, job_code, AVG(salary) AS avg_salary
        FROM employee GROUP BY job_code) WHERE avg_salary
        > 42000;
```

Question 4 options:

a. This is not a valid query and, in order to make the query correct, both emp_no and job_code must be in the GROUP BY clause.
b. This is not a valid query because you cannot put SELECT statements inside a FROM clause.
c. This is not a valid query because the WHERE clause is not allowed.
d. This is a valid query.

Q 6: Given the following relations: Which of the following queries results in the following table?

Recommendation:

We need to focus more on encouraging students to write the query by hand together with hands-on MySQL experience. Students did well in assignments, as they had time to fix the needed SQL query but struggled to write the query using pen and paper. More practice level assignments could help with this.

Use of Results to Improve Outcomes:

- It may be beneficial to place a greater emphasis on abstract depictions of code (e.g. class diagrams, sequence diagrams, etc.) and ensure that students understand and can articulate the value of these tools for software development.

SLO 3 Communicate effectively in a variety of professional contexts.

Define Outcome:
Students can communicate effectively in a variety of professional contexts.

This outcome is as defined by the Accreditation Board for Engineering and Technology (ABET) Computer Science Accreditation Commission (CAC).

Assessment Methods:
Direct Assessment. Several courses are assessed every semester. These assessments directly examine student work based on traits (performance criteria) created specifically for each student outcome. The measurement rubric used for direct assessment uses a four-level rubric: Excelling, Practicing, Apprentice, and Novice (E/P/A/N). These criteria are performed on a per student basis. An example is provided below.
Performance Criteria (Traits):

- Students can communicate project status. (Bloom's taxonomy level: Synthesis)
- Students can describe an overview of a project. (Bloom's taxonomy level: Comprehension)

Faculty Course Reflections (all courses): Each faculty member is asked to complete a course reflection at the end of each semester. The reflection allows a faculty member to summarize the results of the course, map the appropriate objectives and outcomes to the course and identify successes from the semesters, opportunities for improvement, puzzles (i.e., questions to be resolved), suggested changes, issues with facilities, technology issues, and other reflections.

Pre-Post Surveys (Pre-Post): Pre-post surveys are conducted for courses in which a direct assessment is scheduled. The pre-post survey is administered twice: once at the beginning of a semester and again at the end of a semester.

Criteria for Success (Thresholds for Assessment Methods):
Direct Assessment

- *Summative Assessment:* 70% of students in Excelling or Practicing. Summative assessments capture the "endgame" so to speak and so we use this measure to kick-off identification of action items.
- *Formative Assessment:* 70% of students in Excelling, Practicing, or Apprentice. Formative assessments provide us with "mid-term" knowledge of attainment and provide a comparative measure by which to identify whether students are making progress in the program.

Indirect Assessment

Pre-Post Surveys (Pre-Post): Pre-post surveys are conducted for courses in which a direct assessment is scheduled. The pre-post survey is administered twice: once at the beginning of a semester and again at the end of a semester. The results of the pre-post survey is measured using a Student's T-Test to determine whether a statistically significant change in a student's perception of learning is observed. Any measurement of the T-Test that results in a p-value of 0.05 or lower is deemed as significant.

In regard to attainment levels, we expect the following: Student perceptions should exhibit a change in the aggregate mean towards "Extremely Well". Achieving a p-value of 0.05 is desirable but secondary.

Link to 'Tech Tomorrow' Strategic Plan:

1.D High Impact Practices

Results and Analysis:

Outcome 3: Students can communicate effectively in a variety of professional contexts.

Overall Assessment Results:

Values: <*number of students*> (<*percentage of total*>)

Outcome 3 Trait 1. Students can develop and present training material on domain knowledge areas of computer science.				
	Excelling	**Practicing**	**Apprentice**	**Novice**
Group Tutorial Video	46 (43.8%)	43 (41%)	15 (14.3%)	1 (1%)
Draft Tutorial Advertisement Flyer	84 (80%)	13 (12.4%)	10 (9.5%)	1 (1%)
Final Tutorial Advertisement Flyer	87 (82.9%)	17 (16.2%)	0 (0%)	1 (1%)
TOTAL	**217 (72.3%)**	**73 (24.3%)**	**25 (8.3%)**	**3 (1%)**

Outcome 3 Trait 2. Students can organize, describe, and write procedural directions.				
	Excelling (>=90%)	**Practicing (>=80%)**	**Apprentice (>=60%)**	**Novice (<60%)**
Group Tutorial Project Documentation	69 (65.7%)	33 (31.4%)	2 (1.9%)	1 (1%)
Documenting the Steps Assignment	101 (96.2%)	0 (0%)	0 (0%)	4 (3.8%)

TOTAL	**170 (85%)**	**33 (16.5%)**	**2 (1%)**	**5 (2.5%)**

Outcome 3 Trait 3. **Students can communicate effectively and professionally orally and via written communication**				
	Excelling (>=90%)	**Practicing (>=80%)**	**Apprentice (>=60%)**	**Novice (<60%)**
Purple Career Readiness Certification	99 (94.3%)	0 (0%)	0 (0%)	6 (5.7%)
Interview Assignment	88 (83.8%)	9 (8.6%)	4 (3.8%)	4 (3.8%)
Industry Professional Ethics Interview	95 (90.5%)	7 (6.7%)	2 (1.9%)	2 (1.9%)
Total	**282 (94%)**	**16 (5.3%)**	**6 (2%)**	**12 (4%)**

Outcome 3, Trait 1: Students can develop and present material on domain knowledge areas of computer science.

Group Tutorial Video

Scale

Excelling (≥90%), Practicing (≥80%, <90%), Apprentice (≥60%, <80%), Novice (<60%)

Assignment Description

Each group will create a video tutorial on a topic of their choice. The topic of the video must be relevant to Computer Science or Software Engineering. A group's video could be the group members showing or demonstrating something "unplugged" (not on a computer) such as how to build your own computer or how to play "Potato Pirates". Another option is to demonstrate how to install, use, create, or play something on your computer – which would be a screen casted video. The third option would be to have a combination of screen casting and unplugged demonstration like a tutorial on how to 3D print. Videos have a minimum time limit of 7 minutes and a maximum time limit of 10 minutes. After the video submission deadline, the videos will be shared with the class. Each student must review each group's presentation, including their own. Before I play each video, I will state the title and the intended audience that was provided in the memo.

Draft Tutorial Advertisement Flyer

Scale

Excelling (≥90%), Practicing (≥80%, <90%), Apprentice (≥60%, <80%), Novice (<60%)

Assignment Description

Your group will create a draft of your flyer to advertise your group's tutorial video to make people

interested in watching the tutorial. Pretend the flyer will be hung up in an appropriate place where your intended audience will see it once the tutorial is complete. The flyer should be eye-catching, contain highlights that would encourage your intended audience to watch your tutorial, and have a QR code that will link to the tutorial on YouTube. Your flyer should answer "What will I get out of watching this tutorial?"

Final Tutorial Advertisement Flyer

Scale

Excelling (≥90%), Practicing (≥80%, <90%), Apprentice (≥60%, <80%), Novice (<60%)

Assignment Description

Your group will create the final version of your flyer to advertise your group's tutorial video to make people interested in watching the tutorial. Pretend the flyer will be hung up in an appropriate place where your intended audience will see it once the tutorial is complete. The flyer should be eye-catching, contain highlights that would encourage your intended audience to watch your tutorial, and have a QR code that will link to the tutorial on YouTube. Your flyer should answer "What will I get out of watching this tutorial?"

Outcome 3 Trait 1. Students can develop and present training material on domain knowledge areas of computer science.				
	Excelling	**Practicing**	**Apprentice**	**Novice**
Group Tutorial Video	46 (43.8%)	43 (41%)	15 (14.3%)	1 (1%)
Draft Tutorial Advertisement Flyer	84 (80%)	13 (12.4%)	10 (9.5%)	1 (1%)
Final Tutorial Advertisement Flyer	87 (82.9%)	17 (16.2%)	0 (0%)	1 (1%)
TOTAL	**217 (72.3%)**	**73 (24.3%)**	**25 (8.3%)**	**3 (1%)**

Outcome 3, Trait 2: Students can organize and write procedural directions.

Group Tutorial Project Documentation

Assignment Overview: Create a comprehensive written document for your video tutorial. This document should serve as a detailed step-by-step guide. It must be precise, clear, and thorough enough to stand alone as a guide for users who may not have access to the video.

Tasks: Write the technical documentation following the structure detailed below. Each group member should contribute equally to this process and each group member must review the documentation for accuracy, clarity, and completeness. Every member must sign off on the document before submission. You will turn this paper in by hand.

Make sure the pages of your documentation are numbered and stapled in order. You will turn this

document on paper (not through ilearn).

Title Page: should contain the tutorial title, group members' names, and the course name & number.
Introduction: should contain an overview of the tutorial topic, and the target audience
Prerequisites: your documentation needs to contain the prerequisites for understanding the tutorial included required prior knowledge or skills and necessary software or hardware
Tutorial Content: the tutorial content in your documentation should be structured in sections/subsections and should contain step-by-step instructions mirroring the video tutorial. Include screenshots or diagrams where applicable. Highlight key concepts and procedures.
Troubleshooting Section: your documentation should contain a troubleshooting section where you identify potential issues and their solutions and offer tips for effective implementation (if applicable).
How to Learn More Section: include a "how to learn more" section where you identify other learning opportunities to compliment your tutorial.
References: cite all sources used in preparing the tutorial, advertising materials (flyer), and this documentation.
Member Sign-Off Section: make sure there is space for each group member to sign and date as confirmation of their review and agreement with the final document.

Documenting the Steps In-Class Assignment

Assignment Description

You were given a topic on a card. Look up a "how-to" website related to your topic that contains step-by- step instructions. Using this website, answer the questions in the "Documenting the Steps Assignment" document. Below are the questions in the document:
Were all the supplies needed listed?
Were images used?
Was the target audience addressed?
Are there references, if applicable?
Was there too much information? Was anything missing?
Were the steps easy to follow?
What would you do differently?
What is your level of knowledge after reading the instructions? Can you do it?
What is your overall reflection on the effectiveness of the documented procedure?
Do you have any additional thoughts related to this assignment?

Outcome 3 Trait 2. Students can organize, describe, and write procedural directions.				
	Excelling (>=90%)	**Practicing (>=80%)**	**Apprentice (>=60%)**	**Novice (<60%)**
Group Tutorial Project Documentation	69 (65.7%)	33 (31.4%)	2 (1.9%)	1 (1%)

Documenting the Steps Assignment	101 (96.2%)	0 (0%)	0 (0%)	4 (3.8%)
TOTAL	**170 (85%)**	**33 (16.5%)**	**2 (1%)**	**5 (2.5%)**

Outcome 3, Trait 3: Students can communicate effectively and professionally orally and via written communication

Purple Career Readiness Certification

The Purple Career Readiness certificate program (https://www.tntech.edu/career/students/career- ready.php#purple-career-readiness) offered through Tennessee Tech's Center for Career Development is focused on ten competencies for career readiness for junior and senior students. These competencies include career/self-development through strength and weakness identification, professional communication, critical thinking, equity & inclusion, financial literacy, leadership, lifelong wellbeing, professionalism, teamwork, and leveraging technologies to enhance efficiencies. Students in CSC 3040 completed the requirements of the program throughout the semester and submitted their certificate for a completion grade.

Interview Assignment

Go to https://www.tntech.edu/career/students/interviewstream.php and review the instructions for InterviewPrep (used to be called InterviewStream). Click the "Interviewing.com" button and create an account/login. It is recommended to complete this assignment using a laptop and a webcam. The interview process will take at least 30 minutes, plan accordingly. You will need to complete this interview in a relatively quiet area. You will have one chance to complete this interview. You cannot stop in the middle or come back to complete it. It is strongly recommended that you complete some example interviews to become familiar with the system. Here is a link to the pdf from Center for Career Development on InterviewStream: https://www.tntech.edu/career/pdf/instructions/interviewstream-instructions.pdf. There will be 10 questions. You will have 10 seconds prep time for each question, 3 minutes to answer each question, and will be allowed 1 retry per question. Come to the interview prepared. When you have completed your interview, you must take the self-assessment in the system. Then, download the completed assessment and upload it to the assignment. In the submission box, describe something you learned about yourself in the interview. Were you surprised by something? Is there something you would like to work on?

The grading criteria included in the rubric include submitting self-assessment in ilearn as a pdf, wrote response on what you learned, and then the following related to the actual interview: personal attributes, general attitude, professional appearance, well-constructed, confident responses in 1-3 minutes, poised answering difficult or stressful questions, and self-knowledge. Below are the ten questions that were asked of the students:

1. If we were to meet in an elevator and we had only 1 minute to talk, what would you tell me about yourself and why I should hire you? (Elevator Pitch)
2. What are you involved in on campus, and why?
3. Why did you choose this industry to study?

4. Do you strongly prefer using a particular programming language or development tool? If so, which one(s)?
5. Describe a challenging situation you faced in the classroom or at work. How did you respond and what did you learn about yourself?
6. Name a company you admire, and why?
7. What is your best quality, and how will that help you in your profession?
8. This position requires team-based development. How do you approach working with a team and where do you see your role in the team?
9. Look at the room you are in – how many pennies would it take to fill that room?

Industry Professional Ethics Interview Assignment

The objective of this assignment is to gain insights into the ethical considerations and practices within the computer science industry. By conducting an informational interview with an industry professional, you will: explore the role of ethics in their daily routine, identify examples of ethical and unethical behaviors in the workplace, understand how they handle ethical issues, and reflect on how this knowledge will influence your own professional career. You will also get experience with written communication in that you will be writing a professional email to the industry profession, and you will share your experience in this assignment via writing a 2–3-page paper.

Assignment Specifications

Step One: Research and identify an industry professional working in the computer science field. This individual should have experience in a role that aligns with your interests within the industry.

Step Two: Send a professional email to your identified person to request an interview. Once the industry professional has accepted and confirmed a date and time for the interview, be sure to send them a calendar invite. See the instructor if you have questions on how to do this.

Step Three: Develop a list of interview questions to guide your conversation with the industry professional. These questions should cover various aspects related to ethics in the workplace. You may use ChatGPT/AI to help you craft the questions. This is the <u>only</u> time AI can be used in this assignment. Suggested questions: What is your daily routine? What role does ethics play in this routine? What are examples of ethical and unethical behaviors in the workplace? When you've had ethical issues arise at work, whom did you consult and what steps did you take to solve them? What ethical qualities and behaviors do you feel are essential in this industry?

Step Four: Meet with the industry professional either in person, over the phone, Zoom, or MS Teams. Get to know them, ask the prepared questions, and encourage them to provide detailed responses. Take notes during the interview to record key points and insights.

Step Five: After the interview, write a 2–3-page double-spaced paper reflecting on your conversation and the insights gained. You will be graded on the components in your paper (see rubric for complete details):

1. Introduction: Introduce the professional you interviewed, their workplace, and their role

within the company. 2. Summary of the interview: Provide a concise summary of the key points discussed during the interview, focusing on the professional's daily routine, examples of ethical and unethical behaviors, consultation process for ethical issues, and the essential ethical qualities and behaviors in the industry. 3. Personal reflection: Reflect on what you learned from the interview and how it has shaped your understanding of ethics in the computer science industry. Discuss how you plan to incorporate this knowledge into your own professional career. 4. Conclusion: Summarize the main takeaways from the interview and reiterate the significance of ethical considerations in the computer science industry.

Outcome 3 Trait 3. Students can communicate effectively and professionally orally and via written communication				
	Excelling (>=90%)	**Practicing (>=80%)**	**Apprentice (>=60%)**	**Novice (<60%)**
Purple Career Readiness Certification	99 (94.3%)	0 (0%)	0 (0%)	6 (5.7%)
Interview Assignment	88 (83.8%)	9 (8.6%)	4 (3.8%)	4 (3.8%)
Industry Professional Ethics Interview	95 (90.5%)	7 (6.7%)	2 (1.9%)	2 (1.9%)
TOTAL	**282 (94%)**	**16 (5.3%)**	**6 (2%)**	**12 (4%)**

CSC 4610 Software Engineering I and CSC 4615/4620 Software Engineering II

Performance Criteria (Traits):
Students can communicate project status. (Bloom's taxonomy level: Synthesis)
Students can describe an overview of a project. (Bloom's taxonomy level: Comprehension)

Overall Assessment Results

Values: <*number of students*> (<*percentage of total*>)

Trait 1. Students can communicate project status.				
Assessment	Excelling	Practicing	Apprentice	Novice
Iteration reports	**18 (55%)**	**9 (27%)**	**6 (18%)**	**0**
Team Iteration 1 Showcase (video)	**33 (100%)**	**0**	**0**	**0**
Trait 2. Students can describe an overview of a project.				
Assessment	Excelling	Practicing	Apprentice	Novice
Project poster	**34 (100%)**	**0**	**0**	**0**

Project final showcase video	**12 (35%)**	**22 (65%)**	**0**	**0**

Students can communicate project status. (Bloom's taxonomy level: Synthesis)
Iteration Report: Student **teams** submit an **Iteration 1** report **at the end of the first semester** that includes an initial burn-up chart, summary of completed stories, and code committed to git repository. This assignment assesses the students' ability to present written material to a customer.

Summary: Overall, students did very well on their Iteration 1 report; some need to work on the overall detail in their reports and the clarity of what is accomplished.

Scale: Excelling (>=90%), Practicing (>=80%, <90%), Apprentice (>=70%, <80%), Novice (<70%)

Assessment	Excelling	Practicing	Apprentice	Novice
Iteration Reports	**18 (55%)**	**9 (27%)**	**6 (18%)**	**0**

Team Iteration 1 Showcase: Student **teams** create a video demonstrating their application after Iteration 1 **at the end of the first semester**. This assignment assesses the students' ability to orally and visually present material in a professional manner.

Summary: First the first time, ALL of the teams did an excellent of creating a well-versed video showing their editing and presentation skills. Some do need to make sure they announce their name when they speak, but other than that, good work.

Scale: Excelling (>=90%), Practicing (>=80%, <90%), Apprentice (>=70%, <80%), Novice (<70%)

Assessment	Excelling	Practicing	Apprentice	Novice
Team Iteration 1 Showcase (video)	**33 (100%)**	**0**	**0**	**0**

Students can describe an overview of a project. (Bloom's taxonomy level: Comprehension)
Project Poster: Student **teams** present a poster of their completed project **at the end of the second semester**. This assignment assesses the students' ability to present visual and

written material to a customer.

<u>Summary</u>: Overall, the students did an excellent job of creating a professional poster showing their work for the Senior Exp.

Scale: Excelling (>=90%), Practicing (>=80%, <90%), Apprentice (>=70%, <80%), Novice (<70%)

Assessment	Excelling	Practicing	Apprentice	Novice
Project Poster (written)	**34 (100%)**	**0**	**0**	**0**

Project Final Showcase: Student **teams** create a video demonstrating their complete application **at the end of the second semester**. This assignment assesses the students' ability to orally and visually present material in a professional manner.

<u>Summary</u>: Some teams created very professional videos that covered their entire product. Some teams either were not as professional in their video, or they did not create a comprehensive demo of their product.

Scale: Excelling (>=90%), Practicing (>=80%, <90%), Apprentice (>=70%, <80%), Novice (<70%)

Assessment	Excelling	Practicing	Apprentice	Novice
Project Final Showcase (video)	**12 (35%)**	**22 (65%)**	**0**	**0**

Recommendation:

Overall, students seem to be getting better in terms of their professionalism and presentation skills. Some students still struggle with public speaking and could use further instruction (outside of this course).

Optional (but highly suggested) Improvements

Keeping the class smaller this time was very helpful as it allowed me to spend more one-on- one time with the teams, helping them with topics like professionalism and detail.

Use of Results to Improve Outcomes:

- Overall, students seem to be getting better in terms of their professionalism and presentation skills. Some students still struggle with public speaking and could use further instruction (outside of this course).
- Keeping the class smaller this time was very helpful as it allowed me to spend more one-on- one time with the teams, helping them with topics like professionalism and detail.

SLO 4. Recognize professional responsibilities and make informed judgments

Define Outcome:
Students can recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.

This outcome is as defined by the Accreditation Board for Engineering and Technology (ABET) Computer Science Accreditation Commission (CAC).

Assessment Methods:
Direct Assessment. Several courses are assessed every semester. These assessments directly examine student work based on traits (performance criteria) created specifically for each student outcome. The measurement rubric used for direct assessment uses a four-level rubric: Excelling, Practicing, Apprentice, and Novice (E/P/A/N). These criteria are performed on a per student basis. An example is provided below.
Performance Criteria (Traits):

- Students can recognize responsibilities as computing professionals. (Bloom's taxonomy level: Knowledge)
- Students can recognize, identify, and describe ethical concepts related to computing. (Bloom's taxonomy level: Comprehension)
- Students can recognize, identify, and describe legal concepts related to computing. (Bloom's taxonomy level: Comprehension)
- Students can analyze the challenges associated with ethical concepts in the context of computing. (Bloom's taxonomy level: Analysis)
- Students can analyze the challenges associated with legal concepts in the context of computing. (Bloom's taxonomy level: Analysis)
- Students can apply ethical concepts to assess computing practice. (Bloom's taxonomy level: Application)
- Students can apply legal concepts to assess computing practice. (Bloom's taxonomy level: Application)

Faculty Course Reflections (all courses): Each faculty member is asked to complete a course reflection at the end of each semester. The reflection allows a faculty member to summarize the results of the course, map the appropriate objectives and outcomes to the course and identify successes from the semesters, opportunities for improvement, puzzles (i.e., questions to be resolved), suggested changes, issues with facilities, technology issues, and other reflections.

Pre-Post Surveys (Pre-Post): Pre-post surveys are conducted for courses in which a direct assessment is scheduled. The pre-post survey is administered twice: once at the beginning of a semester and again at the end of a semester.

Criteria for Success (Thresholds for Assessment Methods):

Direct Assessment

- *Summative Assessment:* 70% of students in Excelling or Practicing. Summative assessments capture the "endgame" so to speak and so we use this measure to kick-off identification of action items.
- *Formative Assessment:* 70% of students in Excelling, Practicing, or Apprentice. Formative assessments provide us with "mid-term" knowledge of attainment and provide a comparative measure by which to identify whether students are making progress in the program.

Indirect Assessment

Pre-Post Surveys (Pre-Post): Pre-post surveys are conducted for courses in which a direct assessment is scheduled. The pre-post survey is administered twice: once at the beginning of a semester and again at the end of a semester. The results of the pre-post survey is measured using a Student's T-Test to determine whether a statistically significant change in a student's perception of learning is observed. Any measurement of the T-Test that results in a p-value of 0.05 or lower is deemed as significant.

In regard to attainment levels, we expect the following: Student perceptions should exhibit a change in the aggregate mean towards "Extremely Well". Achieving a p-value of 0.05 is desirable but secondary.

Link to 'Tech Tomorrow' Strategic Plan:

2.A Technology Infused Programs

Results and Analysis:

Outcome 4: Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.

CSC 3040 Professionalism, Communication and Research in

Computing *Performance Criteria (Traits):*

1. Students can recognize responsibilities as computing professionals. (*Bloom's taxonomy level: Knowledge*)
2. Students can recognize, identify, and describe *ethical* concepts related to computing. (*Bloom's taxonomy level: Comprehension*)
3. Students can recognize, identify, and describe *legal* concepts related to computing.

(*Bloom's taxonomy level: Comprehension*)

4. Students can analyze the challenges associated with *ethical* concepts in the context of computing. (Bloom's taxonomy level: Analysis)
5. Students can analyze the challenges associated with *legal* concepts in the context of computing. (*Bloom's taxonomy level: Analysis*)
6. Students can apply *ethical* concepts to assess computing practice. (*Bloom's taxonomy level: Application*)
7. Students can apply *legal* concepts to assess computing practice. (*Bloom's taxonomy level: Application*)

Overall Assessment Results:

Values: <number of students> (<percentage of total>)

Trait 1. Students can recognize responsibilities as a computing professional.				
Assessment	Excelling	Practicing	Apprentice	Novice
Q5, Final Exam	20 (31%)	39 (60%)	2 (3%)	4 (6%)
Professionalism Essay	63 (89%)	5 (7%)	0 (0%)	3 (4%)

Trait 2. Students can recognize, identify, and describe ethical concepts related to computing.				
Assessment	Excelling	Practicing	Apprentice	Novice
Midterm exam - selected questions	115 (42%)	58 (21%)	79 (29%)	25 (9%)
Q11, Final Exam	64 (98%)	1 (2%)	0 (0%)	0 (0%)

Trait 3. Students can recognize, identify, and describe legal concepts related to computing.				
Assessment	Excelling	Practicing	Apprentice	Novice
Midterm exam - selected questions	54 (83%)	2 (3%)	4 (6%)	5 (8%)
Final exam- selected questions	33 (51%)	18 (28%)	13 (20%)	1 (2%)

Trait 4. Students can analyze the challenges associated with ethical concepts in the context of computing.				
Assessment	Excelling	Practicing	Apprentice	Novice

Q36, Midterm Exam	61 (88%)	8 (12%)	0 (0%)	0 (0%)
Q1, Final Exam	61 (94%)	0 (0%)	4 (6%)	0 (0%)
Trait 5. Students can analyze the challenges associated with legal concepts in the context of computing.				
Assessment	Excelling	Practicing	Apprentice	Novice
Q36, Midterm Exam	67 (98%)	1 (1%)	0 (0%)	1 (1%)
Q12, Final Exam	57 (88%)	7 (11%)	0 (0%)	1 (1%)
Trait 6. Students can apply ethical concepts to assess computing practice.				
Assessment	Excelling	Practicing	Apprentice	Novice
Q3, Final Exam	41 (63%)	3 (5%)	6 (9%)	15 (23%)
Ethics Essay	20 (31%)	39 (60%)	2 (3%)	4 (6%)
Trait 7. Students can apply legal concepts to assess computing practice.				
Assessment	Excelling	Practicing	Apprentice	Novice
Q38, Midterm Exam	32 (46%)	16 (23%)	11 (16%)	10 (14%)
Q4, Final Exam	37 (57%)	20 (31%)	7 (11%)	1 (2%)

Trait 1

Students can recognize responsibilities as computing professionals. (*Bloom's taxonomy level: Knowledge*)

Final exam – selected question:

Exam question to recognize responsibilities as a computing professional.
Scale: Excelling (≥90%), Practicing (≥80%, <90%), Apprentice (≥60%, <80%), Novice (<60%)
Text of selected question from final exam:

Q5. Discuss how the field of software engineering tries to ensure software quality?

Assessment	Excelling	Practicing	Apprentice	Novice
Q5, Final Exam (section 001)	11(31%)	21 (60%)	1 (3%)	2 (6%)
Q5, Final Exam (section 002)	9 (30%)	18 (60%)	1 (3%)	2 (7%)
Total	20 (31%)	39 (60%)	2 (3%)	4 (6%)

Professionalism essay:

Essay requiring students to write an essay pertaining to a professional soft skill they wish to improve.
Scale: Excelling (≥90%), Practicing (≥80%, <90%), Apprentice (≥60%, <80%), Novice (<60%)
Text of professional soft skill essay assignment:

Write a 600-1000-word essay pertaining to a soft skill that you want to improve. You should describe the skill. Tell why the skill is important in the workplace. Talk about what could possibly happen if people did not have this skill. Talk about ways a person can improve this skill. The essay must have citations in IEEE format and be supported by 3 to 5 relevant peer-reviewed articles published between 2020 – 2022.

Assessment	Excelling	Practicing	Apprentice	Novice
Professionalism Essay (section 001)	35 (88%)	4 (10%)	0 (0%)	1 (3%)
Professionalism Essay (section 002)	28 (90%)	1 (3%)	0 (0%)	2 (6%)
Total	63 (89%)	5 (7%)	0 (0%)	3 (4%)

Trait 2

Students can recognize, identify, and describe ethical concepts related to computing. (*Bloom's taxonomy level: Comprehension*)

Midterm exam - selected questions:

Exam questions to recognize, identify, and describe basic ethical concepts.
Scale: Excelling (≥90%), Practicing (≥80%, <90%), Apprentice (≥70%, <80%), Novice (<70%) Text of selected questions from midterm exam:

Q2: Which of the following can be used to describe Social Contract Theory? Select all that apply.

a. Associated with individuals' rights and societal duties.
b. The consequences of an action matter more than the intentions of an action.
c. Not treating people as a means to an end.
d. Act only from moral laws that can be universal moral laws.
e. Attempts to resolve the issue of "moral luck".
f. Rational people will follow the "rules" on the condition that other people will follow them too.
g. An action is right to the extent that it increases total happiness.
h. We ought to adopt moral rules that lead to the greatest increase in total happiness.

Q3: Which of the following can be used to describe Act Utilitarianism? Select all that apply.

a. Associated with individuals' rights and societal duties.
b. The consequences of an action matter more than the intentions of an action.
c. Not treating people as a means to an end.
d. Act only from moral laws that can be universal moral laws.
e. Attempts to resolve the issue of "moral luck".
f. Rational people will follow the "rules" on the condition that other people will follow them too.
g. An action is right to the extent that it increases total happiness.
h. We ought to adopt moral rules that lead to the greatest increase in total happiness.

Q4: Which of the following can be used to describe Kantianism? Select all that apply.

a. Associated with individuals' rights and societal duties.
b. The consequences of an action matter more than the intentions of an action.
c. Not treating people as a means to an end.
d. Act only from moral laws that can be universal moral laws.
e. Attempts to resolve the issue of "moral luck".
f. Rational people will follow the "rules" on the condition that other people will follow them too.
g. An action is right to the extent that it increases total happiness.
h. We ought to adopt moral rules that lead to the greatest increase in total happiness.

Q5 Which of the following can be used to describe Rule Utilitarianism? Select all that apply.

a. Associated with individuals' rights and societal duties.
b. The consequences of an action matter more than the intentions of an action.
c. Not treating people as a means to an end.
d. Act only from moral laws that can be universal moral laws.
e. Attempts to resolve the issue of "moral luck".

f. Rational people will follow the "rules" on the condition that other people will follow them too.
g. An action is right to the extent that it increases total happiness.
h. We ought to adopt moral rules that lead to the greatest increase in total happiness.

Assessment	Excelling	Practicing	Apprentice	Novice
Midterm exam - selected questions (section 001)	71 (44%)	29 (18%)	44 (28%)	16 (10%)
Midterm exam – selected questions (section 002)	44 (38%)	29 (25%)	35 (30%)	9 (8%)
Total	115 (42%)	58 (21%)	79 (29%)	25 (9%)

Final exam – selected question:

Exam questions to recognize, identify, and describe basic ethical concepts.
Scale: Excelling (≥90%), Practicing (≥80%, <90%), Apprentice (≥70%, <80%), Novice (<70%) Text of selected question from final exam:

Q11: Which of the following is NOT a benefit of privacy? Select all that apply.

a. An abundance of privacy is a blessing to outcasts. (Example: a prisoner being assigned to solitary confinement.)
b. Privacy is necessary to plan and carry out illegal activities.
c. Privacy is necessary for a person to become and develop as an individual.
d. Privacy allows people to focus their thoughts without interruption, be creative, and grow spiritually.
e. Privacy allows for increased abuse in dysfunctional families.

Assessment	Excelling	Practicing	Apprentice	Novice
Q11, Final Exam (section 001)	35 (100%)	0 (0%)	0 (0%)	0 (0%)
Q11, Final Exam	29 (75%)	1 (3%)	0 (0%)	0 (0%)
(section 002				
Total	64 (98%)	1 (2%)	0 (0%)	0 (0%)

Trait 3

Students can recognize, identify, and describe legal concepts related to computing. (*Bloom's taxonomy level: Comprehension*)

Midterm exam - selected questions:

Exam questions to recognize, identify, and describe basic legal concepts.
Scale: Excelling (≥90%), Practicing (≥80%, <90%), Apprentice (≥70%, <80%), Novice (<70%)
Text of selected questions from midterm exam:
Q19: Which of the following can be used to describe Patent?

a. The circumstances under which it is legal to reproduce protected works.
b. A way the US government provides an inventor with an exclusive right to a piece of intellectual property.
c. How the US government provides authors with certain rights to original works that they have written.
d. A confidential piece of intellectual property that provides a company with a competitive advantage.
e. A word, symbol, picture, sound, or color used by a business to identify goods.
f. Contains information about an incident or action reported to a government agency for the purpose of informing the public.

Q20: Which of the following can be used to describe Copyright?

a. The circumstances under which it is legal to reproduce protected works.
b. A way the US government provides an inventor with an exclusive right to a piece of intellectual property.
c. How the US government provides authors with certain rights to original works that they have written.
d. A confidential piece of intellectual property that provides a company with a competitive advantage.
e. A word, symbol, picture, sound, or color used by a business to identify goods.
f. Contains information about an incident or action reported to a government agency for the purpose of informing the public.

Q22: Which of the following can be used to describe Trade Secret?

a. The circumstances under which it is legal to reproduce protected works.
b. A way the US government provides an inventor with an exclusive right to a piece of intellectual property.
c. How the US government provides authors with certain rights to original works that they have written.
d. A confidential piece of intellectual property that provides a company with a competitive advantage.
e. A word, symbol, picture, sound, or color used by a business to identify goods.

f. Contains information about an incident or action reported to a government agency for the purpose of informing the public.

Q21: Which of the following can be used to describe Trademark?

a. The circumstances under which it is legal to reproduce protected works.
b. A way the US government provides an inventor with an exclusive right to a piece of intellectual property.
c. How the US government provides authors with certain rights to original works that they have written.
d. A confidential piece of intellectual property that provides a company with a competitive advantage.
e. A word, symbol, picture, sound, or color used by a business to identify goods.
f. Contains information about an incident or action reported to a government agency for the purpose of informing the public.

Q35: How is intellectual property (IP) different from physical property?

Assessment	Excelling	Practicing	Apprentice	Novice
Midterm exam - selected questions (section 001)	29 (83%)	2 (6%)	1 (3%)	3 (9%)
Midterm exam – selected questions (section 002)	25 (83%)	0 (0%)	3 (10%)	2 (7%)
Total	54 (83%)	2 (3%)	4 (6%)	5 (8%)

Final exam – selected questions:

Exam questions to recognize, identify, and describe basic legal concepts.
Scale: Excelling (≥90%), Practicing (≥80%, <90%), Apprentice (≥70%, <80%), Novice (<70%) Text of selected question from final exam:

Q15: Match the government legislature with the correct description.

1. Employee Polygraph Protection Act (EPPA)
2. Children's Online Privacy Protection Act (COPPA)
3. Telecommunications Act
4. Electronic Communications Privacy Act (ECPA)
5. Communications Assistance for Law Enforcement Act (CALEA)
6. Clarifying Lawful Overseas Use of Data Act (CLOUD Act)
7. Privacy Act of 1974
8. Computer Matching and Privacy Protection Act

9. USA PATRIOT Act
10. General Data Protection Regulation (GDPR)
11. Health Insurance Portability and Accountability Act (HIPPA)
12. Family Educational Rights and Privacy Act (FERPA)
13. Right to Financial Privacy Act (RFPA)
14. Fair Credit Reporting Act (FCRA)
15. Fair and Accurate Credit Transactions Act (FACTA)
16. Fair Debt Collection Practices Act (FDCPA)
17. Driver's Privacy Protection Act (DPPA)
18. Information Technology Management Reform Act
19. Computer Fraud and Abuse Act (CFAA)
20. E-Government Act

_____ Protect the privacy of personal information assembled by State Department of Motor Vehicles (DMVs) by prohibiting the release or use by any state DMV of PI about an individual obtained by the department.

_____ A U.S. federal statute that modernized the flow of healthcare information, stipulating how personally identifiable information maintained by the healthcare and healthcare insurance industries should be protected from fraud and theft.

_____ Prohibits most private employers from using lie-detector tests in most situations.

_____ Authorizes the Federal Communications Commission (FCC) to impose restrictions on telecommunications carriers regarding the access, use, and disclosure of customer information.

_____ United States statute with the purpose of improving the management and promotion of electronic government services and processes by establishing a Federal Chief Information Officer of the United States within the Office of Management and Budget and by establishing a framework of measures that require using internet-based information technology to improve citizen access to government information and services.

_____ Primarily amends the Stored Communications Act (SCA) of 1986 to allow federal law enforcement (like the FBI) to force U.S.-based technology companies (like Microsoft) via warrant or subpoena to provide requested data stored on servers regardless of whether the data are stored in the U.S. or on foreign soil.

_____ A US wiretapping law that requires phone companies to design or be able to modify networking equipment so that law enforcement agencies can trace calls, listen in on telephone calls, and intercept email messages.

_____ Was enacted following the September 11 attacks and the 2001 anthrax attacks with the stated goal of dramatically tightening U.S. national security, especially foreign terrorism.

_____ A consumer protection amendment, establishing legal protection from abusive debt

collection practices.

_____ Establishes a Code of Fair Information Practice that governs the collection, maintenance, use, and dissemination of personally identifiable information about individuals that is maintained in systems of records by federal agencies.

_____ A law that governs the access to educational information and records by publicly funded educational institutions, and foreign governments.

_____ An amendment to the Fair Credit Reporting Act and allows consumers to request and obtain a free credit report once every 12 months from each of the three nationwide consumer credit reporting companies (Equifax, Experian, and TransUnion) via AnnualCreditReport.com.

_____ Allows police to attach two kinds of surveillance devices to a suspect's phone line. If the suspect makes a phone call, a pen register displays the number being dialed. If the suspect gets a phone call, a trap-and-trace device displays the caller's phone number.

_____ Establishes specific procedures that federal government authorities must follow in order to obtain information from a financial institution about a customer's financial records.

_____ Requires Federal agencies to enter into written agreements with other agencies or non-Federal entities before disclosing records for use in computer matching programs.

_____ The purpose is to improve the way the federal government acquires, uses, and disposes information technology (IT). Information technology with respect to an executive agency is defined in this act as any equipment or system that is used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information by the executive agency.

_____ This Act's primary aim is to enhance individual's control and rights over their personal data and to simplify the regulatory environment for international business.

_____ Enacted to promote the accuracy, fairness, and privacy of consumer information contained in the files of consumer reporting agencies. It was intended to shield consumers from the willful and/or negligent inclusion of erroneous data in their credit reports.

_____ Designed to reduce the amount of information gathered from children using the Internet.

_____ US cybersecurity bill that was enacted as an amendment to existing computer fraud law which had been included in the Comprehensive Crime Control Act of 1984

Assessment	Excelling	Practicing	Apprentice	Novice
Q15, Final Exam Section 001	15 (43%)	13 (37%)	6 (17%)	1 (3%)

Q15, Final Exam Section 002	18 (60%)	5 (17%)	7 (23%)	0 (0%)
Total	33 (51%)	18 (28%)	13 (20%)	1 (2%)

Trait 4

Students can analyze the challenges associated with ethical concepts in the context of computing. (Bloom's taxonomy level: Analysis)

Midterm exam - selected question:

Exam question to analyze challenges associated with pros/cons of ethical concepts.
Scale: Excelling (≥90%), Practicing (≥80%, <90%), Apprentice (≥70%, <80%), Novice (<70%)
Text of selected question from midterm exam:

Q36: Describe at least one way that computers make it harder to protect intellectual property.

Assessment	Excelling	Practicing	Apprentice	Novice
Q36, Midterm Exam Section 001	33 (83%)	7 (17%)	0 (0%)	0 (0%)
Q36, Midterm Exam Section 002	28 (97%)	1 (3%)	0 (0%)	0 (0%)
Total	61 (88%)	8 (12%)	0 (0%)	0 (0%)

Final exam – selected question:

Exam question to analyze challenges associated with pros/cons of ethical concepts.
Scale: Excelling (≥90%), Practicing (≥80%, <90%), Apprentice (≥70%, <80%), Novice (<70%)
Text of selected question from final exam:

Q1: Explain two ethical concerns related to telework (working from home).

Assessment	Excelling	Practicing	Apprentice	Novice
Q1, Final Exam Section 001	33 (94%)	0 (0%)	2 (6%)	0 (0%)
Q1, Final Exam Section 002	28 (93%)	0 (0%)	2 (7%)	0 (0%)
Total	61 (94%)	0 (0%)	4 (6%)	0 (0%)

Trait 5

Students can analyze the challenges associated with legal concepts in the context of computing. (Bloom's taxonomy level: Analysis)

Midterm exam - selected question:

Exam question to analyze challenges associated with pros/cons of legal concepts. Scale: Excelling (≥90%), Practicing (≥80%, <90%), Apprentice (≥70%, <80%), Novice (<70%) Text of selected questions from midterm exam:

Q36: Describe one thing about the Internet that makes its censorship challenging.

Q36, Midterm Exam Section 001	38 (95%)	1 (2.5%)	0 (0%)	1 (2.5%)
Q36, Midterm Exam Section 002	29 (100%)	0 (0%)	0 (0%)	0 (0%)
Total	67 (98%)	1 (1%)	0 (0%)	1 (1%)

Final exam – selected question:

Exam questions to analyze challenges associated with pros/cons of legal concepts. Scale: Excelling (≥90%), Practicing (≥80%, <90%), Apprentice (≥70%, <80%), Novice (<70%) Text of selected question from final exam:

Q12: Which of the following circumstances must be true to justify whistleblowing?

a. actions taken by their employer causes extra work on employees
b. actions taken by their employer may harm the public or they have identified fraudulent use of tax dollars
c. they attempted to report their concerns through authorized organizational channels and were ignored or rebuffed
d. they talked about their concerns to their best friends in the same department
e. actions taken by their employer make the working environment boring

Assessment	Excelling	Practicing	Apprentice	Novice
Q12, Final Exam Section 001	30 (86%)	4 (11%)	0 (0%)	1 (3%)
Q12, Final Exam Section 002	27 (90%)	3 (10%)	0 (0%)	0 (0%)
Total	57 (88%)	7 (11%)	0 (0%)	1 (1%)

Trait 6

Students can apply ethical concepts to assess computing practice. (*Bloom's taxonomy level: Application*)

Final exam – selected question:

Exam questions to think through the application of ethical concepts.
Scale: Excelling (≥90%), Practicing (≥80%, <90%), Apprentice (≥70%, <80%), Novice (<70%)
Text of selected question from final exam:

Q3: You are a software engineer at April's House of Software. Your manager, Bingo, tells you that the software project you are developing needs to be released tomorrow, but you have not finished testing. Use the Utilitarianism ethical framework to argue how you should respond to Bingo's demand and why.

Assessment	Excelling	Practicing	Apprentice	Novice
Q3, Final Exam Section 001	25 (71%)	0 (0%)	1 (3%)	9 (26%)
Q3, Final Exam Section 002	16 (53%)	3 (10%)	5 (17%)	6 (20%)
Total	41 (63%)	3 (5%)	6 (9%)	15 (23%)

Ethics essay:

Essay requiring students to explain and defend an ethical claim related to networked communications.
Scale: Excelling (≥90%), Practicing (≥80%, <90%), Apprentice (≥70%, <80%), Novice (<70%)
Text of ethics essay assignment:

Write an essay about an ethical issue pertaining to a topic discussed in Chapter 3 Networked Communications. Find one or more current (2019 to 2022) news article(s) that contain(s) information about an ethical dilemma pertaining to networked communication (email, social network, search engines, internet, internet of things devices, data mining, online privacy, internet-based research, identity theft, internet addiction, cyberbullying, online predators, etc.) Make sure the news article is valid (nothing off reddit, TikTok, etc.). Then, explain and defend if the action taken in the dilemma was right or wrong based on the Kantianism ethical theory.

Assessment	Excelling	Practicing	Apprentice	Novice
Ethics essay (section 001)	28 (70%)	4 (10%)	4 (10%)	4 (10%)
Ethics essay (section 002)	22 (71%)	6 (19%)	2 (6%)	1 (3%)
Total	50 (70%)	10 (14%)	6 (8%)	5 (7%)

Trait 7

Students can apply legal concepts to assess computing practice. (*Bloom's taxonomy level: Application*)

Midterm exam – selected question:
Exam questions to think through the application of legal concepts.
Scale: Excelling (≥90%), Practicing (≥80%, <90%), Apprentice (≥70%, <80%), Novice (<70%)
Text of selected question from midterm exam:

Q38: Name four factors used to determine fair use.

Assessment	Excelling	Practicing	Apprentice	Novice
Q38, Midterm Exam Section 001	19 (48%)	5 (12%)	8 (20%)	8 (20%)
Q38, Midterm Exam Section 002	13 (45%)	11 (38%)	3 (10%)	2 (5%)
Total	32 (46%)	16 (23%)	11 (16%)	10 (14%)

Final exam – selected questions:

Exam questions to think through the application of legal concepts.
Scale: Excelling (≥90%), Practicing (≥80%, <90%), Apprentice (≥70%, <80%), Novice (<70%) Text of selected question from final exam:

Q4: What are the implications of the Stored Communications Act for all those who let an Internet service providers handle their e-mail.

Assessment	Excelling	Practicing	Apprentice	Novice
Q4, Final Exam Section 001	22 (63%)	7 (20%)	5 (14%)	1 (3%)
Q4, Final Exam Section 002	15 (50%)	13 (43%)	2 (7%)	0 (0%)
Total	37 (57%)	20 (31%)	7 (11%)	1 (2%)

Recommendation:

An observation is that students tend to forget to use an ethical framework to defend their opinions unless they are explicitly told to do so in the text of the question. In future semesters, we need to stress the importance of defending opinions with an ethical framework based on logic, reason, and facts.

CSC 3570-001 "IT Security"

Performance Criteria (Traits):
Students can recognize, identify, and describe ethical and legal concepts related to computing and associated challenges (*Bloom's taxonomy level: Comprehension and Analysis*)

Assessment Results:

Trait 1. Students can recognize identify and describe ethical and legal concepts related to computing and associated challenges				
Assessment	Excelling	Practicing	Apprentice	Novice
Midterm exam, question 3	68 (98.6%)	0 (0.0%)	0 (0.0%)	1 (1.5%)

Midterm exam, Question 14:
(Generative AI Allowed) Create a digital privacy policy for a university using the CCPA as a basis for the policy. As with the other AI-based responses, please cite your work correctly and provide the prompt you used to create the response. Compare your version to the Tennessee Tech Policy 802

Assessment	Excelling	Practicing	Apprentice	Novice
Final exam – question 3	51 (76.5%)	12 (17.6%)	1 (1.5%)	4 (5.9%)

Text of laboratory question (ethical and correct use of tools)

In this part of the lab, we will be using Wireshark to analyze PCAP (Packet Capture) files. **WARNING:** We are not scanning anything with Wireshark in this lab, we are only opening the provided pcap files inside of Wireshark. Do NOT scan a network you do not own or have permission to scan. Do NOT scan TN Tech's network.

Recommendation:
Enhance discussion of ethical and legal uses of potentially intrusive cybersecurity tools. The program currently requires the signature of a "code of ethics" at the beginning of the course.

Optional (but highly suggested) Improvements – Ethics will be covered much earlier in the

semester.

Use of Results to Improve Outcomes:

- An observation is that students tend to forget to use an ethical framework to defend their opinions unless they are explicitly told to do so in the text of the question. In future semesters, we need to stress the importance of defending opinions with an ethical framework based on logic, reason, and facts.
- Enhance discussion of ethical and legal uses of potentially intrusive cybersecurity tools. The program currently requires the signature of a “code of ethics” at the beginning of the course.
- Ethics will be covered much earlier in the semester.

SLO 5. Function effectively as a member or leader of a team

Define Outcome:
Students can function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.

This outcome is as defined by the Accreditation Board for Engineering and Technology (ABET) Computer Science Accreditation Commission (CAC).

Assessment Methods:
Direct Assessment. Several courses are assessed every semester. These assessments directly examine student work based on traits (performance criteria) created specifically for each student outcome. The measurement rubric used for direct assessment uses a four-level rubric: Excelling, Practicing, Apprentice, and Novice (E/P/A/N). These criteria are performed on a per student basis. An example is provided below.
*Performance Criteria (Traits)**:***

- Students can create and manage a plan. (Bloom's taxonomy level: Synthesis)
- Students can track and manage a plan. (Bloom's taxonomy level: Synthesis)
- Students can produce deliverables. (Bloom's taxonomy level: Application)

Faculty Course Reflections (all courses): Each faculty member is asked to complete a course reflection at the end of each semester. The reflection allows a faculty member to summarize the results of the course, map the appropriate objectives and outcomes to the course and identify successes from the semesters, opportunities for improvement, puzzles (i.e., questions to be resolved), suggested changes, issues with facilities, technology issues, and other reflections.

Pre-Post Surveys (Pre-Post): Pre-post surveys are conducted for courses in which a direct assessment is scheduled. The pre-post survey is administered twice: once at the beginning of a semester and again at the end of a semester.

Criteria for Success (Thresholds for Assessment Methods):
Direct Assessment

- *Summative Assessment:* 70% of students in Excelling or Practicing. Summative assessments capture the "endgame" so to speak and so we use this measure to kick-off identification of action items.
- *Formative Assessment:* 70% of students in Excelling, Practicing, or Apprentice. Formative assessments provide us with "mid-term" knowledge of attainment and provide a comparative measure by which to identify whether students are making progress in the program.

Indirect Assessment

Pre-Post Surveys (Pre-Post): Pre-post surveys are conducted for courses in which a direct assessment is scheduled. The pre-post survey is administered twice: once at the beginning of a semester and again at the end of a semester. The results of the pre-post survey are measured using a Student's T-Test to determine whether a statistically significant change in a student's perception of learning is observed. Any measurement of the T-Test that results in a p-value of 0.05 or lower is deemed as significant.

In regard to attainment levels, we expect the following: Student perceptions should exhibit a change in the aggregate mean towards "Extremely Well". Achieving a p-value of 0.05 is desirable but secondary.

Link to 'Tech Tomorrow' Strategic Plan:

2.A Technology Infused Programs

Results and Analysis:

Outcome 5: Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.

CSC 3040 Professionalism, Communication and Research in Computing

Performance Criteria (Traits):

- Students can work with a team to develop and present a tutorial on domain knowledge areas of computer science.
- Students can collaborate in group discussions regarding ethics topics in computing.

Outcome 5 Overall Assessment Results:

Values: <*number of students*> (<*percentage of total*>)

Outcome 5 Trait 1. Students can work with a team to develop and present a tutorial on domain knowledge areas of computer science.				
	Excelling (>=90%)	**Practicing (>=80%)**	**Apprentice (>=60%)**	**Novice (<60%)**
Group Tutorial Video	46 (43.8%)	43 (41%)	15 (14.3%)	1 (1%)
Evaluations of Group Tutorial Videos	57 (54.3%)	32 (30.5%)	17 (16.2%)	2 (1.9%)
Peer Evaluation of Group Members	72 (68.6%)	22 (21%)	8 (7.6%)	7 (6.7%)
TOTAL	**175 (58.3%)**	**97 (32.3%)**	**40 (13.3%)**	**10 (3.3%)**

Outcome 5 Trait 2. Students can collaborate in group discussions regarding ethics topics in computing.				
	Excelling (>=90%)	**Practicing (>=80%)**	**Apprentice (>=60%)**	**Novice (<60%)**
Professional Ethics Case Study Assignment	92 (87.6%)	3 (2.9%)	0 (0%)	10 (9.5%)
In-Class Ethics Discussion on Networked Communications	94 (89.5%)	3 (2.9%)	2 (1.9%)	7 (6.7%)
In-Class Ethics Discussion on Intellectual Property	88 (83.8%)	0 (0%)	3 (2.9%)	14 (13.3%)
TOTAL	**274 (91.3%)**	**6 (2%)**	**5 (1.7%)**	**31 (10.3%)**

Outcome 5, Trait 1: Students can work with a team to develop and present a tutorial on domain knowledge areas of computer science.

Group Tutorial Video

Assignment Description

Each group will create a video tutorial on a topic of their choice. The topic of the video must be relevant to Computer Science or Software Engineering. A group's video could be the group members showing or demonstrating something "unplugged" (not on a computer) such as how to build your own computer or how to play "Potato Pirates". Another option is to demonstrate how to install, use, create, or play something on your computer – which would be a screen casted video. The third option would be to have a combination of screen casting and unplugged demonstration like a tutorial on how to 3D print. Videos have a minimum time limit of 7 minutes and a maximum time limit of 10 minutes. After the video submission deadline, the videos will be shared with the class. Each student must review each group's presentation, including their own. Before I play each video, I will state the title and the intended audience that was provided in the memo.

Evaluations of Group Tutorial Videos

Assignment Description

After the video submission deadline, the videos will be shown during class. Each student will evaluate each group's video, including their own. Before I play each video, I will state the title and the intended audience that was provided in your group's memo. Each individual person

will be evaluating the group project videos during class and filling out a Qualtrics form. Refer to the master schedule for the tentative dates we will do this. The link to the evaluation form will be provided during class. There will be a unique password for each group's video that will be given by Mrs. Crockett directly after watching the video in class. If you are absent on these days with an unexcused absence, it will affect this grade because I will not be recording class on these days, and I will not be distributing student's videos.

Peer Evaluation of Group Members

Assignment Description

Each individual person in your group will submit their peer evaluation document. The peer evaluation is based on how your team members evaluated you and how you evaluated yourself. If you do not turn in an evaluation, you will get 0 points no matter how your teammates evaluated you. You will be listing (and evaluating) yourself as well as your group members on this form based on the following criteria: quantity of effort, timeliness of effort, quality of effort, attention to detail, project knowledge, and attitude. For each of the criteria above, there will be a 1 to 5 Likert scale where 1 is poor/inadequate and 5 is outstanding/top quality. There will also be a section where you can optionally provide additional comments about group member efforts.

Outcome 5 Trait 1. Students can work with a team to develop and present a tutorial on domain knowledge areas of computer science.				
	Excelling (>=90%)	**Practicing (>=80%)**	**Apprentice (>=60%)**	**Novice (<60%)**
Group Tutorial Video	46 (43.8%)	43 (41%)	15 (14.3%)	1 (1%)
Evaluations of Group Tutorial Videos	57 (54.3%)	32 (30.5%)	17 (16.2%)	2 (1.9%)
Peer Evaluation of Group Members	72 (68.6%)	22 (21%)	8 (7.6%)	7 (6.7%)
TOTAL	**175 (58.3%)**	**97 (32.3%)**	**40 (13.3%)**	**10 (3.3%)**

Outcome 5, Trait 2: Students can collaborate in group discussions regarding ethics topics in computing.

Professional Ethics Case Studies Assignment

Discussion Description

You are provided with four different use-case studies where there is an ethical situation. Use the IEEE / ACM Software Engineering Code of Ethics and Professional Practice to determine

which specific clauses apply to each of the four case studies. There may be good things that the person or people are doing that can be selected from the clauses and there also may be violations. You need to identify both. Then, get with your group and compare/contrast your answers. Should you add any clauses or remove any? Then, for each case study, discuss as a group what could have been done (or not done) differently by the individuals in the use case so that the code of ethics would have been followed completely.

In-Class Ethics Discussion on Networked Communications

Discussion Description

Find a news article from the past month where a networked communication caused harm. Networked communications can include email, social media, a website or online service, streaming services, or online games. Then, write the news article title, link to the article, and write two to three sentences concisely telling what happened making sure to include the networked communication involved and the harm that was caused. In class, group up in 3 to 4-person groups and tell each other about the article and discuss what the specific ethical issues are applicable and discuss if the actions taken were wrong or write based off the Kantianism ethical theory.

In-Class Ethics Discussion on Intellectual Property

Discussion Description

In class, group up in 3 to 4-person groups. Each group is given a topic written on a note card that is related to a story concerning intellectual property. Your group must look up the topic online and investigate what happened, if the story contains any ethical decisions that were made and if so, write down the ethical issues and discuss if the actions taken were wrong or write based off the Utilitarianism ethical theory.

Outcome 5 Trait 2. Students can collaborate in group discussions regarding ethics topics in computing.				
	Excelling (>=90%)	**Practicing (>=80%)**	**Apprentice (>=60%)**	**Novice (<60%)**
Professional Ethics Case Study Assignment	92 (87.6%)	3 (2.9%)	0 (0%)	10 (9.5%)
In-Class Ethics Discussion on Networked Communications	94 (89.5%)	3 (2.9%)	2 (1.9%)	7 (6.7%)
In-Class Ethics Discussion on Intellectual Property	88 (83.8%)	0 (0%)	3 (2.9%)	14 (13.3%)

TOTAL	**274 (91.3%)**	**6 (2%)**	**5 (1.7%)**	**31 (10.3%)**

Performance Criteria (Traits):

1. Students can create and manage a plan. (Bloom's taxonomy level: Synthesis)
2. Students can track and manage a plan. (Bloom's taxonomy level: Synthesis)
3. Students can produce deliverables. (Bloom's taxonomy level: Application)

Overall Assessment Results

Values: <*number of students*> (<*percentage of total*>)

Trait 1. Students can create and manage a plan.				
Assessment	Excelling	Practicing	Apprentice	Novice
Project Charter	**6 (18%)**	**24 (73%)**	**3 (9%)**	**0**

Trait 2. Students can track and manage a plan.				
Assessment	Excelling	Practicing	Apprentice	Novice
Student Progress	**18 (53%)**	**10 (29%)**	**6 (18%)**	**0**
Iteration Reports	**22 (65%)**	**12 (35%)**	**0**	**0**

Trait 3. Students can produce deliverables.				
Assessment	Excelling	Practicing	Apprentice	Novice
Project Showcase Demo (video)	**12 (35%)**	**22 (65%)**	**0**	**0**

Traits

Students can create and manage a plan. (Bloom's taxonomy level: Synthesis)

Project Charter: Student **teams** create a Project Charter **in the first semester**. This assignment assesses the students' ability to organize and work together as a team.

<u>Summary</u>: Overall, students are able to identify what needs to be done, prioritize, and organize tasks; some need to work on including more detail and identifying sub-tasks and actual individuals assigned to stories.

Scale: Excelling (>=90%), Practicing (>=80%, <90%), Apprentice (>=70%, <80%), Novice (<70%)

Assessment	Excelling	Practicing	Apprentice	Novice
Project Charter	**6 (18%)**	**24 (73%)**	**3 (9%)**	**0**

Students can track and manage a plan. (Bloom's taxonomy level: Synthesis**)**

Student Progress: Student **teams** use gitlab to document the progress of their project. The continual tracking of accomplishments towards a final product assesses the students' ability to keep track of and manage a project plan.

<u>Summary</u>: Most students do not do a good job of updating their board making it difficult to track actual progress.

Scale: Excelling (>=90%), Practicing (>=80%, <90%), Apprentice (>=70%, <80%), Novice (<70%)

Assessment	Excelling	Practicing	Apprentice	Novice
Student Progress	**18 (53%)**	**10 (29%)**	**6 (18%)**	**0**

Iteration Reports: Student **teams** submit a report **at the end of each Iteration** that includes an initial burn-up chart, summary of completed stories, and code committed to git repository. This assignment assesses the students' ability to present written material to a customer.

<u>Summary</u>: Some students do not keep their repo up to date, which has led to inconsistencies in baselines and issues for their teammates.

Scale: Excelling (>=90%), Practicing (>=80%, <90%), Apprentice (>=70%, <80%), Novice (<70%)

Assessment	Excelling	Practicing	Apprentice	Novice
Iteration Reports	**22 (65%)**	**12 (35%)**	**0**	**0**

Students can produce deliverables. (Bloom's taxonomy level: Application)

Project Showcase: Student teams **demo** (and video) the final version of their product **at the end of the second semester**. This assignment assesses the students' ability to orally and visually present material in a professional manner.

<u>Summary</u>: Most teams presented a completed demo of their product which provides a complete retrospective for their customers. Some were very professional, but others still needed to work on their delivery.

Scale: Excelling (>=90%), Practicing (>=80%, <90%), Apprentice (>=70%, <80%), Novice (<70%)

Assessment	Excelling	Practicing	Apprentice	Novice

Project Showcase Demo (video)	**12 (35%)**	**22 (65%)**	**0**	**0**

Recommendation:

While I encouraged the changing of leadership after each iteration, it did not always happen. While some are clearly better than others at being the leader, everyone needs to get the experience.

Optional (but highly suggested) Improvements

Again, I need to find a way to enforce equal input to the reports and not let them rely on one or two individuals to do all the report writing. Perhaps the name of the individual who did each section?

Use of Results to Improve Outcomes:

- While I encouraged the changing of leadership after each iteration, it did not always happen. While some are clearly better than others at being the leader, everyone needs to get the experience.
- Again, I need to find a way to enforce equal input to the reports and not let them rely on one or two individuals to do all the report writing. Perhaps the name of the individual who did each section?

SLO 6. Apply computer science theory and software development fundamentals

Define Outcome:
Students can apply computer science theory and software development fundamentals to produce computing-based solutions.

This outcome is as defined by the Accreditation Board for Engineering and Technology (ABET) Computer Science Accreditation Commission (CAC).

Assessment Methods:
Direct Assessment. Several courses are assessed every semester. These assessments directly examine student work based on traits (performance criteria) created specifically for each student outcome. The measurement rubric used for direct assessment uses a four-level rubric: Excelling, Practicing, Apprentice, and Novice (E/P/A/N). These criteria are performed on a per student basis. An example is provided below.
Performance Criteria (Traits):

- Students can apply computer science theory and software development fundamentals to design computing-based solutions. (Bloom's taxonomy level: Apply)
- Students can apply computer science theory and software development fundamentals to implement computing-based solutions. (Bloom's taxonomy level: Apply)

Faculty Course Reflections (all courses): Each faculty member is asked to complete a course reflection at the end of each semester. The reflection allows a faculty member to summarize the results of the course, map the appropriate objectives and outcomes to the course and identify successes from the semesters, opportunities for improvement, puzzles (i.e., questions to be resolved), suggested changes, issues with facilities, technology issues, and other reflections.

Pre-Post Surveys (Pre-Post): Pre-post surveys are conducted for courses in which a direct assessment is scheduled. The pre-post survey is administered twice: once at the beginning of a semester and again at the end of a semester.

Criteria for Success (Thresholds for Assessment Methods):
Direct Assessment

- *Summative Assessment:* 70% of students in Excelling or Practicing. Summative assessments capture the "endgame" so to speak and so we use this measure to kick-off identification of action items.
- *Formative Assessment:* 70% of students in Excelling, Practicing, or Apprentice. Formative assessments provide us with "mid-term" knowledge of attainment and provide a

comparative measure by which to identify whether students are making progress in the program.

Indirect Assessment

Pre-Post Surveys (Pre-Post): Pre-post surveys are conducted for courses in which a direct assessment is scheduled. The pre-post survey is administered twice: once at the beginning of a semester and again at the end of a semester. The results of the pre-post survey are measured using a Student's T-Test to determine whether a statistically significant change in a student's perception of learning is observed. Any measurement of the T-Test that results in a p-value of 0.05 or lower is deemed as significant.

In regard to attainment levels, we expect the following: Student perceptions should exhibit a change in the aggregate mean towards "Extremely Well". Achieving a p-value of 0.05 is desirable but secondary.

Link to 'Tech Tomorrow' Strategic Plan:
2.A Technology Infused Programs

Results and Analysis:
Outcome 6: Apply computer science theory and software development fundamentals to produce computing-based solutions

CSC 2310 Object-Oriented Programming and Design

Performance Criteria (Traits):

Students can apply computer science theory and software development fundamentals to ***design*** computing-based solutions. (*Bloom's taxonomy level: Apply*)
Students can apply computer science theory and software development fundamentals to ***implement*** computing-based solutions. (*Bloom's taxonomy level: Apply*)

Criterion 1 – Students can apply computer science theory and software development fundamentals to ***design*** computing-based solutions.

Students were given a description of a software development project as provided by the client and eventual end user. Students were then asked to produce the following artifacts:

Use Case Diagram – Adapting user stories and client requests, and inferring necessary features based on the project description.

Class Diagram – Depicting classes, attributes, and class relations for a potential implementation given the features expressed in the use case diagram.

The students' diagrams were evaluated according to three standards: correctness, internal consistency, and external consistency.

Correctness refers to the student's understanding and proper use of diagram notation.

Internal consistency refers to how accurately the diagrams reflect the student's personal interpretation of the project, and whether the diagrams depict a cohesive product (it is possible for students to misunderstand the project requirements but still produce an otherwise excellent and coherent solution).

External consistency refers to how accurately the diagrams reflect the project requirements as given by the client/user and in-class discussions.

A student's performance in these three categories determined their achievement for the assignment, given in five levels: excelling, practicing, apprentice, novice, and insufficient. These levels can be considered approximations of a traditional five-category grade scale. Student achievement levels are depicted in the following table.

Excelling	43%
Practicing	25%
Apprentice	9%
Novice	3%
Insufficient	6%

Criterion 2 – Students can apply computer science theory and software development fundamentals to ***implement*** computing-based solutions.

Students were assigned two development iterations, each lasting one-and-half weeks (abbreviated from two weeks due to schedule constraints) to implement the features depicted in the design stage and produce working software solutions.

Iteration 1 – Produce underlying classes necessary for the program to read input data and generate appropriate objects.

Iteration 2 – Produce managerial classes to handle objects produced in Iteration 1, and ensure that the program is compatible with the user interface.

For both iterations, student progress was evaluated as a percentage of the necessary features (correctly working) produced by the student. Achievement for these assignments is expressed in the same five levels as Criterion 1: excelling, practicing, apprentice, novice, and insufficient.

In Iteration 1, a minimum of twenty-three methods across at least two classes were needed to satisfy the project requirements. Student achievement levels are depicted in the following table.

Excelling	76%
Practicing	5%
Apprentice	1%
Novice	5%
Insufficient	13%

In Iteration 2, a minimum of eight features (accessed by the user) were needed to satisfy the project requirements. Implementation of these features was spread across four classes and approximately forty-two methods (which the students produced) and which must be compatible with the other files provided in the project environment. Student achievement levels are depicted in the following table.

Excelling	31%
Practicing	15%
Apprentice	24%
Novice	14%
Insufficient	15%

Observations

Between the ***design*** stage and Iteration 1 of the ***implement*** stage, the percentage of students in the excelling category increased significantly, from 43% to 76% respectively. However, this percentage dropped to 31% for Iteration 2, and Iteration 2 likewise saw the highest percentage of insufficient, novice, and apprentice achievement.

Firstly, it should be noted that Iteration 2 (occurring in the last weeks of the semester) will naturally suffer from student fatigue and divided attention, and so some degree of lower performance is expected. That said, it seems probable that the student achievement at each task is connected, to some extent, with the nature of the assignment. This is discussed as follows:

For the Use Case and Class Diagrams, students performed reasonably well, with 68% achievement at either excelling or practicing. Students were able to quickly grasp design and modeling concepts and could think critically about a software solution without connecting it to a specific implementation.

For Iteration 1, students achieved highest performance levels, with 81% at either excelling or practicing (76% of which was excelling). I suspect this is because Iteration 1 demanded a concrete implementation (which may be easier for students to grasp than abstract design), but the implementation was not directly dependent on an external environment or on code produced by other developers. This means Iteration 1 largely tested the students' ability to produce working code in a vacuum, a task at which most students seemed to excel.

For Iteration 2, students achieved the lowest performance levels, with only 46% at excelling or practicing. Continuing from the observations on Iteration 1, I expect this decrease in performance is attributable, in part, to the students needing to produce a software solution that was compatible. With a predetermined environment and with code produced by other developers. This task not only requires the ability to code in a vacuum, but also to understand pre-existing code, accommodate it, and debug issues that occur across many different project files.

Recommendations

Given the performance levels discussed in observations, I feel students will benefit from more practice programming in a specific environment and with multiple collaborators (past or present) working on the same project. This will exercise their ability to not only code in a vacuum, but to understand, analyze, and accommodate pre-existing code, and to cooperate with other developers. The students are already asked to perform these tasks, but I feel the relative drop in performance indicates that a greater emphasis may need to be placed on them.

CSC 4575 Spring 2022

Performance Criteria (Traits):

Students can apply computer science theory and software development fundamentals to ***design*** computing-based solutions. (*Bloom's taxonomy level: Apply*)
Students can apply computer science theory and software development fundamentals to ***implement*** computing-based solutions. (*Bloom's taxonomy level: Apply*)

Trait 1. Students can apply computer science theory and software development fundamentals to ***design*** computing-based solutions. (*Bloom's taxonomy level: Apply*)

Question from Assignment.

Decipher the following text produced by a **Caesar cipher**. Code to compute Correlation of Frequency for cryptanalysis.

If you use brute force with an exhaustive key search, you get

HALF points. Must show your work in detail. [20]

IT STY XYZRGQJ TAJW XTRJYMNSL GJMNSI DTZ

(shows spaces in proper place)

The following was enciphered with a **Vigenere cipher**. Find the key and decipher it. Code to compute Index of Coincidence (IC).

UPRCW IHSGY OXQJR IMXTW AXVEB DREGJ AFNIS EECAG SSBZR TVEZU RJCXT OGPCY OOACS
EDBGF ZIFUB KVMZU FXCAD CAXGS FVNKM SGOCG FIOWN KSXTS ZNVIZ HUVME DSEZU
LFMBL PIXWR MSPUS FJCCA IRMSR FINCZ CXSNI BXAHE LGXZC BESFG HLFIV ESYWO RPGBD
SXUAR JUSAR GYWRS GSRZP MDNIH WAPRK HIDHU ZBKEQ NETEX ZGFUI FVRI

You may work on part of it by hand (like which IC to choose).

You may reuse work from question 1 here once you have found the period and split the alphabet accordingly.

Must show your work in detail. [20]

Trait 1. Students can apply computer science theory and software development fundamentals to *design* computing-based solutions.				
Assessment	Excelling	Practicing	Apprentice	Novice
Assignment 2 - Cryptanalysis	54(87%)	2 (3%)	4 (6%)	2 (3%)

Trait 2. Students can apply computer science theory and software development fundamentals to
implement computing-based solutions. (*Bloom's taxonomy level: Apply*)

Hands-On Lab – PKI Implementation.

Public key cryptography is the foundation of today's secure communication, but it is subject to man-in-the- middle attacks when one side of the communication sends its public key to the other side. The fundamental problem is that there is no easy way to verify the ownership of a public key, i.e., given a public key and its claimed owner information, how do we ensure that the public key is indeed owned by the claimed owner? The Public Key Infrastructure (PKI) is a practical solution to this problem.

The learning objectives of this lab are to gain hands-on experience with PKI and learn how to do the following:

- Generate public/private key pair in Linux;
- Generate a Certificate Signing Request (CSR);
- Generate the self-signed certificates for the Certificate Authority (CA);
- Configure CA certificates in web browsers.

By doing the tasks in this lab, you should be able to gain a better understanding of how PKI works, and how PKI is used to protect the Web. Moreover, you will be able to understand the root of the trust in the PKI, and what problems will arise if the root trust is broken. This lab covers the following topics:

- Public-key encryption;
- Public-Key Infrastructure (PKI);
- Certificate Authority (CA) and root CA;
- X.509 certificate and self-signed certificate;
- HTTPS protocol for webservers.

Trait 1. Students can apply computer science theory and software development fundamentals to *implement* computing-based solutions.				
Assessment	Excelling	Practicing	Apprentice	Novice
Assignment 8 – PKI Implementation	50 (80%)	6 (9%)	4 (6%)	2 (3%)

Recommendation

None

Pre-Post Surveys

We administer a Pre-Post survey in selected courses according to a set schedule determined by our assessment plan. The tables shown below provide a summary of the responses by students according to questions related to each respective outcome. The data in each table shows the number of responses (N), the mean of the pretest (pre mean), standard deviation of the pretest (pre std), and the corresponding responses in the post test (i.e., post N, post mean, and post std). A positive value in the change column indicates an improvement in student perceptions of learning in that area. The p-value indicates the significance of the result.

We have notably found that in some semesters that the response rate of students exhibited a mismatch between respondents in pre-post administrations. We consider those data points to be invalid and have highlighted them as such. The remaining data shows that in most cases there is a positive shift in the means between the pre and post surveys except for a few instances. This indicates that students believe there is a perception of learning during a given

semester. We are especially interested in the results of the capstone courses (i.e., the culminating experience). In each of these cases, there is a positive shift in the mean.

OUTCOME 1 – Fall 2023

Q1 - How well can you analyze a complex problem? (Analyzing a problem means determining the elements or essential features of that problem.)								
	pre N	pre mean	pre std	post N	post mean	post std	change	p-value
1300-001	8	2.38	0.52	10	2.40	0.52	-0.02	0.46
1300-002	8	2.13	0.99	1	2.00	N/A	0.13	N/A
1300-003	22	2.45	0.51	13	2.08	0.86	0.38	0.06
1300-ALL	38	2.37	0.63	24	2.21	0.72	0.16	0.18
Capstone1	15	2.27	0.80	3	2.00	0.00	0.27	0.58
Capstone2	14	1.86	0.66	4	1.75	0.50	0.11	0.39
Capstone	29	2.07	0.75	7	1.86	0.38	0.21	0.24

Q2 - How well can you identify and define the computing requirements appropriate for a solution to a complex problem?								
	pre N	pre mean	pre std	post N	post mean	post std	change	p-value
1300-001	8	2.38	0.52	10.00	2.80	0.92	-0.43	0.12
1300-002	8	2.50	0.76	1.00	2.00	N/A	0.50	N/A
1300-003	22	2.73	0.70	13.00	2.23	0.93	0.50	0.04
1300-ALL	38	2.61	0.68	24.00	2.46	0.93	0.15	0.24
Capstone1	15	2.60	0.74	3	2.00	1.00	0.60	0.12

Use of Results to Improve Outcomes:

- Given the performance levels discussed in observations, I feel students will benefit from more practice programming in a specific environment and with multiple collaborators (past or present) working on the same project. This will exercise their ability to not only code in a vacuum, but to understand, analyze, and accommodate pre-existing code, and to cooperate with other developers. The students are already asked to perform these tasks, but I feel the relative drop in performance indicates that a greater emphasis may need to be placed on them.

Summative Evaluation:

SLO 1:

- Each year, the number of excelling continues to increase. There are still a surprising number of students that are unable to identify issues with a story. They do fine as a Team (see the previous example), but individually, they still need to work on writing good user stories.
- In previous years, it was suggested to workshop with them on story writing. However, given the size of this class this year (86), there just was not the time to work with each Team.

SLO 2:

- It may be beneficial to place a greater emphasis on abstract depictions of code (e.g. class diagrams, sequence diagrams, etc.) and ensure that students understand and can articulate the value of these tools for software development.

SLO 3:

- Overall, students seem to be getting better in terms of their professionalism and presentation skills. Some students still struggle with public speaking and could use further instruction (outside of this course).
- Keeping the class smaller this time was very helpful as it allowed me to spend more one-on-one time with the teams, helping them with topics like professionalism and detail.

SLO 4:

- An observation is that students tend to forget to use an ethical framework to defend their opinions unless they are explicitly told to do so in the text of the question. In future semesters, we need to stress the importance of defending opinions with an ethical framework based on logic, reason, and facts.
- Enhance discussion of ethical and legal uses of potentially intrusive cybersecurity tools. The program currently requires the signature of a “code of ethics” at the beginning of the course.
- Ethics will be covered much earlier in the semester.

SLO 5:

- While I encouraged the changing of leadership after each iteration, it did not always happen. While some are clearly better than others at being the leader, everyone needs to get the experience.
- Again, I need to find a way to enforce equal input to the reports and not let them rely on one or two individuals to do all the report writing. Perhaps the name of the individual who did each section?

SLO 6:

- Given the performance levels discussed in observations, I feel students will benefit from more practice programming in a specific environment and with multiple collaborators (past or present) working on the same project. This will exercise their ability to not only code in a vacuum, but to understand, analyze, and accommodate pre-existing code, and to cooperate with other developers. The students are already asked to perform these tasks, but I feel the relative drop in performance indicates that a greater emphasis may need to be placed on them.

List of Appendices:
Appendix 1: Curriculum Map

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	Outcome Relevancy Level (L = Low or None, M = Medium, H = High)					
	1	**2**	**3**	**4**	**5**	**6**
CSC 1200 - Principles of Computing	H	H	L	L	L	L
CSC 1300 - Intro to Problem Solving and Computer Programming	H	H	L	L	L	L
CSC 1310 - Data Structures and Algorithms	H	H	L	M	L	H
CSC 2310 - Object-Oriented Programming and Design	H	H	L	L	L	H
CSC 2400 - Design of Algorithms	H	H	L	L	L	M
CSC 2500 - Unix Laboratory	L	L	L	L	L	L
CSC 2560 Networks for Information Technology	H	H	L	L	L	H
CSC 2700 - Discrete Structures for Computer Science	L	L	L	L	L	L
CSC 3020 Numerical Methods	H	H	L	L	L	M
CSC 3040 – Professionalism, Communication, and Research in Comp	L	L	H	H	L	L
CSC 3220 Fundamentals of Data Science	H	H	M	M	M	L
CSC 3230 Healthcare Data Analytics	H	H	M	H	L	H
CSC 3300 - Database Management Systems	M	M	L	L	L	M
CSC 3410 - Computer Organization and Assembly Lang Programming	H	M	L	L	L	M
CSC 3710 - Foundations of Computer Science	M	M	L	L	L	M
CSC 4010 Programming Languages	H	H	L	L	L	H
CSC 4040 Undergraduate Computing Research Experience	H	H	M	M	L	H
CSC 4100 (5100) - Operating Systems	M	L	L	L	L	H
CSC 4200 (5200) – Computer Networks	M	M	L	L	L	H
CSC 4220 Data Mining and Machine Learning	H	H	M	M	M	L
CSC 4240 Artificial Intelligence	M	L	L	M	M	L
CSC 4320 (5320) - Computer Architecture	M	L	L	L	L	M
CSC 4400 Analysis of Algorithms	H	M	L	L	L	M
CSC 4570 IT Security	H	L	M	H	H	L
CSC 4575 Information Assurance and Cryptography	H	L	H	H	H	L
CSC 4580 Software Reverse Engineering	H	H	L	L	L	H
CSC 4610 - Software Engineering I	H	H	H	H	H	H
CSC 4620 - Software Engineering II	H	H	H	H	H	H
CSC 4710 Design and Development of Human/Web Interfaces	H	H	M	M	M	H
CSC 4750 Computer Graphics	H	M	L	L	L	H
CSC 4760 Parallel Programming	M	H	L	L	L	H
CSC 4770 Distributed and Cloud Computing	M	H	L	L	L	L
CSC 4990 Computer Science Internship	M	M	H	H	H	M