Institutional Effectiveness Report
2022-2023

Program: Computer Science BS

College and Department: College of Engineering – Computer Science

Contact: Gerald C. 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 it's focus on improving student experience, transforming technology, and creating distinctive programs.

Attach Curriculum Map (Educational Programs Only):
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 "end-game" 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 regards 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:

CSC 4610 Software Engineering I

Performance Criteria (Traits):

1. **Students can identify and define the computing requirements appropriate to its solution. (Bloom's taxonomy level: Analysis)**
2. **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	**49 (57%)**	**19 (22%)**	**8 (9%)**	**10 (12%)**
Midterm: Analysis – Q2a-d	**15 (17%)**	**11 (13%)**	**19 (22%)**	**41 (48%)**
Project Charter Documents	**32 (37%)**	**42 (49%)**	**12 (14%)**	**0**

Trait 2. Students can analyze and weigh trade-offs related to computing problems.				
Assessment	Excelling	Practicing	Apprentice	Novice
Midterm: Analysis – Q3a-d	**36 (42%)**	**13 (15%)**	**18 (21%)**	**19 (22%)**
Midterm: Short Answer – Q3	**56 (65%)**	**9 (11%)**	**2 (2%)**	**19 (22%)**

Traits

1. **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>: Overall, students were able to identify relevant stakeholders, and while most understood their importance to a project, a small number had difficulty in 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	**49 (57%)**	**19 (22%)**	**8 (9%)**	**10 (12%)**

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.

Level of Influence			
	High Influence	Keep Satisfied	Manage Closely
	Low Influence	Monitor	Keep Informed
		Low Interest	High Interest

Level of Interest

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.

  <u>Summary</u>: Students 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	**15 (17%)**	**11 (13%)**	**19 (22%)**	**41 (48%)**

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 software development manager, I want the *developers to follow our processes* so that we can be an efficient organization"
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 thousands financial systems in production in the industry as well as future systems."
d. "As a student user of iLearn, I want to be able to *generate an audio study guide using the **planned** podcast feature* of iLearn, so that I can listen to lectures online while I am in my car."

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 user 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>*". In addition, these same teams also identified story points and priorities (using MoSCoW). The "apprentice" listed their stories but were missing some context, weightings, or priorities.

Assessment	Excelling	Practicing	Apprentice	Novice
Project Charter Documents	**32 (37%)**	**42 (49%)**	**12 (14%)**	**0**

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

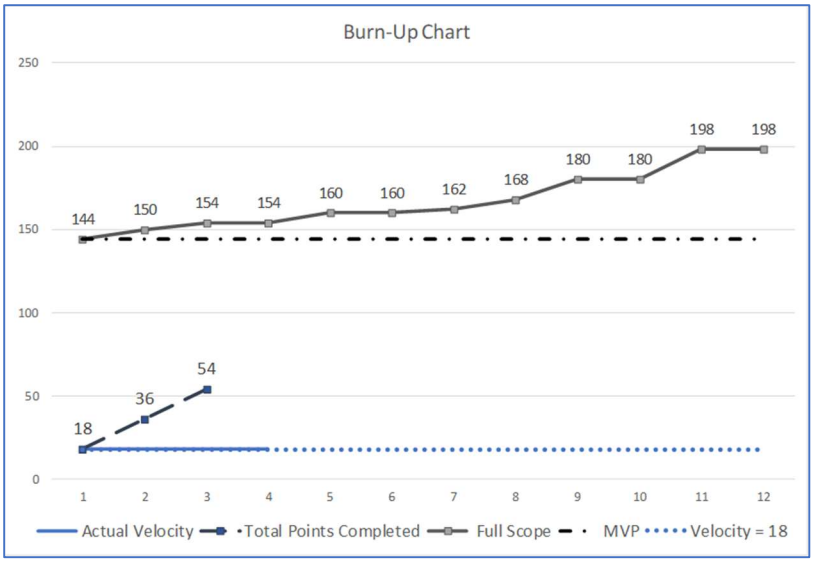
- Burn-up chart question on exam: ***Analysis – Q3a-d*** – these questions assess students' ability to analyze the amount of effort needed for a project.

  Summary: 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 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/explain how you came up with your answer.
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/explain how you came up with your answer.
d. Given the scenario in the previous questions, what must happen in order to effectively deliver the "new" MVP?

Assessment	Excelling	Practicing	Apprentice	Novice
Analysis - Q3a-d	**36 (42%)**	**13 (15%)**	**18 (21%)**	**19 (22%)**

- Business Rule Variation Question on exam: ***Short Answer - Question 3*** – this question exercises the students' ability to identify variations (i.e., alternatives) to potential features in a requested software system.

  <u>Summary</u>: 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 – Q3 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 – Q3	**56 (65%)**	**9 (11%)**	**2 (2%)**	**19 (22%)**

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.**

1) *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: Outcome 2 was assessed using the following criteria:

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

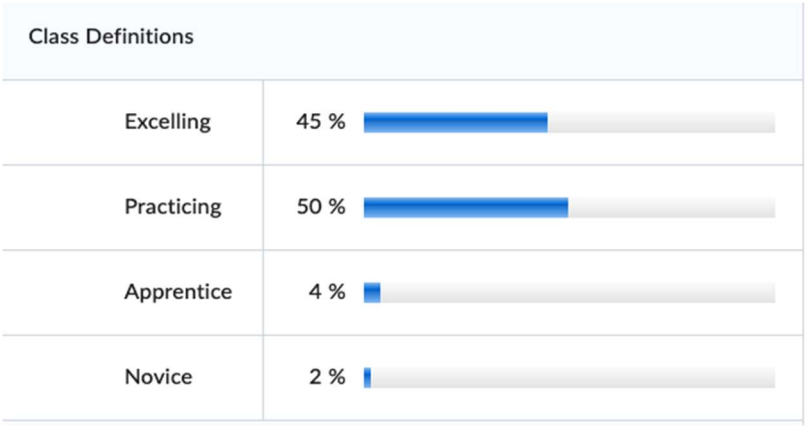
We assessed these criteria using a significant design and implementation project. The assignment description is attached.

Performance Criterion 1: The student can design a computing-based solution given a set of requirements

We assessed this criterion using *Concept Initiate 2*, which was an activity that required the students to translate user requirements expressed with use case diagrams into class diagrams representing three levels of concerns, namely data (via class definitions), aggregates (via refinements of the class definitions), and relations (i.e., the relationships between different classes). The rubric used to assess the work of the students is shown below for the *data* component of this assessment.

Data	Excelling 6 points	Practicing 4 points	Apprentice 1 point	Novice 0 points	Criterion Score
Class Definitions	Class definitions capture attributes, including correct specification of types	Missing some key attributes, methods, or there problems with the spec (missing types?)	Missing most classes, attributes, methods, or there are major problems with types	No submission or major problems	/ 6

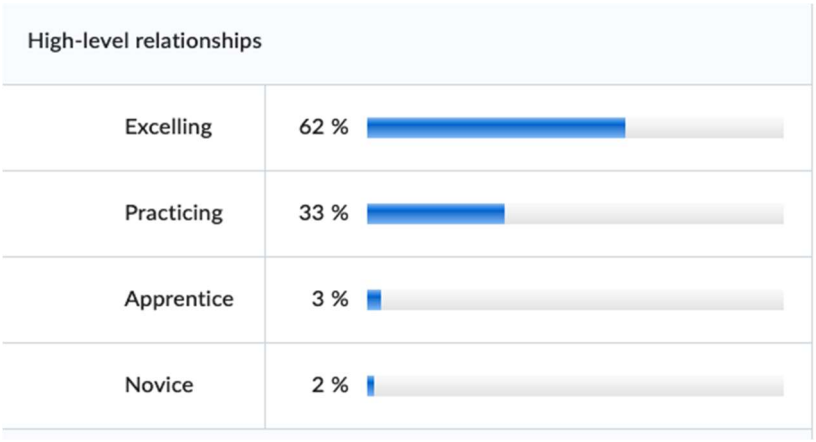
The table shown below shows that 95% of the student submissions were at the Excelling and Practicing levels. This means that most problems were minor and easily correctable.



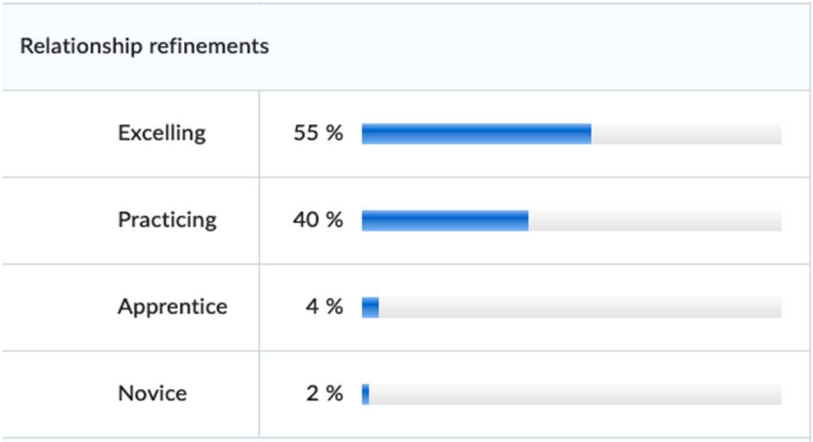
The modeling of complex relationships between classes was assessed using the following rubric. The assessment was split into three different components: high-level relationships, relationship refinements, and multiplicities.

Relations	Excelling 6 points	Practicing 4 points	Apprentice 1 point	Novice 0 points	Criterion Score
High-level relationships	Captures basic relationships between classes	missing some high-level relationships	missing most high-level relationships	No submission or major problems	/ 6
Relationship refinements	Correctly refines relationships according to semantic definitions of aggregation, composition, and inheritance	some refinements used	relationships refined incorrectly, including using the wrong symbols	No submission or major problems	/ 6
Multiplicities	Correctly captures use of multiplicities	some minor multiplicity problems	multiplicities missing entirely or mostly incorrect	No submission or major problems	/ 6

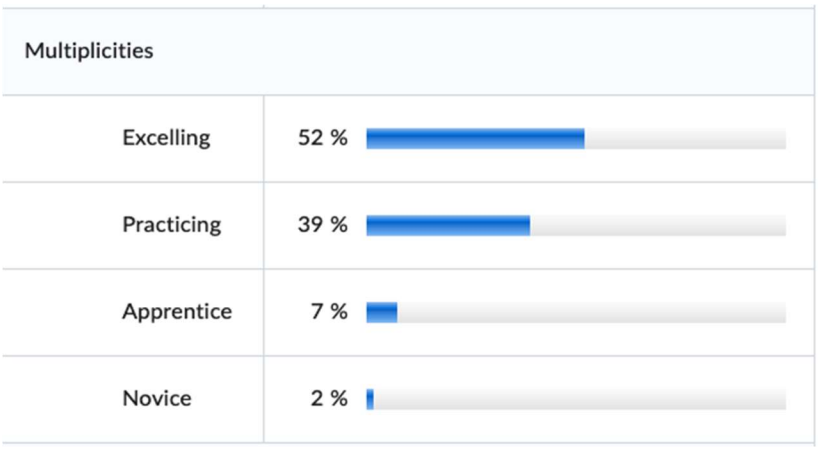
The tables below show the results of the direct assessment of student work. With respect to High-Level relationships, 95% of the submissions met the criteria of Excelling or Practicing, indicating that they were able to capture most if not all of the primary relationships that were expected in the system, with 62% achieving Excelling and 33% achieving Practicing. The remaining 5% had major problems in their design. This assessment evaluated whether students were able to recognize and specify that classes had a basic relationship via association (or some variant thereof).



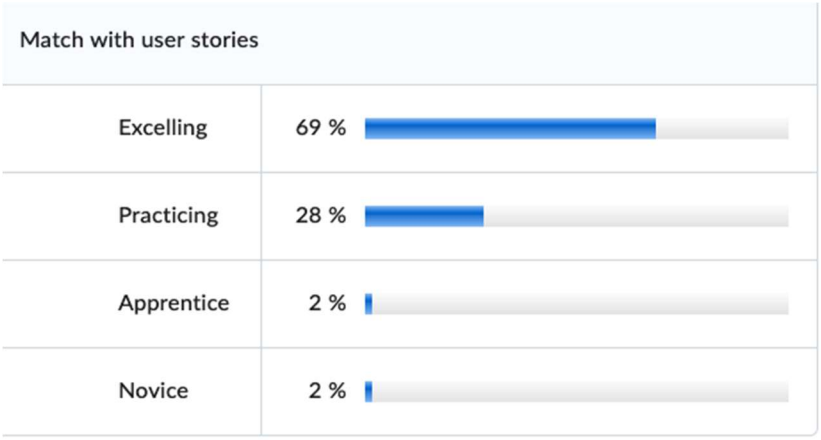
The next criterion (Relationship refinements) also had a 95% achievement rate above Excelling and Practicing, but had fewer in the Excelling level (55%) and more in the Practicing level (40%). This particular assessment focuses on the ability of students to use more than just the standard *association* relationship and instead showed refinements using either *composition* or *aggregation.*



The *Multiplicities* criterion further evaluates student knowledge of modeling relationships by verifying whether multiplicity values were captured. The overall achievement level for this criterion in the Excelling/Practicing range was reduced to 89% compared to the previous criterion. As students refine models, this criterion demonstrates more advanced knowledge.



Finally, we evaluated whether students were able to translate design and requirements into a model. A small number of students (4%) were below the Excelling and Practicing range.



Performance Criterion 2: The student can implement a computing-based solution given a set of requirements

Performance Criterion 2 was evaluated using both Iteration 1 and Iteration 2 of the project from this semester. We were primarily evaluating whether students were able to implement the classes that were required for the iteration. The rubric for Iteration 1 is shown below for the implementation of the ArtistGraph and Collaboration classes. In these rubrics, the levels represent the following:

Level 4 – Excelling – Student exceeds expectations

Level 3 – Practicing – Student meets expectations

Level 2 – Apprentice – Student is below expectations

Level 1 – Novice – Student is well below expectations

Coding	**Level 4** 5 points	**Level 3** 3 points	**Level 2** 1 point	**Level 1** 0 points
ArtistGraph	Coded solution addresses expectations	Some problems in the implementation	Major problems with code	No submission
Collaboration	Coded solution addresses expectations	Some problems in the implementation	Major problems with code	No submission

The tables shown below provide the results of the assessment of student implementations. As shown below, 98% of the students were able to implement the basic ArtistGraph class at Excelling or Practicing levels, whereas 93% were able to achieve these levels for the Collaboration class.

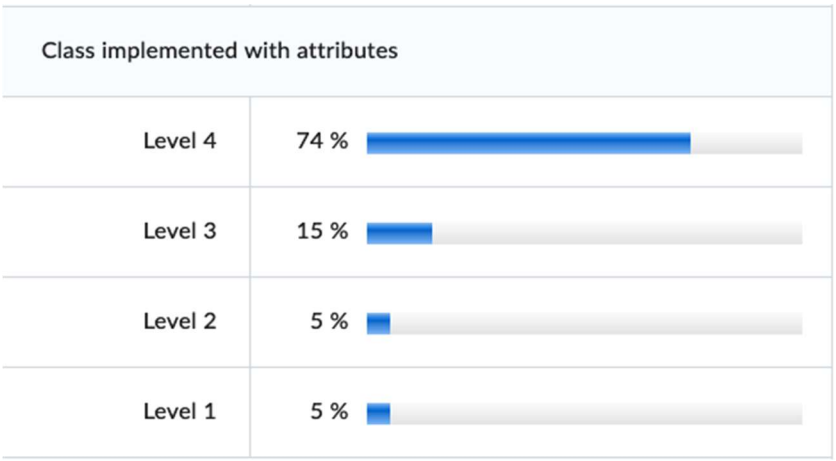
ArtistGraph	
Level 4	49 %
Level 3	49 %
Level 2	1 %
Level 1	1 %

Collaboration	
Level 4	57 %
Level 3	36 %
Level 2	6 %
Level 1	1 %

For Iteration 2, students were required to implement a class called “DiscogsBridge”, a class that was responsible for connecting the application to an external web service. The rubric was based on assessing implementation of reading class attribute values from the service.

Class implemented with attributes	5 points Class implements the basic attributes	3 points Missing attributes	1 point	0 points No submission	/ 5

As shown below, 89% of the students were able to accurately implement the use of the data service.



Performance Criterion 3: The student can evaluate/test a computing-based solution given a set of requirements

Performance Criterion 3 evaluates whether students can test a solution. We measured this criterion by evaluating whether student solutions passed the tests provided by the instructor and tests that were self-written.

The rubric for the instructor tests is shown below.

Instructor (AG)	**Excelling** 10 points	**Practicing** 7 points	**Apprentice** 4 points	**Novice** 0 points
Artist Graph	All tests pass	Fewer than 3 tests fail	Many tests fail	No submission
Collaboration, ArtistList, MongoBridge	All tests pass	Fewer than 4 tests fail	Many tests fail	No submission

As shown in the next table, for the ArtistGraph class, 69% of the students were at the Excelling and Practicing levels, while 31% were in Apprentice/Novice.

Artist Graph	
Excelling	33 %
Practicing	36 %
Apprentice	30 %
Novice	1 %

The achievement on the Collaboration, ArtistList, and MongoBridge tests are shown below. For these tests, 78% of the students were at the Excelling and Practicing levels, while 22% were at Apprentice and Novice.

Collaboration, ArtistList, MongoBridge	
Excelling	40 %
Practicing	38 %
Apprentice	21 %
Novice	1 %

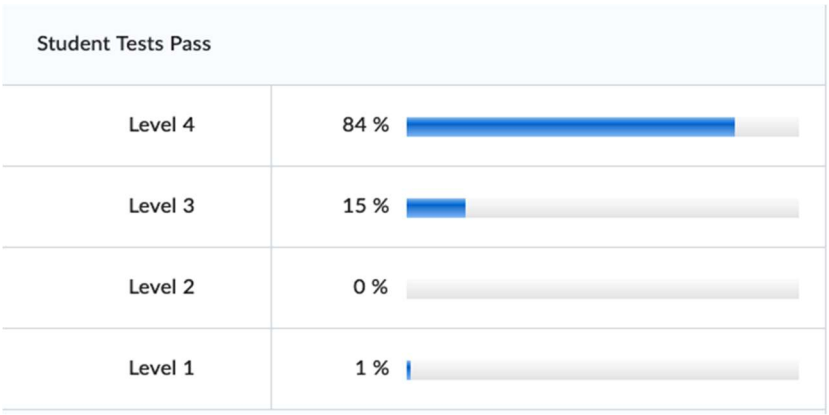
Students were also given the opportunity to submit their own unit tests for this iteration. The rubric is shown below. The rubric assessed whether students created comprehensive sets of tests and whether their code passed those submitted tests.

Student Tests Written	Comprehensive set of tests	At least one test per method created	Few tests or tests are only minor variations of the provided tests	No submission
Student Tests Pass	All student tests pass	Most student tests pass (fewer than 4 fail)	Many student tests fail	No submission

As shown in the next table, 97% of the students submitted tests that were either in the Excelling or Practicing levels.

Student Tests Written	
Level 4	74 %
Level 3	23 %
Level 2	0 %
Level 1	2 %

The final assessment was focused on whether submitted tests passed. As shown below, 99% of the students achieved Excelling and Practicing levels of achievement on their own tests.



Use of Results to Improve Outcomes:

The achievement levels for all the applied rubrics were well within the expectations of the course, based on passed achievement levels in previous semesters. None of the assessments yielded performance requiring further study. A significant outcome of this semester was that the shift in programming languages from Java to Python seemed to have the desired effect that student performance fell within expected ranges of achievement.

Recommendations:

There are no recommendations at this time for changes to this course or to ways in which Outcome 2 should be taught.

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

Define Outcome:

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Indirect Assessment

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2.A Technology Infused Programs

Results and Analysis:

2) *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 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
Test1 – Q 8	36 (62.5%)	0 (0%)	0 (0%)	21 (37.5%)
Test1 – Q 9	44 (78.6%)	0 (0%)	0 (0%)	12 (21.4%)
Test2 – Q 1	37 (66.1%)	0 (0%)	0 (0%)	19 (33.9%)
Test4 – Q 8	18 (32.7%)	12 (21.8%)	22 (40%)	3 (5.5%)
Test4 – Q 10	14 (25.5%)	24 (43.6%)	12 (21.8%)	5 (9.1%)
Test4 – Q 12	53 (96.4%)	0 (0%)	0 (0%)	2 (3.6%)

Trait 2. Students can implement a computing-based solution to meet a given set of database related computing requirements				
Assessment	Excelling	Practicing	Apprentice	Novice
Test1 – Q 4	51 (91.1%)	0 (0%)	0 (0%)	5 (8.9%)
Test1 – Q 6	46 (82.1%)	0 (0%)	0 (0%)	10 (17.9%)
Test1 – Q 10	55 (98.2%)	0 (0%)	1 (1.8%)	0 (0%)
Test2 – Q 8	28 (48.3%)	15 (25.9%)	14 (24.1%)	1 (1.7%)
Test2 – Q 10	45 (77.6%)	4 (6.9%)	8 (13.8%)	1 (1.7%)
Test2 – Q 11	54 (93.1%)	2 (3.5%)	1 (1.7%)	1 (1.7%)

Test2 – Q 12	28 (48.3%)	18 (31%)	10 (17.2%)	2 (3.5%)
Test2 – Q 20	49 (84.5%)	6 (10.3%)	2 (3.5%)	1 (1.7%)
Test3 – Q 4	44 (78.6%)	0 (0%)	0 (0%)	12 (21.4%)
Test3 – Q 9	34 (60.7%)	0 (0%)	0 (0%)	22 (39.3%)
Test3 – Q 16	31 (55.4%)	0 (0%)	0 (0%)	25 (44.6%)
Test4 – Q 1	28 (50.9%)	0 (0%)	0 (0%)	27 (49.1%)
Test4 – Q 9	42 (76.4%)	0 (0%)	0 (0%)	13 (23.6%)
Test4 – Q11	1 (1.8%)	38 (69.1%)	14 (25.5%)	2 (3.6%)

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
Test1 – Q 1	51 (91.1%)	0 (0%)	0 (0%)	5 (8.9%)
Test1 – Q 2	45 (80.4%)	0 (0%)	0 (0%)	11 (19.6%)
Test1 – Q12	54(96.4%)	0 (0%)	0 (0%)	2 (3.6%)
Test2 – Q 5	43 (76.8%)	0 (0%)	0 (0%)	13 (23.2%)
Test2 – Q 17	26 (46.4%)	0 (0%)	0 (0%)	30 (53.6%)
Test2 – Q 19	14 (25%)	0 (0%)	0 (0%)	42 (75%)
Test3 – Q 10	47 (83.9%)	0 (0%)	0 (0%)	9 (16.1%)
Test3 – Q 11	54 (96.4%)	2 (3.6%)	0 (0%)	0 (0%)
Tets3 – Q 18	29 (51.8%)	13 (23.2%)	10 (17.9%)	4 (7.1%)
Test4 – Q 2	44 (80%)	0 (0%)	0 (0%)	11 (20%)
Test4 – Q 6	32 (58.2%)	19 (34.5%)	4 (7.3%)	0 (0%)
Test4 – Q 18	22 (40%)	0 (0%)	0 (0%)	33 (60%)

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)***

Test1 – selected questions:

- Exam questions to identify and design database concepts

Assessment	Excelling	Practicing	Apprentice	Novice
Test1 – Q 8	36 (62.5%)	0 (0%)	0 (0%)	21 (37.5%)
Test1 – Q 9	44 (78.6%)	0 (0%)	0 (0%)	12 (21.4%)

Text of selected questions from test1

Q 8: (1 point; TRUE/FALSE) {card_no, email_address} is the candidate key of the relation MEMBER.

- True
- False

Q 9: (1 point; TRUE/FALSE) Let's consider:
- removing the table BOOK_AUTHOR from the database schema, and
- adding an attribute author_id to the table BOOK, and
- making the attribute author_id a foreign key referencing the attribute author_id of a relation AUTHOR.

Is it true or false, that in the new schema of the database it will be possible for a book to have at most one author?

- (•) True
- False

Test2 – selected questions:

- Exam questions to identify and design database concepts

Assessment	Excelling	Practicing	Apprentice	Novice
Test2 – Q 1	37 (66.1%)	0 (0%)	0 (0%)	19 (33.9%)

Text of selected questions from test2

Q 1: (2 points; TRUE/FALSE) If a ***grade*** attribute of the relation ***takes*** was part of the current primary key of this relation, then a student could receive more than one grade for a given course section in a given semester and year.

- True
- False

Test4 – selected questions:

- Exam questions to identify and design database concepts

Assessment	Excelling	Practicing	Apprentice	Novice
Test4 – Q 8	18 (32.7%)	12 (21.8%)	22 (40%)	3 (5.5%)

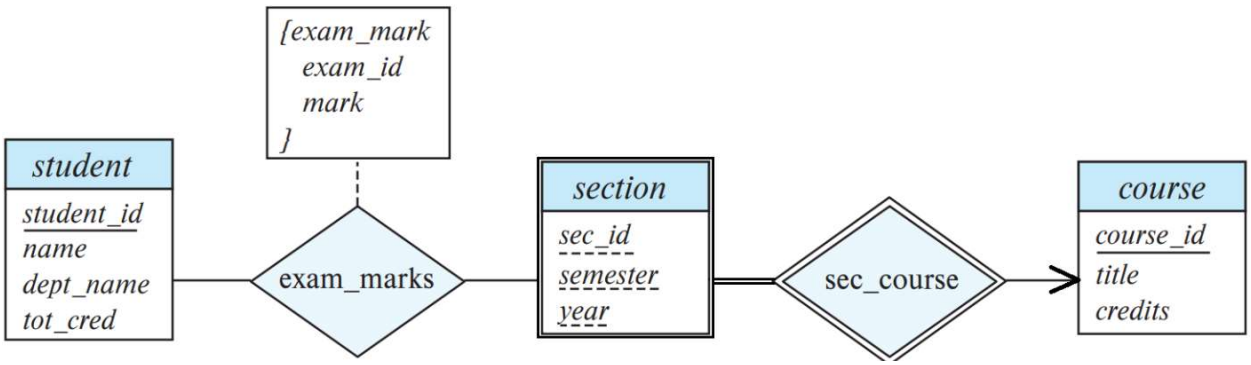
Test4 – Q 10	14 (25.5%)	24 (43.6%)	12 (21.8%)	5 (9.1%)
Test4 – Q 12	53 (96.4%)	0 (0%)	0 (0%)	2 (3.6%)

Text of selected questions from test4

Q 8: (10 points; Fill in the Blanks) Construct an E-R diagram for a car insurance company whose customers own one or more cars and no two customers own the same car. Each car has associated with it zero to any number of recorded accidents. An accident may be associated with 0 or more cars. Each insurance policy covers one or more cars and has one or more premium payments associated with it. Each payment is for a particular period of time, and has an associated due date, and the date when the payment was received. There are [ ] strong entities and [ ] weak entity set(s). There are [ ] relationships. The relationship between CAR entity and ACCIDENT entity is of type [ ]. The relationship between entity CUSTOMER and entity CAR is of type [ ].

10 – 8 students
8 – 10
6 – 12 students
4 – 15
2 – 7
0 – 3

Q 10: (16 points; Multiple Select) What is true about the below diagram?



- ☐ There is one multivalued attribute.
- ☐ There is one derived attribute.
- ☐ Every object of type *section* is associated with exactly one object of type *course*.
- ☐ *sec_id* doesn't uniquely identify a section.
- ☐ There may be no sections for a course.
- ☐ Grades that students get in different exams of different course offerings (sections) are recorded in the database.

☐ One relationship is of type one-to-one.

☐ Student has to receive at least one grade for some test of a course section.

16 – 3 students
14 – 11
12 – 14 students
10 – 10
8 – 8
6 – 4
4 - 3
2 - 2
0 - 0

Q 12: (2 points; Fill in the Blanks) An entity whose existence depends on another entity is called a _____ entity.

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

Test1 – selected questions:

- Exam questions to implement and apply database concepts

Assessment	Excelling	Practicing	Apprentice	Novice
Test1 – Q 4	51 (91.1%)	0 (0%)	0 (0%)	5 (8.9%)
Test1 – Q 6	46 (82.1%)	0 (0%)	0 (0%)	10 (17.9%)
Test1 – Q 10	55 (98.2%)	0 (0%)	1 (1.8%)	0 (0%)

Text of selected questions from test1

Q 4: (1 point; Multiple Choice) Which date does the following query not return?

```
πb2.date_borrowed σb1.date_borrowed < b2.date_borrowed (ρb1 BORROW ×
ρb2 BORROW)
```

○ It doesn't return the earliest date someone borrowed a book.

○ It doesn't return the latest date someone borrowed a book.

Q 6: (1 point; Multiple Choice) What does the following query return?

```
πba1.ISBN (σba1.ISBN = ba2.ISBN ∧ ba2.ISBN = ba3.ISBN ∧
ba1.author_id ≠ ba2.author_id ∧ ba2.author_id ≠ ba3.author_id ∧
ba1.author_id ≠ ba3.author_id
(ρba1 BOOK_AUTHOR × ρba2 BOOK_AUTHOR × ρba3 BOOK_AUTHOR))
```

- ISBNs of books having 3 or more authors.
- ISBNs of books having 3 authors.
- ISBNs of books having 2 or more authors.
- None of the other options/Something else.

Q 10: (1 point; Multiple Select) Which relational algebra queries, if any, return card numbers, first, middle and last names of members who didn't ever borrow any book?
Answer

- `πcard_no, first_name, middle_name, last_name MEMBER - πcard_no, first_name, middle_name, last_name(MEMBER ⋈ BORROW)`
- `πcard_no, first_name, middle_name, last_name ((πcard_no MEMBER - πcard_no BORROW) ⋈ MEMBER)`
- `πcard_no, first_name, middle_name, last_name (MEMBER ⋈ BORROW)`
- `πcard_no, first_name, middle_name, last_name MEMBER - πcard_no BORROW`

1 – 52 students received that number of points
0.72 - 3
0.5 - 0
0.25 - 1
0 – 0 students

Test2 – selected questions:

- Exam questions to implement and apply database concepts

Assessment	Excelling	Practicing	Apprentice	Novice
Test2 – Q 8	28 (48.3%)	15 (25.9%)	14 (24.1%)	1 (1.7%)
Test2 – Q 10	45 (77.6%)	4 (6.9%)	8 (13.8%)	1 (1.7%)
Test2 – Q 11	54 (93.1%)	2 (3.5%)	1 (1.7%)	1 (1.7%)
Test2 – Q 12	28 (48.3%)	18 (31%)	10 (17.2%)	2 (3.5%)
Test2 – Q 20	49 (84.5%)	6 (10.3%)	2 (3.5%)	1 (1.7%)

Text of selected questions from test2

Q 8: (8 points; Multiple Select) Which query returns IDs and names of instructors from the Computer Science Dept. who taught a course along with its direct prerequisite in some semester and year.

☐
```
select i1.ID, i1.name
from instructor i1 natural join teaches tc1 natural join course as
c1, instructor i2 natural join teaches t2 natural join course as c2,
prereq
where i1.ID = i2.ID
and i1.dept_name = 'Comp. Sci.'
and prereq.course_id = c1.course_id
and prereq.prereq_id = c2.course_id;
```
☐
```
select i1.ID, i1.name
from instructor i1 natural join teaches tc1, course as c1, instructor
i2 natural join teaches tc2, course as c2,
prereq
where i1.ID = i2.ID
and i1.dept_name = 'Comp. Sci.'
and tc1.course_id = c1.course_id
and tc2.course_id = c2.course_id
and prereq.course_id = c1.course_id
and prereq.prereq_id = c2.course_id;
```
☐
```
select i1.ID, i1.name
from instructor i1 natural join teaches tc1, course as c1, instructor
i2 natural join teaches tc2, course as c2,
prereq
where i1.ID = i2.ID
and i1.dept_name = 'Comp. Sci.'
and tc1.course_id = c1.course_id
and tc2.course_id = c2.course_id
and prereq.course_id = c1.course_id
and prereq.prereq_id = c2.course_id
and tc1.semester = tc2.semester
and tc1.year = tc2.year;
```
☐
```
select i1.ID, i1.name
from instructor i1 natural join teaches tc1 natural join course as c1
natural join instructor i2 natural join teaches tc2 natural join
course as c2,
prereq
where i1.dept_name = 'Comp. Sci.'
and prereq.course_id = c1.course_id
and prereq.prereq_id = c2.course_id;
```
☐ None of the given queries is right.

(58 students)
8 – 26 students
6.4 - 2
4.8 – 15 students
3.2 - 14
0 – 1

Q 10: (8 points; Multiple Select) Course sections (their ***course_id***, ***sec_id***, ***semester*** and ***year***) which

more students enrolled in/took, than there were seats in the classroom they were assigned to be taught.

- [ ]
```
select course_id, sec_id, semester, year
from section natural join takes natural join classroom
group by course_id, sec_id, semester, year, capacity
having capacity < count(ID);
```

- [ ]
```
select section.course_id, section.sec_id, section.semester,
section.year
from section, takes, classroom
where section.course_id = takes.course_id
and section.sec_id = takes.sec_id
and section.semester = takes.semester
and section.year = takes.year
and section.building = classroom.building
and section.room_number = classroom.room_number
group by course_id, sec_id, semester, year, capacity
having capacity < count(ID);
```

- [ ]
```
with temp (course_id, sec_id, semester, year, capacity,
students_no) as
(select course_id, sec_id, semester, year, capacity, count(ID)
from section natural join takes natural join classroom
group by course_id, sec_id, semester, year, capacity)
select course_id, sec_id, semester, year
from temp where capacity < students_no;
```

- [ ]
```
with temp (course_id, sec_id, semester, year, students_no) as
(select course_id, sec_id, semester, year, count(ID)
from section natural join takes
group by course_id, sec_id, semester, year)
select course_id, sec_id, semester, year
from temp natural join classroom
where capacity < students_no
```

- [ ] None of the given queries is right.

(58 students)
8 – 23 students
6.4 - 22
4.8 – 4 students
3.2 – 1
1.6 - 7
0 – 1

Q 11: (8 points; Multiple Select) Info about instructors (their ***ID***, ***name***, ***dept_name*** and ***salary***) with the highest salary.

- [ ]
```
select *
from instructor i1
where salary > all (select salary from instructor i2 where i1.ID <>
i2.ID);
```

☐
```
select *
from instructor
where salary in (select max(salary) from instructor);
```
☐
```
select ID, name, dept_name, salary
from instructor natural join (select max(salary) from instructor) as
temp;
```
☐
```
select ID, name, dept_name, salary
from instructor, (select max(salary) highest_salary from instructor)
as temp
where instructor.salary = temp.highest_salary;
```
☐ None of the given queries is right.

(58 students)
8 – 6 students
6.4 - 48
4.8 – 2 students
3.2 – 1
1.6 - 0
0 – 1

Q 12: (4 points; Multiple Select) Students (their ***ID***, ***name***, ***dept_name***, ***tot_cred***) who don't have advisors.

☐
```
select *
from student
where ID not in (select i_id from advisor);
```
☐
```
select ID, name, dept_name, tot_cred
from student natural join advisor
where i_id is null;
```
☐
```
select ID, name, dept_name, tot_cred
from student natural join advisor natural join instructor
where ID is null;
```
☐
```
with temp(ID) as
(select s_id
from advisor
where i_id is null)
select *
```
from student natural join temp;
☐ None of the given queries is right.

(58 students)
8 – 28 students
6.4 - 0
4.8 – 18 students
3.2 – 7
1.6 - 3
0 – 2

Q 20: (8 points; Multiple Select) Which query/queries return course(s) with prerequisite(s) from other departments. We are interested in ***course_id***(s), ***title***(s) and ***dept_name***(s) of a course with its prerequisite's ***course_id***(s), ***title***(s) and ***dept_name***(s).

☐
```
select c.course_id, c.title, c.dept_name, p.course_id, p.title,
p.dept_name
from course c, prereq, course p
where c.course_id = prereq.course_id and prereq.prereq_id =
p.course_id
and c.dept_name <> p.dept_name;
```

☐
```
select c.course_id, c.title, c.dept_name, p.course_id, p.title,
p.dept_name
from course c, prereq p
where c.course_id = p.course_id
and c.dept_name <> p.dept_name;
```

☐
```
select c.course_id, c.title, c.dept_name, p.course_id, p.title,
p.dept_name
from course c natural join prereq p
where c.dept_name <> p.dept_name;
```

☐
```
select c.course_id, c.title, c.dept_name, p.course_id, p.title,
p.dept_name
from course c, prereq p
where c.course_id = p.course_id
and c.course_id = p.prereq_id
and c.dept_name <> p.dept_name;
```

☐ None of the given queries is right.

(58 students)
8 – 38 students
6.4 - 1
4.8 – 6 students
3.2 – 1
1.6 - 1
0 – 1

Test3 – selected questions:

- Exam questions to implement and apply database concepts

Assessment	Excelling	Practicing	Apprentice	Novice
Test3 – Q 4	44 (78.6%)	0 (0%)	0 (0%)	12 (21.4%)
Test3 – Q 9	34 (60.7%)	0 (0%)	0 (0%)	22 (39.3%)
Test3 – Q 16	31 (55.4%)	0 (0%)	0 (0%)	25 (44.6%)

Text of selected questions from test3

Q 4: (1 point; TRUE/FALSE) Definition of the prereq table could be changed from

```
create table prereq
(course_id        varchar(8),
prereq_id        varchar(8),
primary key (course_id, prereq_id),
foreign key (course_id) references course(course_id) on delete
cascade,
foreign key (prereq_id) references course(course_id)
);
```

to

```
create table prereq
(course_id        varchar(8),
prereq_id        varchar(8),
primary key (course_id, prereq_id),
foreign key (course_id) references course(course_id) on delete
cascade,
foreign key (prereq_id) references course(course_id) on delete set
null
);
```

.

- True
- False

Q 9: (2 points; Multiple Choice) What does the below query return?

```
select takes.ID, teaches.ID
from takes join teaches using (course_id, sec_id, semester, year)
group by takes.ID, teaches.ID
having count(teaches.ID)>2;
```

- IDs of students along with IDs of instructors who taught them more than 2 course sections.
- IDs of students along with IDs of their instructors who taught more than 2 course sections.
- IDs of students along with IDs of their instructors who taught more than 2 sections of a course they shared.
- IDs of students along with IDs of instructors who taught more than 2 course sections.

Q 16: (1 point; TRUE/FALSE) The below view is updatable.

```
create view instructor_info as
select ID, name, building
```

```
from instructor, department
where instructor.dept_name = department.dept_name;
```

- True
- False

Test4 – selected questions:

- Exam questions to implement and apply database concepts

Assessment	Excelling	Practicing	Apprentice	Novice
Test4 – Q 1	28 (50.9%)	0 (0%)	0 (0%)	27 (49.1%)
Test4 – Q 9	42 (76.4%)	0 (0%)	0 (0%)	13 (23.6%)
Test4 – Q11	1 (1.8%)	38 (69.1%)	14 (25.5%)	2 (3.6%)

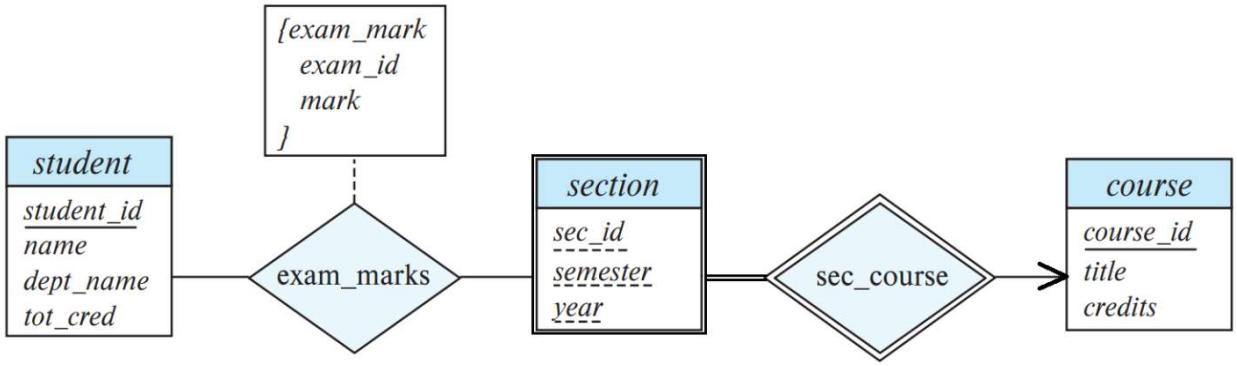
Text of selected questions from test4

Q 1: (2 points; TRUE/FALSE) Below is the DDL command creating table *prereq* in the University database.
In this definition, there is no "on delete cascade" on an attribute *prereq_id*. Two triggers are needed in order to ensure that any tuple can be deleted from the University database.

```
create table prereq
(course_id        varchar(8),
prereq_id        varchar(8),
primary key (course_id, prereq_id),
foreign key (course_id) references course(course_id) on delete
cascade,
foreign key (prereq_id) references course(course_id)
);
```

- True
- False

Q 9: (4 points; Multiple Choice) How many tables will be created for the schema modeled with the below E-R diagram?



- 4
- 5
- 3
- 2

Q 11: (6 points; Multiple Select) Which statements, if any, are true about the below trigger?

```
create trigger t1
before update on takes
for each row
begin
  if (new.grade = '')
  then set new.grade = null;
  end if;
end
```

- ☐ It ensures the grades are not equal to an empty string ('').
- ☐ It doesn't work because there is no access to the variable *new* in the trigger with condition "**before update**".
- ☐ If the first occurrence of the variable *new* was replaced with the variable *old*, then the trigger would ensure the updated grade is not an empty string ('').
- ☐ None of the statements is true.

6 – 0 students
4.5 – 1
3 – 38 students
1.5 – 14
0 – 2

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)

Test1 – selected questions:

- Exam questions to evaluate the selection of correct database concepts

Assessment	Excelling	Practicing	Apprentice	Novice
Test1 – Q 1	51 (91.1%)	0 (0%)	0 (0%)	5 (8.9%)
Test1 – Q 2	45 (80.4%)	0 (0%)	0 (0%)	11 (19.6%)
Test1 – Q12	54(96.4%)	0 (0%)	0 (0%)	2 (3.6%)

Text of selected questions from test1

Q 1: (1 point; Multiple Choice) Consider the below table instances. How many tuples returns the following query?

BOOK ⋈ BOOK_AUTHOR ⋈ AUTHOR

BOOK

title	genre	ISBN	date_published	publisher	edition	description
Alice in Wonderland	fiction	979-8749522310	2021-05-06	Independently published	1	This edition of the book includes original illustrations.
Oregon Archaeology	History	978-0870716065	2011-10-01	Oregon State University Press	1	Recent archeological findings on the history of Oregon.

AUTHOR

author_id	first_name	middle_name	last_name
2	Levis	null	Carroll
11	Melvin	C.	Aikens
12	Thomas	J.	Connolly
13	Dennis	L.	Jenkins

BOOK_AUTHOR

ISBN	author_id
979-8749522310	2
978-0870716065	11
978-0870716065	12

978-0870716065	13

- 4
- 2
- 32
- 16

Q 2: (4 points; Multiple Choice) If relation COPY has 10 tuples, then what is the minimal number of tuples in the relation BOOK?

- 0
- 1
- 10

Q 12: (1 point; TRUE/FALSE) Assume BOOK has 10 tuples and MEMBER has 5 tuples. Regardless, BOOK × MEMBER returns an empty table, because MEMBER doesn't reference BOOK and other way round (in other words, BOOK and MEMBER don't have any common attributes).

- True
- False

Test2 – selected questions:

- Exam questions to evaluate the selection of correct database concepts

Assessment	Excelling	Practicing	Apprentice	Novice
Test2 – Q 5	43 (76.8%)	0 (0%)	0 (0%)	13 (23.2%)
Test2 – Q 17	26 (46.4%)	0 (0%)	0 (0%)	30 (53.6%)
Test2 – Q 19	14 (25%)	0 (0%)	0 (0%)	42 (75%)

Text of selected questions from test2

Q 5: (2 points; TRUE/FALSE) An instructor can teach two different course sections, in a given semester and year, in two different classrooms in the same time slot.

- True
- False

Q 17: (2 points; TRUE/FALSE) Below commands will run, when invoked subsequently, on any instance of the University database.

```
insert into department values ('Sanitation', 'BrunerHall', '70000');
insert into instructor values ('1', 'Brown', 'Sanitation', '100000');
insert into student values ('100', 'Blue', 'Sanitation', '120');
insert into takes values ('100', 'CS-101', '1', 'Fall', '2009',
```

```
null);
insert into teaches values ('1', 'CS-101', '1', 'Fall', '2009');
```

- True
- False

Q 19: (2 points; Multiple Choice) What is the minimal number of tuples that need to be added to the University database, in which neither relation has any tuples, before a course section can be inserted (tuple can be inserted to the ***section*** relation).

- 0
- 1
- 2
- 5

Test3 – selected questions:

- Exam questions to evaluate the selection of correct database concepts

Assessment	Excelling	Practicing	Apprentice	Novice
Test3 – Q 10	47 (83.9%)	0 (0%)	0 (0%)	9 (16.1%)
Test3 – Q 11	54 (96.4%)	2 (3.6%)	0 (0%)	0 (0%)
Tets3 – Q 18	29 (51.8%)	13 (23.2%)	10 (17.9%)	4 (7.1%)

Text of selected questions from test3

Q 10: (1 point; Multiple Choice) The tester checks the application (e.g. Web application) for security vulnerabilities. Which character is usually used first to check if SQL injection is possible?

- $ (dollar)
- ' (single quote)
- ; (semicolon)
- " (double quote)

Q 11: (4 points; Multiple Select) Assume that all the below commands were run on a University database and server with users: Grey, Amit, Green and Brown. Which users, if any, have permission to find out for each student of the 'Comp. Sci.' Department the number of course sections he failed (received a grade 'F' for).

```
create role teaching_assistant;
create role lecturer;
create role dean;

grant select on takes to teaching_assistant;
```

```
grant update on takes to teaching_assistant;

grant select on student to lecturer;

grant select on instructor to dean;

grant teaching_assistant to lecturer;
grant lecturer to dean;

grant dean to Grey;
grant dean to Amit;
grant update on instructor to Amit;

grant lecturer to Brown;
grant update on student to Brown;

grant teaching_assistant to Green;
```

- ☐ Amit
- ☐ Brown
- ☐ Green
- ☐ Grey

4 – 36 students received that number of points
3 - 18
2 - 2
1 - 0
0 – 0 students

Q 18: (3 points; Multiple Select) Which queries, if any, will use some index?

☐
```
select *
from instructor
where ID = '10101'
```

☐
```
select *
from instructor
where ID = 10101;
```

☐
```
select *
from instructor
where ID = 00010101;
```

☐
```
select *
from instructor
where name = 'Wu'
```

Hint: MYSQL: explain

3 – 10 students received that number of points
2.25 - 19
1.5 - 13

0.75 - 10
0 – 4 students

Test4 – selected questions:

- Exam questions to evaluate the selection of correct database concepts

Assessment	Excelling	Practicing	Apprentice	Novice
Test4 – Q 2	44 (80%)	0 (0%)	0 (0%)	11 (20%)
Test4 – Q 6	32 (58.2%)	19 (34.5%)	4 (7.3%)	0 (0%)
Test4 – Q 18	22 (40%)	0 (0%)	0 (0%)	33 (60%)

Text of selected questions from test4

Q 2: (2 points; TRUE/FALSE) If the DDL command creating table *course* was changed to the below one, then a functional dependency *title* → *dept_name* would hold on the table course.

```
create table course
(course_id varchar(8),
title varchar(50),
dept_name varchar(20),
credits numeric(2,0) check (credits > 0),
primary key (course_id),
unique(title),
foreign key (dept_name) references department(dept_name) on delete
set null
);
```

- True
- False

Q 6: (4 points; Multiple Select) Which functional dependencies, if any, hold on the University Database?

- ID -> grade
- course_id -> prereq_id
- building, room_number -> course_id, sec_id, semester, year
- course_id -> title
- None of the statements is true.

4 – 15 students received that number of points
3.2 - 17
2.4 - 19
1.6 - 4
0 – 0 students

Q 18: (2 points; TRUE/FALSE) The decomposition is a Lossless Join Decomposition if the natural join of the relations in the decomposition produces the relation with all attributes of the original relation.

- True
- False

Use of Results to Improve Outcomes:

Overall, the assessment results indicate a strong grasp of designing, implementing, and evaluating computing-based solutions for database-related requirements in the context of the program's discipline. Students have shown commendable performance across various tests and questions, reflecting a sound understanding of Database Management Systems.

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 "end-game" 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 regards 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:

3) Outcome 3: Communicate effectively in a variety of professional contexts.

CSC 3040 Professionalism, Communication and Research in Computing

Performance Criteria (Traits):

- **Students can develop and present material on domain knowledge areas of computer science.**
- **Students can organize and write procedural directions.**
- **Students can communicate effectively and professionally orally and via written communication.**

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	50 (74.6%)	10 (14.9%)	7 (10.4%)	0 (0%)
Draft Tutorial Advertisement Flyer	24 (35.8%)	35 (52.2%)	7 (10.4%)	0 (0%)
Final Tutorial Advertisement Flyer	59 (88.1%)	8 (11.9%)	0 (0%)	0 (0%)
Total	**133 (66.2%)**	**53 (26.4%)**	**14 (7%)**	**0 (0%)**

Outcome 3 Trait 2. Students can organize and write procedural directions.				
	Excelling	**Practicing**	**Apprentice**	**Novice**
Procedural Writing Project	41 (61.2%)	18 (26.9%)	3 (4.5%)	5 (7.5%)

Outcome 3 Trait 3. Students can communicate effectively and professionally orally and via written communication				
	Excelling	**Practicing**	**Apprentice**	**Novice**
Elevator Pitch Assignment	50 (74.6%)	10 (14.9%)	3 (4.5%)	4 (6%)
Interview Assignment	38 (56.7%)	18 (26.9%)	7 (10.4%)	4 (6%)
Professional Email Assignment	50 (74.6%)	9 (13.4%)	2 (3%)	6 (9%)
Total	**138 (68.7%)**	**37 (18.4%)**	**12 (6%)**	**14 (7%)**

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 12 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 show the group's flyer, 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	50 (74.6%)	10 (14.9%)	7 (10.4%)	0 (0%)
Draft Tutorial Advertisement Flyer	24 (35.8%)	35 (52.2%)	7 (10.4%)	0 (0%)
Final Tutorial Advertisement Flyer	59 (88.1%)	8 (11.9%)	0 (0%)	0 (0%)
Total	**133 (66.2%)**	**53 (26.4%)**	**14 (7%)**	**0 (0%)**

Trait 2: Students can organize and write procedural directions.

Procedural Writing Project

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 12 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 show the group's flyer, state the title and the intended audience that was provided in the memo.

Outcome 3 Trait 2. Students can organize and write procedural directions.				
	Excelling	**Practicing**	**Apprentice**	**Novice**
Procedural Writing Project	41 (61.2%)	18 (26.9%)	3 (4.5%)	5 (7.5%)

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

Elevator Pitch Assignment

Scale

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

Assignment Description

Create and record a video of your 30 second (or less) elevator pitch. The camera should show you and your voice should be recorded. You may record your elevator pitch in any way that you want to if the video created is in MP4 format. Your elevator pitch will be graded on general attitude, introduction, your objective, conveyance of strengths including examples and accomplishments, and time constraint.

Interview Assignment

Scale

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

Assignment Description

Go to https://www.tntech.edu/career/students/interviewstream.php and review the instructions for InterviewStream. Click the "INTERVIEWSTREAM (NOW INTERVIEWPREP)" 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. The grading criteria included in the rubric is on personal attributes, general attitude, professional appearance, well-constructed, confident responses in 1-3 minutes, poised answering difficult or stressful questions, and self-knowledge.

Professional Email Assignment

Scale

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

Assignment Description

Create an email signature in your TTU email account including your first & Last name, major, Tennessee Tech University, and email address. Then, write a professional, formal email to your instructor where you will explain (respectfully) a professional soft skill that you hope to improve this semester and the action items of how you plan to go about improving it. You should have the following components in your professional email: appropriate subject, respectful greeting, introduction of who you are (course & section number), message body (can contain bullet points or more than one short paragraph), salutation, and signature.

Outcome 3 Trait 3. Students can communicate effectively and professionally orally and via written communication				
	Excelling	**Practicing**	**Apprentice**	**Novice**
Elevator Pitch Assignment	50 (74.6%)	10 (14.9%)	3 (4.5%)	4 (6%)
Interview Assignment	38 (56.7%)	18 (26.9%)	7 (10.4%)	4 (6%)
Professional Email Assignment	50 (74.6%)	9 (13.4%)	2 (3%)	6 (9%)
Total	**138 (68.7%)**	**37 (18.4%)**	**12 (6%)**	**14 (7%)**

4) Outcome 3: Communicate effectively in a variety of professional contexts.

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

Performance Criteria (Traits):

1. **Students can communicate project status. (Bloom's taxonomy level: Synthesis)**
2. **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	**50 (58%)**	**30 (35%)**	**6 (7%)**	**0**
Team Iteration 1 Showcase (video)	**38 (44%)**	**48 (56%)**	**0**	**0**

Trait 2. Students can describe an overview of a project.				
Assessment	Excelling	Practicing	Apprentice	Novice
Project poster (written)	**84 (100%)**	**0**	**0**	**0**
Project final showcase (video)	**78 (93%)**	**6 (7%)**	**0**	**0**

Traits

1. **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 professionalism of their reports, but the content was mostly as expected.

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

Assessment	Excelling	Practicing	Apprentice	Novice
Iteration Reports	**50 (58%)**	**30 (35%)**	**6 (7%)**	**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: Overall, students appear to be well-versed in video editing and presentation skills, but do need to use a better microphone in some cases; could also use better coordination of the presentation, and announce their name when they speak.

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

Assessment	Excelling	Practicing	Apprentice	Novice
Team Iteration 1 Showcase (video)	**38 (44%)**	**48 (56%)**	**0**	**0**

2. 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>: Student teams did an outstanding job of putting together coherent, well-designed posters, and presenting them to attendees at the Senior Expo.

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

Assessment	Excelling	Practicing	Apprentice	Novice
Project Poster (Engineering Showcase)	**84 (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>: Overall, student teams did an excellent job of putting together solid videos demonstrating their product.

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

Assessment	Excelling	Practicing	Apprentice	Novice
Project Final Showcase (video)	**78 (93%)**	**6 (7%)**	**0**	**0**

Use of Results to Improve Outcomes:

Overall, students seem to be getting better in terms of their professionalism and presentation skills. For some, talking in front of others is still an issue. We should consider additional instruction in our curriculum for public speaking.

Optional (but highly suggested) Improvements

Given that in the future we are planning on going to smaller class sizes (30-40), it should be possible to give more one-on-one time to the students to help in these areas.

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 a computing professional. (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 "end-game" 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 regards 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):

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

6. Students can analyze the challenges associated with *ethical* concepts in the context of computing. (Bloom's taxonomy level: Analysis)
7. Students can analyze the challenges associated with *legal* concepts in the context of computing. (*Bloom's taxonomy level: Analysis*)
8. Students can apply *ethical* concepts to assess computing practice. (*Bloom's taxonomy level: Application*)
9. 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 a computing professional. (*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 an 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 (section 002	29 (75%)	1 (3%)	0 (0%)	0 (0%)
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	33 (94%)	0 (0%)	2 (6%)	0 (0%)

Section 001				
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.

Assessment	Excelling	Practicing	Apprentice	Novice
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 was ignored or rebuffed
  d. they talked about their concerns to their best friends in the same department
  e. actions taken by their employer makes 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 a 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 provider 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%)

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.

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 "end-game" 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 regards 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.**

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	**Practicing**	**Apprentice**	**Novice**
Group Tutorial Video	50 (74.6%)	10 (14.9%)	7 (10.4%)	0 (0%)
Draft Tutorial Advertisement Flyer	24 (35.8%)	35 (52.2%)	7 (10.4%)	0 (0%)

Final Tutorial Advertisement Flyer	59 (88.1%)	8 (11.9%)	0 (0%)	0 (0%)
Peer Evaluation of Group Members	53 (79.1%)	4 (6%)	4 (6%)	6 (9%)
Total	**186 (69.4%)**	**57 (21.3%)**	**18 (6.7%)**	**6 (2.2%)**

Outcome 5 Trait 2. Students can collaborate in group discussions regarding ethics topics in computing.				
	Excelling	**Practicing**	**Apprentice**	**Novice**
In-Class Ethics Discussion on Networked Communications	56 (83.6%)	6 (9%)	2 (3%)	3 (4.5%)
In-Class Ethics Discussion on Intellectual Property	54 (80.6%)	4 (6%)	4 (6%)	5 (7.4%)
Total	**110 (83.3%)**	**10 (7.5%)**	**6 (4.5%)**	**6 (4.5%)**

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

Group Tutorial Video

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 12 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 show the group's flyer, state the title and the intended audience that was provided in the memo.

Draft Group 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 Group 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?"

Peer Evaluation of Group Members

Scale

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

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	**Practicing**	**Apprentice**	**Novice**
Group Tutorial Video	50 (74.6%)	10 (14.9%)	7 (10.4%)	0 (0%)
Draft Tutorial Advertisement Flyer	24 (35.8%)	35 (52.2%)	7 (10.4%)	0 (0%)
Final Tutorial Advertisement Flyer	59 (88.1%)	8 (11.9%)	0 (0%)	0 (0%)
Peer Evaluation of Group Members	53 (79.1%)	4 (6%)	4 (6%)	6 (9%)
Total	**186 (69.4%)**	**57 (21.3%)**	**18 (6.7%)**	**6 (2.2%)**

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

In-Class Ethics Discussion on Networked Communications

Scale

Excelling (100%), Practicing (≥80%, <90%), Apprentice (≥60%, <80%), Novice (<60%)

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

Scale

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

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 of the Utilitarianism ethical theory.

Outcome 5 Trait 2. Students can collaborate in group discussions regarding ethics topics in computing.				
	Excelling	**Practicing**	**Apprentice**	**Novice**
In-Class Ethics Discussion on Networked Communications	56 (83.6%)	6 (9%)	2 (3%)	3 (4.5%)
In-Class Ethics Discussion on Intellectual Property	54 (80.6%)	4 (6%)	4 (6%)	5 (7.4%)
Total	**110 (83.3%)**	**10 (7.5%)**	**6 (4.5%)**	**6 (4.5%)**

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

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	**32 (37%)**	**42 (49%)**	**12 (14%)**	**0**

Trait 2. Students can track and manage a plan.				
Assessment	Excelling	Practicing	Apprentice	Novice
Student Progress	**60 (71%)**	**12 (15%)**	**6 (7%)**	**6 (7%)**
Iteration Reports	**66 (79%)**	**18 (21%)**	**0**	**0**

Trait 3. Students can produce deliverables.				
Assessment	Excelling	Practicing	Apprentice	Novice
Project Showcase Demo (video)	**78 (93%)**	**6 (7%)**	**0**	**0**

Traits

1. **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	**32 (37%)**	**42 (49%)**	**12 (14%)**	**0**

2. **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>: All student Teams had to use a github (or similar) repository. As a program, we are doing more to introduce the students to github, so they are getting better with its use.

However, many teams leave it to one or two individuals, so not everyone is getting the same experience.

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

Assessment	Excelling	Practicing	Apprentice	Novice
Student Progress	**60 (71%)**	**12 (15%)**	**6 (7%)**	**6 (7%)**

- 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>: Overall, students produced fairly professional reports to the level of detail requested. Sometimes a little proof-reading would have helped (probably rushed to meet the deadlines).

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

Assessment	Excelling	Practicing	Apprentice	Novice
Iteration Reports	**66 (79%)**	**18 (21%)**	**0**	**0**

3. 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>: Overall, students did a good job of demoing their product to their customer, allowing the customer to transition the product to either their company or a future team.

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

Assessment	Excelling	Practicing	Apprentice	Novice
Project Showcase Demo	**78 (93%)**	**6 (7%)**	**0**	**0**

(Engineering Showcase)				

Use of Results to Improve Outcomes:

Enforce the changing of leadership after each iteration. While some are clearly better than others at being the leader, everyone needs to get the experience.

Optional (but highly suggested) Improvements

Find a way to enforce equal input to the reports, and not letting them rely on one or two individuals to do all the report writing.

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 "end-game" 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 regards 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

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

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

We assessed Performance Criterion 1 using models from the Concept Inititate 1 and Concept Initiate 2 assignments. For Concept Initiate 1, students were required to develop a use case diagram. The assignment evaluated students' ability to use correct diagramming notation and in the completeness of their design. The rubric used for this evaluation is shown below.

Content	**Excelling** 10 points	**Practicing** 7 points	**Apprentice** 4 points	**Novice** 1 point
Correctness	Model uses all the correct notational conventions and the use cases are partitioned	All of the use cases are present but there is no partitioning of the model, some of the notation is used incorrectly	The use cases are not built correct, some notational issues	Model missing or incorrect in all aspects of its construction
Completeness	Includes all use cases as well as some of their own cases	Uses the reference use cases only or may be missing appendices	Missing some use cases; only includes a few cases and misses some of the reference cases	Model missing or not relevant to the problem of the project

The following two tables show the assessment of student work using the rubric. Regarding correctness (i.e., proper use of the notation), approximately 93% of the students performed at the Excelling or Practicing level, whereas only 7% fell below that. With respect to completeness, all students performed at Excelling or Practicing. These results indicate that the students were able to translate the requirements of the project (as expressed using user stories) into proper use case diagrams.

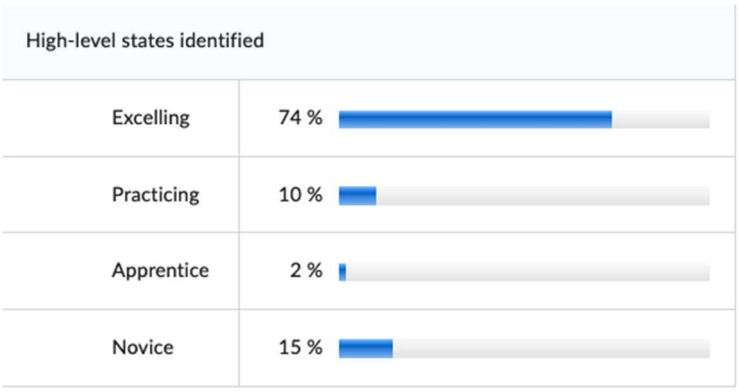
Correctness	
Excelling	35 %
Practicing	58 %
Apprentice	7 %
Novice	0 %

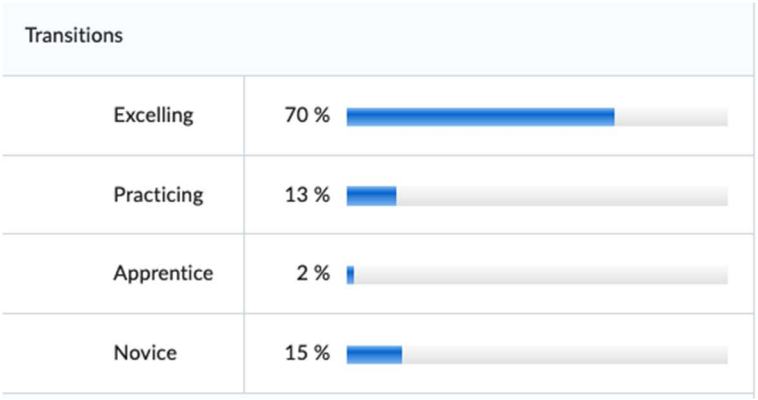
Completeness	
Excelling	93 %
Practicing	7 %
Apprentice	0 %
Novice	0 %

The second assignment that we used to assess Performance Criterion 1 was from Concept Initiate 2. Students were asked to create state models that describe behavior of a set of classes. The rubric for this part of the assignment is shown below, and includes three criteria: identification of high-level states, modeling of transitions between states, and the conditions causing transitions to be taken.

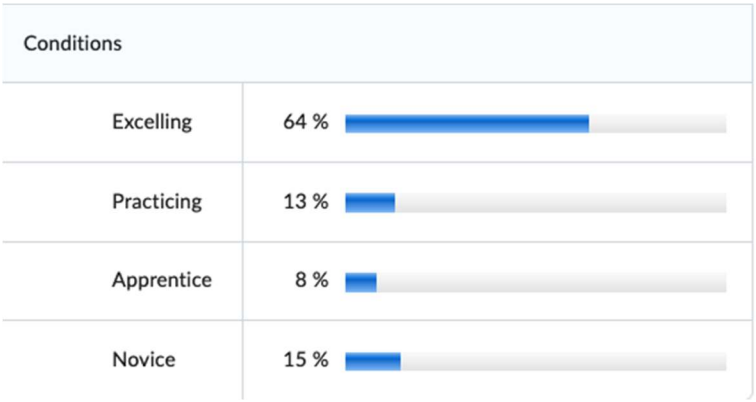
State Diagrams	**Excelling** 4 points	**Practicing** 2 points	**Apprentice** 1 point	**Novice** 0 points
High-level states identified	Identifies states for the models	missing some states	missing most states	No submission or major problems
Transitions	Correctly refines transitions	Some transitions missing	Missing most transitions or specified incorrectly	No submission or major problems
Conditions	All transition conditions included	Missing some conditions	Missing most conditions	No submission or major problems

The performance of students for each of the criterion are shown below. For high-level state identification, 83% of the students were at the Excelling or Practicing level, with 17% falling below this. Having 15% of the students at Novice level seems to indicate that when students “didn’t get it”, they really didn’t get it. Likewise, for modeling transitions, the performance is nearly the same.





When it comes to modeling the conditions that allow for transitions between states, more students fell into the Apprentice/Novice range (as shown below). This seems to indicate that the concepts for state transition models need to be better addressed via repetition and other learning activities. However, 77% of the students in the course were still at the Excelling or Practicing level, which is still acceptable.



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

Performance criterion 2 was evaluated using the Iteration 2 assignment. The rubrics below were used to evaluate student work as follows. First, we evaluated the execution of student solutions against instructor defined unit tests. Second, we evaluated the execution of student solutions on student defined tests. Finally, we evaluated student programming skills via inspection of their code.

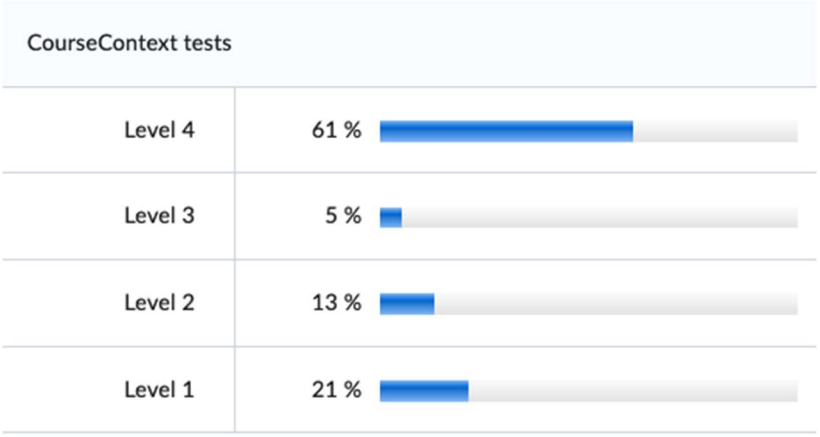
Correctness	Level 4	Level 3	Level 2	Level 1
CourseContext tests	10 points All five tests pass	8 points 1 test fails	4 points 2 or more tests fail	0 points all tests fail or no submission
DirectoryContext tests	10 points All five tests pass	8 points 1 test fails	4 points 2 or more tests fail	0 points all tests fail or no submission

Student tests submitted for CourseContext	7 points Unique tests created for primary features	4 points Minimal tests created	2 points	0 points No tests created
Student tests submitted for DirectoryContext	7 points Unique tests created for primary features	4 points Minimal tests created	2 points	0 points No tests created

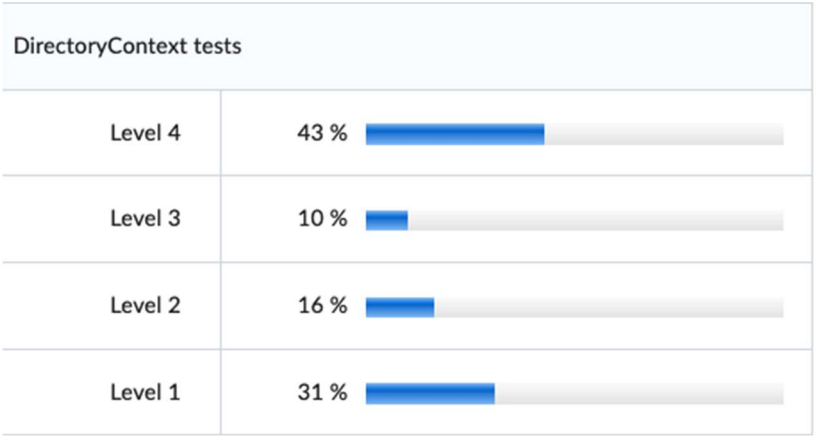
The results of the evaluation of student solutions is found in the following tables. The levels in reverse order from 4 to 1 correspond to our usual standard of Excelling, Practicing, Apprentice, and Novice, respectively.

For faculty defined tests for implementing the CourseContext intent, students were required to support a question and answer sequence for making a call to a course webservice. The service returns course information for a given subject and number. In this evaluation, 66% of the students were evaluated in the

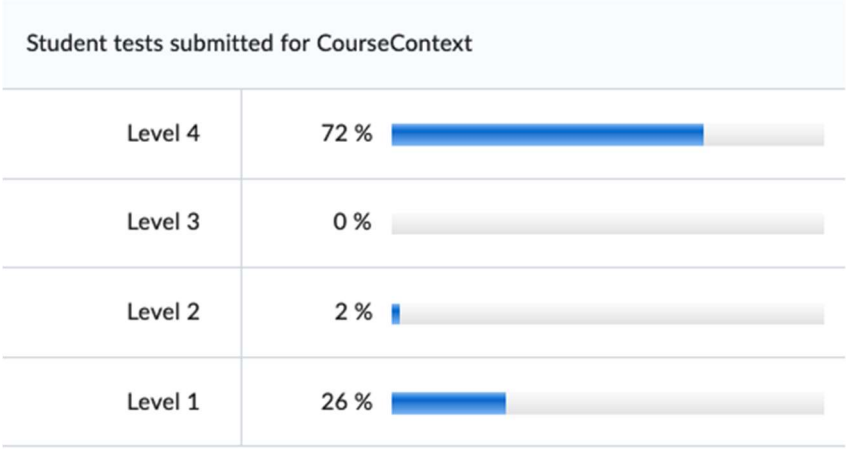
Excelling (4) or Practicing (3) level. The problem was a challenging one, and the performance demonstrates this.



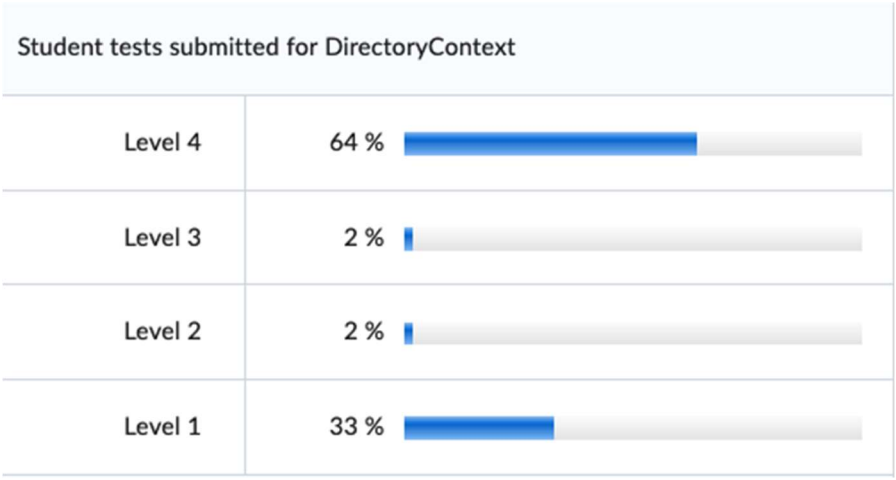
The students fared little better on the DirectoryContext tests, as the overall performance dropped to 53% at the Excelling and Practicing levels.



For student defined tests, the performance is as shown in the following table, with 72% achieving Excelling and the remainder being at Apprentice and Novice levels.



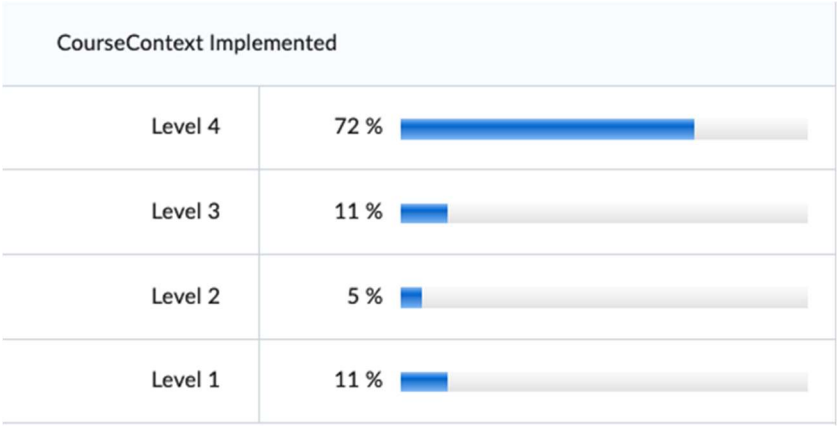
As with the DirectoryContext tests provided by the faculty member, students also performed at a lower level of achievement on their own tests.



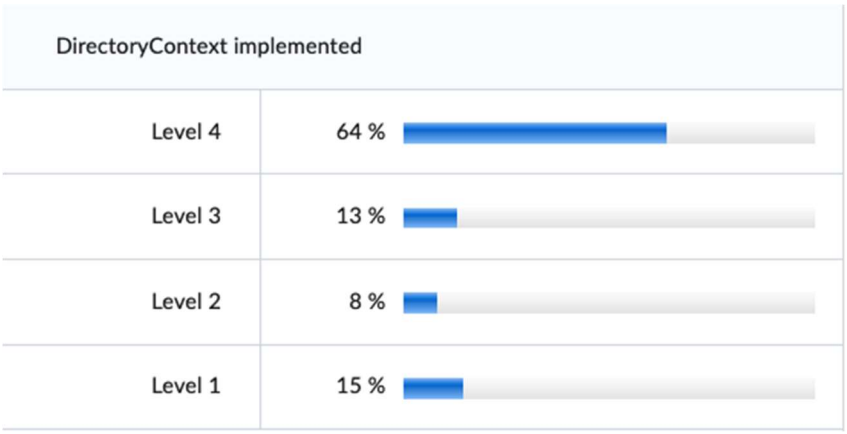
We also evaluated student code by inspection in order to determine whether certain aspects of the implementation were created. The rubric is below.

Completeness	Level 4	Level 3	Level 2	Level 1
CourseContext Implemented	7 points Connection to webservices made; data retrieved; exceptions handled	4 points Missing some aspect of the implementation	2 points Major problems in implementation	0 points No submission
DirectoryContext implemented	7 points Connection to webservices made; data retrieved; exceptions handled	4 points Missing some aspect of the implementation	2 points Major problems in implementation	0 points No submission

As shown in the table below, for CourseContext, approximately 83% of the students performed at the Excelling or Practicing level. In a manner consistent with the tests, we found that when students implemented the solutions as expected, the tests (either their own or instructor provided) generally were positive.



The last table shows that fewer students were able to implement the DirectoryContext service at Excelling or Practicing levels (77%).



Use of Results to Improve Outcomes:

The performance of students on the design activities for the course were consistent with our expectations from past courses. The programming activities, however, demonstrated that there are still some challenges to overcome on improving the quality of programming from students. The assignments we provide for this course are challenging, which follows a philosophy that we have regarding moving students towards becoming better programmers.

Recommendation

It has been observed that some students struggle with programming in this course. We need to increase the level of difficulty in the laboratories while keeping them at a low-stakes level in order to foster repetition. We are trying to strike a balance between teaching tools and techniques while also beginning the introduction of design. It is the recommendation that the course begin looking at increasing the amount of programming that the students engage in early in the course.

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