Computing and Data Science MS

Technical Competence - To Develop And Demonstrate Knowledge Of Theoretical Materials, And Computational And Technical Skills

Goal Description:

Graduates with a master degree in Computing and Data Science will have a strong technical foundation, that is, to develop and demonstrate knowledge of theoretical materials, and computational and technical skills in the areas of Computing and Information Science.

Providing Department: Computing and Data Science MS

Progress: Completed

RELATED ITEMS/ELEMENTS

RELATED ITEM LEVEL 1

Understand The Body Of Knowledge Of Computer Science And Information Technologies

Learning Objective Description:

Students will develop and demonstrate knowledge of theoretical materials, technical skills and project management relevant to computer information systems.

RELATED ITEM LEVEL 2

Written Comprehensive Examination

Indicator Description:

MS in CDS Comprehensive Exam

Our MS in CDS offers two options of Degree Plan:

- **Plan 1 – Thesis Option** requires 24 hours of a coursework which is a combination of compulsory (core) and track elective courses, and 6 hours of thesis courses (COSC/DFSC 6348 and 6049). In total, the program requires 30 hours. Thesis students must register for COSC/DFSC 6347 in their proposal semester, and for COSC/DFSC 6049 in their defense semester. Note that continuous enrollment in the thesis course is required upon initiation of the thesis until completion.
- **Plan 2 – Non-Thesis Option** requires 27 hours of a coursework which is a combination of compulsory (core) and track elective courses, and 3 hours of a master project course (COSC/DFSC 6347). In total, the program requires 30 hours. Non-thesis students are required to complete written comprehensive exams in core subjects where they received a grade of B or lower. Non-thesis students must register for COSC/DFSC 6347 in their terminal-semester. Note that continuous enrollment in the COSC 6347 course is required upon initiation of COSC 6347 until completion.

All MS in CDS students in Non-Thesis Option must pass **written comprehensive exams for core subjects where they obtained a grade of B or lower**, **achieving a grade of at least 70**. As exams are conducted during their terminal semester, it is strongly encouraged to finish the core subjects before the terminal semester.

The core courses for CDS program (Non-Thesis) are:

- COSC 5318 Database Systems
- COSC 5319 Algorithm Design and Analysis
- COSC 5327 Operating Systems

- COSC 6318 Language and Compiler Design
- COSC 6319 Software Engineering

Indicators

The indicators for the MS in CDS Program's comprehensive exam are outlined as follows:

- COSC 5318 Database Systems
  - Students' understanding of core database concepts, such as relational database theory, normalization, transaction management, indexing, and query optimization, is assessed using direct measures, specifically exam scores. The comprehensive exam includes multiple-choice, short-answer, and problem-solving questions designed to evaluate both theoretical knowledge and practical application. The comprehensive exam scores are collected to assess student performance on these key topics.
- COSC 5319 Algorithm Design and Analysis
  - Students' ability to design and analyze computing algorithms, with a focus on correctness, efficiency, and feasibility, is assessed using direct measures, including exam scores and project evaluations. The comprehensive exam includes problem-solving questions that require students to apply techniques such as asymptotic analysis, dynamic programming, and divide-and-conquer strategies. The comprehensive exam scores are collected to assess student performance on these key topics.
- COSC 5327 Operating Systems
  - Students' understanding of operating system concepts, including computer architecture, concurrent processes, multi-threaded systems, and memory management, is assessed through direct measures, such as exam scores and project evaluations. The comprehensive exam includes questions on topics such as scheduling, I/O management, file systems, networking, and distributed systems, requiring both theoretical knowledge and practical application. The comprehensive exam scores are collected to assess student performance on these key topics.
- COSC 6318 Language and Compiler Design
  - Students' understanding of computer programming languages, including language design principles, formal grammars, and language paradigms, is assessed through direct measures, such as exam scores and project evaluations. The comprehensive exam includes questions on topics such as procedural operating environments, language standardization, and language support for parallel and distributed programming. The comprehensive exam scores are collected to assess student performance on these key topics.
- COSC 6319 Software Engineering
  - Students' proficiency in software engineering strategies, techniques, and methodologies is assessed using direct measures, including exam scores and project evaluations. The comprehensive exam includes questions on conventional and object-oriented software engineering methodologies, software measurement, and management. The comprehensive exam scores are collected to assess student performance on these key topics.

Criterion Description:

MS in CDS's Comprehensive Exam Criteria

The criterion for each course's comprehensive exam is to achieve a passing score of at least 70%. If a student fails the exam, they are allowed one re-examination. A third attempt may be permitted only with the approval of the appropriate academic dean and the department. Students who fail all three attempts are terminated from the program. This policy ensures that students have multiple opportunities to demonstrate their understanding of the material while maintaining academic standards.

Findings Description:

MS in CDS, Comprehensive Exam Results

Fall 2023

Out of 11 students in their terminal semester, one student with the Thesis option received a waiver for the comprehensive exam, while the remaining 10 students were required to take the test for the following courses.

- COSC 5318 Database Systems
  - 5 of the 10 students did not take the exam as they received an A.
  - All 5 remaining students scored at least 80% on the test.
- COSC 5319 Algorithm Design and Analysis
  - All 10 students received an A and thus were granted a waiver.
- COSC 5327 Operating Systems
  - 5 of the 10 students did not take the exam as they received an A.
  - All 5 remaining students scored at least 80% on the test.
- COSC 6318 Language and Compiler Design
  - 5 of the 10 students did not take the exam as they received an A.
  - All 5 remaining students scored at least 80% on the test.
- COSC 6319 Software Engineering
  - All 10 students received an A and thus were granted a waiver.

Overall, all students who were required to take the comprehensive exam successfully passed, with each scoring at least 80%. This indicates that the program's preparation and support mechanisms were effective for the students who took the exam.

Spring 2024

There were 4 students required to take the test for the following courses.

- COSC 5318 Database Systems
  - One student received an A and thus was granted a waiver.
  - All 3 remaining students scored at least 80% on the test.
- COSC 5319 Algorithm Design and Analysis
  - 4 students received an A and thus was granted a waiver.
  - One remaining student scored at least 80% on the test.
- COSC 5327 Operating Systems
  - All 10 students received an A and thus were granted a waiver.
- COSC 6318 Language and Compiler Design
  - All 10 students received an A and thus were granted a waiver.
- COSC 6319 Software Engineering
  - All 10 students received an A and thus were granted a waiver.

Overall, all students who were required to take the comprehensive exam successfully passed, with each scoring at least 80%. This indicates that the program's preparation and support mechanisms were effective for the students who took the exam.

Summer 2024

We did not have students required to take the tests.

Findings

- High Passing Rates: All students required to take the comprehensive exam scored at least 80%, demonstrating strong overall performance.
- Effective Preparation: The consistent high performance on the comprehensive exams suggests that the program's preparation and support mechanisms are effective. Note that all MS in CDS scored at least 80%.
- Waivers Due to High Grades: The waiver system appears to be functioning as intended, with a significant number of students receiving waivers due to achieving an A in their core courses. This indicates that students who excel in their coursework are adequately prepared for the comprehensive exam.
- No Students Required to Take Exams in Some Terms: For Summer 2024, there were no students required to take the exams in the MS in CDS program. This may indicate that a large number of students either completed their coursework early or were not in their terminal semester during that term.

RELATED ITEM LEVEL 3

Written Comprehensive Examination
Action Description:

Action Plan for MS in CDS's comprehensive exams:

- Maintain the current support and preparation strategies that have led to high passing rates. Regularly review and update the exam preparation resources and support services based on student feedback and performance data.
- While the waiver system is successful in reducing the number of students required to take the exam, evaluate if any adjustments are needed to better align with program objectives or address any emerging trends.
- Regularly review the comprehensive exam content to ensure it aligns with the current curriculum and adequately assesses the students' knowledge and skills. Update exam content if necessary to reflect any changes in the program or industry standards.
- Ensure that students are well-informed about the comprehensive exam requirements and waiver criteria. This will help maintain high levels of performance and minimize any confusion regarding the examination process.

RELATED ITEM LEVEL 1

Apply Knowledge And Skills In Projects And Real Work Environments
Performance Objective Description:
Students will practice and demonstrate their capabilities and skills relevant to computer information systems in projects simulating real world tasks.

RELATED ITEM LEVEL 2

Final Capstone Project
KPI Description:
MS in CDS's Capstone Projects

Our MS in CDS offers two options of Degree Plan:

- **Plan 1 – Thesis Option** requires 24 hours of a coursework which is a combination of compulsory (core) and track elective courses, and 6 hours of thesis courses (COSC/DFSC 6348 and 6049). In total, the program requires 30 hours. Thesis students must register for

COSC/DFSC 6347 in their proposal semester, and for COSC/DFSC 6049 in their defense semester. Note that continuous enrollment in the thesis course is required upon initiation of the thesis until completion.

- **Plan 2 – Non-Thesis Option** requires 27 hours of a coursework which is a combination of compulsory (core) and track elective courses, and 3 hours of a master project course (COSC/DFSC 6347). In total, the program requires 30 hours. Non-thesis students are required to complete written comprehensive exams in core subjects where they received a grade of B or lower. Non-thesis students must register for COSC/DFSC 6347 in their terminal-semester. Note that continuous enrollment in the COSC 6347 course is required upon initiation of COSC 6347 until completion.

All MS in CDS students in Thesis Option are required to complete a Thesis, while students in Non-Thesis Option must complete a master's project.

- A thesis is typically a more extensive and in-depth research project. It involves conducting original research, often contributing new knowledge or insights to the field. Theses require a rigorous investigation, data collection, analysis, and interpretation of results. They are expected to be comprehensive and demonstrate a deep understanding of the chosen topic. The primary purpose of a thesis is to contribute new knowledge or advance the existing body of knowledge in the chosen field.
- On the other hand, a master's project is generally a smaller-scale endeavor compared to a thesis. It might involve applying existing knowledge to solve a practical problem or developing a prototype, application, or creative work. While it still requires research and analysis, the scope is usually narrower and more focused. Master's projects tend to emphasize practical application.

KPIs

Thesis

- Completion Rate: The percentage of students in the Thesis Option who successfully complete and defend their thesis by the end of their program.
- Grade Achievement: The percentage of students who receive an "A" or equivalent grade for their thesis.
- Publication and Contribution: The number of theses that result in a publication, presentation, or significant contribution to the field.
- Time to Completion: The average time taken for students in the Thesis Option to complete their thesis from the start of the project.

Master's Project

- Completion Rate: The percentage of students in the Non-Thesis Option who successfully complete and present their master's project.
- Grade Achievement: The percentage of students who receive an "A" or equivalent grade for their master's project.
- Timeliness: The average time taken for students in the Non-Thesis Option to complete their master's project from initiation to final submission.

Target Description:

The following targets are associated with each Key Performance Indicator (KPI) for the MS in CDS program:

Thesis

- Completion Rate: Aim for 90% or higher of students in the Thesis Option to successfully complete and defend their thesis by the end of their program.
- Grade Achievement: Target 80% or higher of theses to receive an "A" grade or its equivalent.
- Publication and Contribution: Aim for 25% of theses to result in a publication, presentation, or significant contribution to the field.
- Time to Completion: Average time for thesis completion should be within 2 semesters from the start of the thesis project.

Master's Project

- Completion Rate: Aim for 90% or higher of students in the Non-Thesis Option to successfully complete and present their master's project.
- Grade Achievement: Target 80% or higher of master's projects to receive an "A" grade or its equivalent.
- Timeliness: Average time for project completion should be within two semesters from the start of the project.

Results Description:

Results

Fall 2023

- Thesis Option: One student successfully completed their thesis within two semesters, received an "A" grade, and published the results.
- Non-Thesis Option: Out of 10 students, all received "A" grades and completed their projects within two semesters.

Spring 2024

- Non-Thesis Option: Three students completed their projects within two semesters, all receiving "A" grades.

Summer 2024

No students completed a thesis or master's project during Summer 2024.

Findings

Thesis Completion

The student in the Thesis Option demonstrated high performance by completing the thesis within the expected timeframe, achieving an "A" grade, and publishing the results. This indicates a successful and impactful research outcome.

Master’s Project Completion

All Non-Thesis students in both Fall 2023 and Spring 2024 completed their projects within the expected timeframe and received "A" grades. This suggests that students in the Non-Thesis Option are effectively meeting the program’s project requirements.

Program Effectiveness

The consistent achievement of high grades and timely project completion across both options highlights the effectiveness of the program's support mechanisms and instructional quality.

Summer Term

No thesis or master's projects were completed in the Summer 2024 term, which may be due to the typical academic schedule or student availability. This may be an area to monitor for future trends or consider adjustments if necessary.

RELATED ITEM LEVEL 3

Final Capstone Project

Action Description:

Action Plans for MS in CDS's Casptone Projects

1. Continue to ensure that project proposals are reviewed within the first two weeks of the semester. Consider streamlining the review process if needed, and provide timely feedback to students to help them refine their proposals.
2. Maintain the structure of weekly progress meetings with project advisors. Ensure that these meetings are productive by providing guidelines for effective progress reporting and addressing any issues that arise.
3. Review the midterm evaluation process to ensure it effectively assesses students' progress. Collect feedback from both students and faculty to identify any areas for improvement in the evaluation process.
4. Ensure that the distribution of project activities among committee members is balanced and that all committee members are engaged in the evaluation process. Consider providing additional training or guidelines for committee members to enhance their effectiveness.
5. Evaluate the effectiveness of the final project presentations and provide constructive feedback to students. Consider implementing a formal feedback mechanism for both the presentation and the completed application to help students improve their work.
6. Periodically review the established procedures for managing projects to ensure they align with current best practices and address any emerging needs or challenges. Update procedures as necessary to improve the overall project management process.
7. Promote the identification of significant application development needs by encouraging students to engage with real-world clients or scenarios. Provide additional resources or support to help students address complex, real-world problems in their projects.

RELATED ITEM LEVEL 2

Written Comprehensive Examination

KPI Description:

CDS Comprehensive Exam

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- **Plan 1 – Thesis Option** requires 24 hours of a coursework which is a combination of compulsory (core) and track elective courses, and 6 hours of thesis courses (COSC/DFSC 6348 and 6049). In total, the program requires 30 hours. Thesis students must register for COSC/DFSC 6347 in their proposal semester, and for COSC/DFSC 6049 in their defense semester. Note that continuous enrollment in the thesis course is required upon initiation of the thesis until completion.
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All MS in CDS students in Non-Thesis Option must pass **written comprehensive exams for core subjects where they obtained a grade of B or lower**, **achieving a grade of at least 70**. As exams are conducted during their terminal semester, it is strongly encouraged to finish the core subjects before the terminal semester.

The core courses for CDS program (Non-Thesis) are:

- COSC 5318 Database Systems
- COSC 5319 Algorithm Design and Analysis
- COSC 5327 Operating Systems
- COSC 6318 Language and Compiler Design
- COSC 6319 Software Engineering

KPI (Key Performance Indicators)

- Pass Rate: The percentage of students who achieve a passing score of at least 70% on their first attempt. This metric indicates how well students are performing on their initial exam.
- Success Rate of Re-Examinations: The percentage of students who pass the comprehensive exam on their re-examination attempt. This shows how effective the re-taking policy is in helping students meet the required standards.
- Percentage of Students Passing All Attempts: The percentage of students who successfully pass the comprehensive exam within the allowed number of attempts (including re-examinations). This reflects the overall effectiveness of the exam preparation and support provided.
- Average Exam Score: The average score of all students who take the comprehensive exam, which helps gauge the overall performance and understanding of the course material.
- Exam Failure Rate: The percentage of students who fail the exam on all attempts, which provides insight into the proportion of students struggling with the exam despite multiple attempts.

Target Description:

The target is for at least 85% of students to achieve a passing score of at least 70% on their first attempt at the comprehensive exam. Among those who do not pass on the first attempt, the goal is for at least 75% to pass on their re-examination. The program also aims for an average exam score of 75% or higher across all students taking the exam. The program also seeks to minimize the number of students who fail all three attempts, with fewer than 5% of students reaching this point, indicating effective preparation and support throughout the exam process.

Results Description:

MS in CDS, Comprehensive Exam Results

Fall 2023

Out of 11 students in their terminal semester, one student with the Thesis option received a waiver for the comprehensive exam, while the remaining 10 students were required to take the test for the following courses.

- COSC 5318 Database Systems
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Overall, all students who were required to take the comprehensive exam successfully passed, with each scoring at least 80%. This indicates that the program's preparation and support mechanisms were effective for the students who took the exam.

Spring 2024

There were 4 students required to take the test for the following courses.

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Overall, all students who were required to take the comprehensive exam successfully passed, with each scoring at least 80%. This indicates that the program's preparation and support mechanisms were effective for the students who took the exam.

Summer 2024

We did not have students required to take the tests.

RELATED ITEM LEVEL 3

Written Comprehensive Examination

Action Description:

<u>Action Plan for MS in CDS's comprehensive exams:</u>

- Maintain the current support and preparation strategies that have led to high passing rates. Regularly review and update the exam preparation resources and support services based on student feedback and performance data.
- While the waiver system is successful in reducing the number of students required to take the exam, evaluate if any adjustments are needed to better align with program objectives or address any emerging trends.
- Regularly review the comprehensive exam content to ensure it aligns with the current curriculum and adequately assesses the students' knowledge and skills. Update exam content if necessary to reflect any changes in the program or industry standards.
- Ensure that students are well-informed about the comprehensive exam requirements and waiver criteria. This will help maintain high levels of

performance and minimize any confusion regarding the examination process.

Update to Previous Cycle's Plan for Continuous Improvement Item

Previous Cycle's Plan For Continuous Improvement (Do Not Modify):

Closing Summary

Succesfully launch MS in CDS with a Professional Plan (course-based MS Degree).

Succesffuly launch Online Data Science Certificate program was proposed.

Update of Progress to the Previous Cycle's PCI:

Update:

- MS in CDS Professional Plan: We are currently evaluating the potential implementation of a Professional Plan for the MS in CDS program. This consideration comes in response to the increasing number of students in the DF/IAC program opting for the professional track, which does not require research projects. We aim to ensure that at least one of our MS programs emphasizes research activities, providing students with opportunities for significant research engagement. The decision on whether to proceed with the Professional Plan for the MS in CDS will be based on strategic discussions and an assessment of how it aligns with our goals for research-focused education.
- Online Data Science Certificate Program: We successfully launched the Online Data Science Certificate program. This new program has been well-received and provides students with flexible, high-quality education in data science. The program is designed to enhance the skills of professionals and students in the rapidly growing field of data science, aligning with our commitment to offering innovative and relevant educational opportunities.

Moving forward, we will continue to focus on enhancing the research components of our programs and evaluating new opportunities to expand our offerings based on student and industry needs.

New Plan for Continuous Improvement Item

Closing Summary:

Continue offering recruitment scholarships to attract new students. Expand the scholarship program if possible and ensure that the promotion of these scholarships is well-publicized during orientations and through other channels.

Ensure that financial aid coverage for STEM/Preparatory courses is maintained. Regularly review and adjust financial aid policies to support students effectively and retain them in the program.

Discuss implementing additional support mechanisms for students working on their theses and projects.

Continue to monitor the impact of the Professional and Thesis Options and make necessary adjustments based on student enrollment trends and feedback.