**MS DAIS Curriculum and Assurance of Learning Processes**

**Curriculum**

Curriculum Review Process

The M.S. in Data Analytics and Information Systems (MSDAIS) program curriculum is regularly reviewed every fall semester. The graduate faculty in the Department of Computer Information Systems & Quantitative Methods (CIS & QM) and the MSDAIS program coordinator are responsible for the review and developing curricular improvements. The proposals for curricular changes are reviewed and discussed by the graduate faculty. Minor changes (e.g., addition/deletion/modification of a topic in a course or software used for class) are discussed and approved by the graduate faculty within the department. However, after faculty review and discussion, the graduate faculty will vote on the proposed major changes (e.g., addition/deletion of a core course). All approved major changes will be forwarded to the McCoy College Graduate Policy Committee (GPC) for review and approval. After the GPC approves proposed major changes, these changes are forwarded to the McCoy College of Business Administration Council (CBAC) for review and approval. After approval of major changes by CBAC, these changes go through the university curriculum change process. For curriculum review, feedback is typically solicited from a range of stakeholders, including the CIS & QM faculty and Department of CIS & QM Advisory Board. In Fall 2020, few changes were made in the course content and software used within MSDAIS core courses.

Curriculum Requirements

The MSDAIS thesis and non-thesis options require 30 semester credit hours.

**MSDAIS Non-Thesis Option:\***

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| **Required Courses:** |
| **Course Code** | **Course Title** | **Credit Hours** |
| CIS 5355 | Database Management Systems | 3 |
| CIS 5357 | Computing for Data Analytics | 3 |
| CIS 5364 | Data Warehousing | 3 |
| CIS 5367 | Machine Learning | 3 |
| QMST 5332 | Optimization | 3 |
| QMST 5334 | Statistical Methods for Business | 3 |
| QMST 5335 | Forecasting and Simulation | 3 |
| QMST 5336 | Analytics | 3 |
| **Prescribed Electives:** |
| Choose 6 hours from the following: | 6 |
| CIS 5358 | Agile Project Management For Business Professionals |  |
| CIS 5369 | Independent Study in Computer Information Systems |  |
| CIS 5370 | Enterprise Resource Planning and Business Intelligence |  |
| CIS 5390C or QMST 5390A | Statistical Computing |  |
| CIS 5395 | Internship in Computer Information Systems |  |
| GEO 5301 | Multivariate Quantitative Methods |  |
| GEO 5418 | Geographic Information Systems I |  |
| GEO 5419 | Geographic Information Systems II |  |
| HIM 5311 | Informatics, Analytics and Data Use |  |
| HIM 5340 | Healthcare Informatics |  |
| IE 5310 | Advanced Statistical Design of Experiments for Engineers |  |
| IE 5340 | Applied Deterministic Operations Research for Engineers |  |
| IE 5343 | Non-Linear Optimization Techniques for Engineers |  |
| IE 5398C | Data-Intensive Analysis and Simulation for Engineers |  |
| MGT 5311 | Process Improvement Management in Organizations |  |
| MGT 5321 | Supply Chain Management |  |
| MKT 5322 | Marketing Research Methods |  |
| MKT 5323 | Qualitative Research in Marketing |  |
| MKT 5340 | Digital Marketing |  |
| MKT 5345 | Marketing Analytics |  |
| QMST 5342 | Probability and Statistical Models |  |
| QMST 5343 | Data Mining |  |
| QMST 5395 | Internship in Analytics |  |
| **Total Hours** | 30 |

\* - All MSDAIS students enrolled in the non-thesis option are required to take and pass a written comprehensive examination in their last semester of the program.

**MSDAIS Thesis Option:**

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| **Required Courses:** |
| **Course Code** | **Course Title** | **Credit Hours** |
| CIS 5355 | Database Management Systems | 3 |
| CIS 5357 | Computing for Data Analytics | 3 |
| CIS 5364 | Data Warehousing | 3 |
| CIS 5367 | Machine Learning | 3 |
| QMST 5332 | Optimization | 3 |
| QMST 5334 | Statistical Methods for Business | 3 |
| QMST 5335 | Forecasting and Simulation | 3 |
| QMST 5336 | Analytics | 3 |
| **Thesis Courses:** |
| CIS 5399A or QMST 5399A | Thesis | 3 |
| Choose a minimum of 3 hours from the following: | 3 |
| CIS 5199B or QMST 5199B | Thesis |  |
| CIS 5299B or QMST 5299B | Thesis |  |
| CIS 5399B or QMST 5399B | Thesis |  |
| CIS 5599B or QMST 5599B | Thesis |  |
| CIS 5999B or QMST 5999B | Thesis |  |
| **Total Hours** | 30 |

Curriculum learning experiences relevant to:

* Business theories and practices

The MS DAIS is designed to train students for data driven decision making. It includes topics such as statistical and analytical tools such as optimization and data warehousing that prepares student to develop actionable business intelligence.

* Engagement with business practitioners

Students enrolled in the MSDAIS non-thesis option have the opportunity to engage in busines activity outside of the classroom by doing internships. Although, internship is not a required component, students are advised to do internship during the program. Some of the companies at which MSDAIS students have done internship include 7X Energy, Coveo, IBM, Integra LLC, LPL Financial, Kalypso, Kronologic, and University Federal Credit Union.

A requirement of the MS DAIS program is for students to participate in professional development events that that includes guest speakers and also allows for students to engage with practitioners.

* Cultural norms

The technical nature of this course does not lend itself to addressing issues associated with cultural norms.

* Life long learning

The high dependence of this program on technology requires an associated emphasis on its dynamic and evolving nature, resulting in a mindset of continuous learning.

* Societal impact

The technical nature of this course does not lend itself to addressing issues associated with cultural norms.

Information technology

Current and emerging technologies are incorporated in the curriculum based on the feedback from the faculty, department’s Industry Advisory Board members, and alumni, monitoring changes in industry based on industry surveys in the field, and technology innovations by companies such as Microsoft and SAP. The MSDAIS curriculum has incorporated MS SQL Server/MySQL for database management systems; SAP Business Warehouse for data warehouse; R and Python for analytical and statistical computing, graphics, and machine learning; MATLAB and Advanced MS Excel for statistical analysis and optimization; SAP HANA for in-memory database; SAP Lumira for visualization; Simio for simulation; and Apache Spark for big data analytics.

**Assurance of Learning**

Process for review of learning goals

The process for identification of the initial set of learning goals for the MS DAIS program began with input from the graduate faculty in the department. The department chair then sought feedback from the department’s Industry Advisory Board members. The input from the department’s Industry Advisory Board members was then shared with the graduate faculty in the department. During the fall semester, the graduate faculty in the department met to review and discuss the proposed learning goals. The outcome of the graduate faculty meeting resulted in the proposed list of learning goals. Once approved by the department’s graduate faculty, the proposed learning goals were forwarded to the McCoy College Graduate Policy Committee (GPC) for review and approval. Once approved, the program faculty began the process of creating the assessment performance targets and methods.

It is anticipated that future reviews of the learning goals will follow the same process with the addition that accrued assessment reports will be included as part of the review process.

Learning goals

1. Students will demonstrate critical thinking skills necessary to define and solve problems.
2. Demonstrate analytical skills to develop data-driven solutions for problems.
3. Ability to analyze large datasets and develop modeling solutions to support decision making.
4. Apply knowledge and technical skills to perform prescriptive analytics.
5. Design and implement data management strategies.

How often are learning goals reviewed

The learning goals will be formally reviewed every five years in conjunction with the annual program review. Consideration for changes to the learning goals will be based on input from the CIS & QM faculty, the Department of CIS & QM Industry Advisory Board, and accrued assessment reports. Learning goals are assessed during every long semester in which the class is offered.

Process for assessment of learning goals

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Learning Goal | Performance Target | How Assessed | Where Assessed | When Assessed | Results | Improvement Identify whether process (P) or Curriculum (C) (Date changes were made) |
| Direct Measures |
| 1 | \*See Below | \*\* See Below | QMST 5334CIS 5357 | Every long semester | \*\*\*NA | \*\*\*NA |
| 2 | \*See Below | \*\* See Below | QMST 5336CIS 5357QMST 5335 | Every long semester | \*\*\*NA | \*\*\*NA |
| 3 | \*See Below | \*\* See Below | QMST 5336CIS 5367 | Every long semester | \*\*\*NA | \*\*\*NA |
| 4 | \*See Below | \*\* See Below | QMST 5336QMST 5332 | Every long semester | \*\*\*NA | \*\*\*NA |
| 5 | \*See Below | \*\* See Below | CIS 5355CIS 5364 | Every long semester | \*\*\*NA | \*\*\*NA |
| Indirect Measures |
|  |  |  |  |  |  |  |

Currently the program does not use indirect measures as part of its curriculum or assessment review. However, as part of the next curriculum review process a discussion will be held on prospective indirect measures to obtain and use as part of the review processes. Potential indirect measure to consider will include the college graduate salary survey, the university graduate alumni survey, and others.

**\* The standards of performance are:**

* Scores of 90% correct or better will indicate that the student exceeds expectations.
* Scores greater than 80% correct but less than 90% correct will indicate that the student meets expectations.
* Scores less than 80% correct will indicate that the student failed to meet expectations.

It is expected that 80% of students enrolled in the course during the academic year will meet or exceed the standards on each learning outcome.

**\*\* How Learning Outcomes Are Assessed**

Learning Outcome 1: Students will demonstrate critical thinking skills necessary to define and solve problems.

* In QMST 5334, Statistical Methods for Business, the assessment technique/rubric for outcome 1 is as follows. Short-answer items in exams will be used to assess students’ ability to define problems and apply appropriate statistical techniques. Excellent scores will have correct use of statistical techniques and interpretation of results. Acceptable scores will have some errors in technique used or interpretation of results. Unacceptable scores will have major errors in use of techniques and interpretation of results.
* In CIS 5357, Computing for Data Analytics, the assessment technique/rubric for outcome 1 is as follows. An exam problem will require students to define problem and develop code to implement solution for the given problem. Excellent scores will have correctly implemented the solution for the given problem. Acceptable scores will have some error in the code implementation. Unacceptable scores will have major errors and the code may not work for the problem.
* In QMST 5334, Statistical Methods for Business, the assessment technique/rubric for outcome 1 is as follows. A project that will require students to define problem and use appropriate technique(s) to solve the problem. Excellent scores will have correct use of statistical techniques and interpretation of results. Acceptable scores will have some errors in technique used or interpretation of results. Unacceptable scores will have major errors in use of techniques and interpretation of results.
* In CIS 5357, Computing for Data Analytics, the assessment technique/rubric for outcome 1 is as follows. An out-of-class assignment will require students to define problem and develop code to implement solution for the problem. Excellent scores will have implemented the solution for the given problem. Acceptable scores will have some error in the code implementation. Unacceptable scores will have major errors and the code may not work for the problem.

Learning Outcome 2: Demonstrate analytical skills to develop data-driven solutions for problems.

* In QMST 5336, Analytics, the assessment technique/rubric for outcome 2 is as follows. At least one data-based problem in exams will be used to assess students’ ability to identify and apply appropriate analytical methods to solve given problem. Excellent scores will properly apply analytical methods and interpret results. Acceptable scores will have some errors in applying analytical methods or interpreting results. Unacceptable scores will have fatal errors in applying analytical methods and interpreting results.
* In CIS 5357, Computing for Data Analytics, the assessment technique/rubric for outcome 2 is as follows. At least one problem given in exam will assess student’s ability to develop and data-driven solution for practical scenarios. Excellent scores will have correctly implemented the data-driven solution for the given problem. Acceptable scores will have some errors in the code implementation. Unacceptable scores will have major errors in implementation and the code may not work for the problem.
* In CIS 5357, Computing for Data Analytics, the assessment technique/rubric for outcome 2 is as follows. An out-of-class project will require students to extract/collect data for a problem, read the data, and implement data-driven solution to provide insights for the problem. Excellent scores will have implemented the solution and provided insights for the given problem. Acceptable scores will have some error in the code implementation for the solution or insights provided. Unacceptable scores will have major errors in the code implementation and insights provided, and the code may not work for the problem.
* In QMST 5335, Forecasting & Simulation, the assessment technique/rubric for outcome 2 is as follows. Three projects will require students to develop data-driven solutions for practical problems. First project will require students to use appropriate forecasting methods to develop forecasts for given data. Second project will require students to use simulation for evaluating different scenarios. Third project will require students to analyze and use data to simulate a complex system for decision making. For the first project, excellent scores will have correct selection and implementation of appropriate forecasting method. Acceptable scores will have some errors in the implementation of forecasting method. Unacceptable scores will have major errors in selection and implementation of forecasting method. For the second and third projects, excellent scores will have correctly implemented solution and interpreted results. Acceptable scores will have some errors in interpretation of results. Unacceptable scores will have major errors in the implemented simulation and interpretation of results.

Learning Outcome 3: Ability to analyze large datasets and develop modeling solutions to support decision making.

* In QMST 5336, Analytics, the assessment technique/rubric for outcome 3 is as follows. At least one problem in exam will be used to assess students’ ability to analyze a dataset and interpret the result to support decision making. Excellent scores will have correctly analyzed data and interpreted results to support decision making. Acceptable scores will have some errors in data analysis or interpretation of results. Unacceptable scores will have major errors in use of data analysis and interpretation of results for decision making.
* In CIS 5367, Machine Learning, the assessment technique/rubric for outcome 3 is as follows. At least one problem in exam will be used to assess students’ ability to apply machine learning models for implementing decision systems. Excellent scores will have successfully implemented decision systems using appropriate machine learning models. Acceptable scores will have some errors in implementing the system or using appropriate machine learning models. Unacceptable scores will have major errors in implementation and use of machine learning models for the system.
* In QMST 5336, Analytics, the assessment technique/rubric for outcome 3 is as follows. An out-of-class project will require students to analyze dataset(s) using appropriate analytical methods to support data-driven decision making for a specific problem. Excellent scores will apply appropriate analytical methods to support decision making. Acceptable scores will have some errors in applying analytical methods to decision making. Unacceptable scores will have major errors in applying analytical methods to decision making.
* In CIS 5367, Machine Learning, the assessment technique/rubric for outcome 3 is as follows. At least one assignment will be used to assess students’ ability to apply machine learning models for implementing decision systems. Excellent scores will have successfully implemented decision systems using appropriate machine learning models. Acceptable scores will have some errors in implementing the system or using appropriate machine learning models. Unacceptable scores will have major errors in implementation and use of machine learning models for the system.

Learning Outcome 4: Apply knowledge and technical skills to perform prescriptive analytics.

* In QMST 5336, Analytics, the assessment technique/rubric for outcome 4 is as follows. At least one problem in exams will be used to assess students’ ability to use optimization and/or decision analysis for a given scenario. Excellent scores will correctly formulate and solve the problem, as well as properly explain the results. Acceptable scores will have some errors in formulating, solving process, or explaining results. Unacceptable scores will have major errors in formulating, solving process, and explaining results.
* In QMST 5332, Optimization, the assessment technique/rubric for outcome 4 is as follows. Several exam questions will assess student’s prescriptive analytics skills and knowledge, which includes formulating optimization models (e.g., linear, integer, mixed-integer) and solving optimization models using different tools (e.g., MS Excel, MATLAB) for practical scenarios. Excellent scores will have correct formulation, implementation, and interpretation of results. Acceptable scores will have some errors in formulation, implementation, or interpretation of results. Unacceptable scores will have major errors in formulation, implementation, and interpretation of results.
* In QMST 5336, Analytics, the assessment technique/rubric for outcome 4 is as follows. An out-of-class project will be used to assess students’ ability to use appropriate prescriptive analytics to support data-driven decision making in a given scenario. Excellent scores will demonstrate strong capacity of using appropriate prescriptive analytics to support real-life decision making. Acceptable scores will have some errors in performing prescriptive analytics or interpreting results to support decision making. Unacceptable scores will have major errors in performing prescriptive analytics or interpreting results in decision making.
* In QMST 5332, Optimization, the assessment technique/rubric for outcome 4 is as follows. A project will assess student’s ability to apply prescriptive analytics skills and knowledge to analyze practical optimization problems and their solution concepts. Excellent scores will have correct formulation, analysis, and interpretation of problems and concepts. Acceptable scores will have some errors in formulation, analysis, or interpretation of problems and concepts. Unacceptable scores will have major errors in formulation, analysis, and interpretation of problems and concepts.

Learning Outcome 5: Design and implement data management strategies.

* In CIS 5355, Database Management Systems, the assessment technique/rubric for outcome 5 is as follows. CIS 5355 will use exam-embedded questions. Two components assessed include ability to design and implement database and query database to retrieve data for a business scenario. For the first component, at least one exam question will be used to assess students’ ability to develop conceptual database design and implement a relational database schema for given business data management requirements. For the second component, several exam questions will require students to write Structure Query Language (SQL) statements to generate required business information. For the first component, excellent scores will have correct conceptual database design and implementation of database schema. Acceptable scores will have some errors in the conceptual database design or implementation of relational schema. Unacceptable scores will have major errors in database design and implementation of relational schema. For the second component, excellent scores will have correct SQL statements that generates required business information. Acceptable scores will have some errors in the SQL statements. Unacceptable scores will have major errors in the SQL statements that do not execute or generates incorrect information.
* In CIS 5364, Data Warehousing, the assessment technique/rubric for outcome 5 is as follows. At least one exam question will be used to assess students’ ability to develop data warehouse design for given business data analysis requirements. Excellent scores will have correct data warehouse design to support data analysis requirements. Acceptable scores will have some errors in the data warehouse design. Unacceptable scores will have major errors in the data warehouse design which causes data management and analysis issues.
* In CIS 5355, Database Management Systems, the assessment technique/rubric for outcome 5 is as follows. Two components assessed include ability to design and implement database and query database to retrieve data for a business scenario. For the first component, at least one out-of-class assignment will be used to assess students’ ability to develop conceptual database design and implement a relational database schema for given business data management requirements. For the second component, several assignment questions will require students to write Structure Query Language (SQL) statements to generate required business information. For the first component, excellent scores will have correct conceptual database design and implementation of database schema. Acceptable scores will have some errors in the conceptual database design or implementation of relational schema. Unacceptable scores will have major errors in database design and implementation of relational schema. For the second component, excellent scores will have correct SQL statements that generates required business information. Acceptable scores will have some errors in the SQL statements. Unacceptable scores will have major errors in the SQL statements that do not execute or generates incorrect information.
* In CIS 5364, Data Warehousing, the assessment technique/rubric for outcome 5 is as follows. One assignment question will be used to assess students’ ability to develop data warehouse design for given business data analysis requirements. Excellent scores will have correct data warehouse design to support data analysis requirements. Acceptable scores will have some errors in the data warehouse design. Unacceptable scores will have major errors in the data warehouse design which causes data management and analysis issues.

**\*\*\* MSDAIS Program Evidence of Improvement for 2019-2020**

The MSDAIS is a new program started in Fall 2019. Thus, for the MSDAIS program, no assessment data is available yet as the assessment data will be reported in May 2021.

Faculty involvement in the process

The entire curriculum and assurance of learning review processes are faculty driven. Faculty collectively decide on the learning goals for the program and determine which learning goals will be assessed in which classes. Faculty that teach a program core class review and discuss the assessment results, and make any necessary curriculum adjustments. Additionally, at the annual curriculum review meeting the individual course assessments are reviewed as input for consideration of further program curriculum or structure changes.

**Learner Development**

Admission requirements

The MSDAIS Admissions Committee takes Application to the MS DAIS program are reviewed by a team of three program faculty. When reviewing applications, a holistic approach is taken where if an applicant has a below average last 60 hours GPA, they will look for something to offset it, like an above average GMAT/GRE, or work experience. To be admitted to the program, applicants must be accepted by all three members of the admissions committee.

Advising

The program director is responsible for advising MSDAIS students. Due to course restrictions, most students must visit with the graduate academic advisor before registering for classes.

Student intervention process

If a student’s GPA falls below 3.0, they are automatically placed on academic probation by the Graduate College. The Graduate College requires that the student’s GPA equal or exceed 3.0 by the end of the next semester. When this occurs, the graduate academic advisor meets with the student to design a plan to get the student back on track. In some cases, this may require retaking one or more courses. In other cases, it may be the student takes fewer hours. In all cases, it is made clear to the student what they must do to avoid academic suspension and return to good academic standing. The Associate Dean for Graduate Programs generally reviews each probationary student’s plan.

When was the program last updated?

The MSDAIS program is new having started in Fall 2019. The program curriculum was developed by analyzing job market demand, using information about the knowledge and skills required for MSDAIS graduates as determined by industry surveys conducted by companies such as KPMG, PwC, and IBM, reviewing curriculum of existing leading graduate programs in this field (e.g., The University of Texas at Austin; Northwestern University), and input from faculty, and department’s Industry Advisory Board.

Minor changes were made in the MSDAIS program in Fall 2020.

What changes were made?
As the curriculum for MSDAIS program was developed and implemented after significant research in Fall 2019, there were no course additions or deletions done in Fall 2020. Few changes in the course content include change in QMST 5332 – Optimization course to focus on the applied aspects of optimization for analytics and CIS 5364 – Data Warehousing course to include use of in-memory database. These changes were proposed by the graduate faculty in the Department of Computer Information Systems and Quantitative Methods due to the importance of in-memory database technology and applied optimization in analytics.

Describe where changes to the curriculum were due to the AoL process.

The MSDAIS is a new program started in Fall 2019. No assessment data is available yet as the assessment data will be reported in May 2021. Thus, specific examples of AoL results used to drive curricular changes are unavailable.

What curricular changes are planned for the future?

The MSDAIS program curriculum will be reviewed annually, and proposed changes will be incorporated in the curriculum. Curricular changes will be based on inputs from the graduate faculty, department’s Industry Advisory Board members, and alumni.

Some of the planned curricular changes include in-memory database, data pipelines, cloud analytics, applied optimization, and changes in the restricted elective courses included in the curriculum. The graduate faculty in the department plan to continuously enhance the program curriculum.

How does the program take action when learners have not met competency goals?

Generally, this has not been an issue. All goals are assessed in two or more core MBA courses. In the few cases where it has occurred, the faculty teaching the courses where the goals were not met will meet and discuss the issue and corrective action is taken. This may be in the form of revising how the material is taught or a revision in the assessment method.

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