



WINONA STATE UNIVERSITY
NEW AND REVISED COURSE AND PROGRAM APPROVAL FORM

Routing form for new and revised courses and programs.

Course or Program: B.S. Major – Data Science (DSCI)

| | | |
|--|----------------|---|
| Department Recommendation | | |
|  | <u>1/24/14</u> | <u>bdeppa@winona.edu</u> |
| Department Chair | Date | e-mail address |
| Dean's Recommendation <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No* | | |
|  | <u>1/29/14</u> | |
| Dean of College | Date | |
| *The dean shall forward their recommendation to the chair of the department, the chair of A2C2, and the Vice President for Academic Affairs. | | |
| A2C2 Recommendation <input type="checkbox"/> Approved <input type="checkbox"/> Disapproved | | |
| <hr/> | <hr/> | |
| Chair of A2C2 | Date | |
| Graduate Council Recommendation <input type="checkbox"/> Approved <input type="checkbox"/> Disapproved | | |
| (if applicable) | | |
| <hr/> | <hr/> | |
| Chair of Graduate Council | Date | |
| <hr/> | <hr/> | |
| Director of Graduate Studies | Date | |
| Faculty Senate Recommendation <input type="checkbox"/> Approved <input type="checkbox"/> Disapproved | | |
| <hr/> | <hr/> | |
| President of Faculty Senate | Date | |
| Academic Vice President Recommendation <input type="checkbox"/> Approved <input type="checkbox"/> Disapproved | | |
| <hr/> | <hr/> | |
| Academic Vice President | Date | |
| Decision of President <input type="checkbox"/> Approved <input type="checkbox"/> Disapproved | | |
| <hr/> | <hr/> | |
| President | Date | |
| Please forward to Registrar. | | |
| Registrar | <hr/> | Please notify department chair via e-mail that curricular change has been recorded. |
| | Date entered | |

WINONA STATE UNIVERSITY PROPOSAL FOR A NEW PROGRAM

This form is to be used to submit a proposal for a new undergraduate or graduate major, minor, concentration, or option. Every item on this form must be completed prior to submission to A2C2 for the proposal to be considered for approval. The department proposing a new program must include a *Financial and Staffing Data Sheet* and the *New and Revised Course and Program Approval Form* with department's and dean's signatures. Refer to Regulation 3-4, *Policy for Changing the Curriculum*, for complete information on submitting proposals for curricular changes.

Department: Mathematics & Statistics Date 1/20/14

Title of Program: B.S. – Data Science (DSCI)

This is a new: Major Minor Concentration Option Other
(explain)

Proposed Major/Minor Code: DSCI

Total Semester Hours in Program 59-60 S.H.

Please provide all of the following information:

(Note: Other documentation may not substitute for this. All information must be on this form)

A. A statement of the major focus and objectives of the new program

The role of the data scientist has become increasingly important over the last decade. This is because data scientists hold the key to tackling the fundamental problem created by the revolution in the development of computers and automated systems in the 21st Century: how to make sense of the unprecedented volumes of data that are generated on a daily basis? Indeed, in every facet of modern life, from online shopping and social networks to scientific research and finance, we collect immensely detailed information on actions taking place throughout the world. However, without interpretation, this data is just noise. Data scientists are concerned with turning this large scale data into intelligence through the application of cutting-edge techniques in Statistics and Computer Science.

The proposed B.S. – Data Science major degree is designed to prepare graduates for careers as data scientists by providing with them with the skill set necessary to transform data into information.

B. New catalog copy

1. Provide a list of program content as it will appear in the catalog including required courses, electives, etc., by number and name. Include the number and name for each prerequisite (and prerequisites of those prerequisites) which must be included in the total credit hour calculations for the program.

(note: a course may not be included in any program unless it has been approved according to Regulation 3-4)

Data Science (DSCI) – B.S. Major (59 – 60 S.H.)

The discipline of data science focuses on transforming data into knowledge. This degree requires a student to acquire knowledge and expertise in data science through an understanding of analytical and computational techniques, an interdisciplinary emphasis, and a capstone experience.

Required Courses (53-54 S.H.)

Analytical Knowledge – (21 - 22 S.H.)

- DSCI 210 – Data Science (3 S.H.)
- DSCI 310 – Data Summary and Visualization (3 S.H.)
- DSCI 325 – Management of Structured Data (3 S.H.)

- STAT 210 – Statistics (3 S.H.)
- STAT 310 – Intermediate Statistics (3 S.H.)
- STAT 360 – Regression Analysis (3 S.H.)

- MATH 140 – Applied Calculus (3 S.H.)
or MATH 212 – Calculus I (4 S.H.)

Computational Knowledge – (14 S.H.)

- CS 101 – Introduction to Computer Science (3 S.H.)
- CS 234 – Algorithms and Problem Solving (4 S.H.)
- CS 250 – Algorithms and Problem Solving II (4 S.H.)
- CS 385 – Applied Database Management Systems (3 S.H.)

Interdisciplinary Emphasis – (12 S.H.)

A minimum of 12 S. H. numbered 300 or above with the same prefix, e.g. BIOL, ECON, FIN, etc., chosen in consultation with your academic advisor. Courses with the DSCI, STAT, and CS prefix cannot be used to fulfill this requirement.

Capstone Experience (6 S.H.)

- DSCI 395 – Professional Skill Development for Data Science (2 S.H.)
- DSCI 495 – Communication of Capstone Outcomes (1 S.H.)

A project or internship proposal must be developed in consultation with your academic advisor.

- DSCI 488 – Data Science Project (3 S.H.)
or DSCI 492 – Internship in Data Science (3 S.H.)

Electives (6 S.H.)

Choose 6 S.H. from the following list.

- DSCI 425 – Supervised Learning (3 S.H.)
- STAT 350 – Design of Samples and Surveys (3 S.H.)
- STAT 370 – Statistical Consulting and Communication (3 S.H.)
- CS 341 – Data Structures (4 S.H.)
- CS 368 – Introduction to Bioinformatics (4 S.H.)

2. For each required and elective course in the program, provide the course number, name, and catalog description.

- **CS 101 – Introduction to Computer Science (3 S.H.)**
This course is aimed at students with little or no programming experience. Students will learn how to think methodically and how to solve problems effectively with computers through activity-based learning. Students will learn some of the “Big Ideas” of computing and experiment with activities such as visual programming, creating mobile apps and controlling robotics. Meets GOAL 4. Prerequisites: Qualifying score on mathematics placement exam or MATH 050.
- **CS 234 – Algorithms and Problem Solving (4 S.H.)**
An introduction to the major concepts of algorithm design and problem solving. Emphasis is on algorithm development, analysis, and refinement. Programming strategies and elements of programming also are covered. Various practical applications of problem-solving are demonstrated. Includes formal labs. Prerequisites: CS 101 – Introduction to Computer Science.
- **CS 250 – Algorithms and Problems Solving II (4 S.H.)**
A continuation of the problem solving and programming concepts introduced in CS 234 - Algorithms and Problem-Solving I. Applies the basic principles of software engineering to more complex problems. Topics include recursive problem solving, searching, sorting, and dynamic structures. Prerequisites: CS 234 - Algorithms and Problem-Solving I and MATH 120 - Precalculus.
- **CS 341 – Data Structures (4 S.H.)**
A detailed study of more advanced data structures and algorithms, including concepts and techniques of design efficiency and complexity of algorithms and their lower bounds. Topics include search trees, hash functions, string searching, disjoint sets, internal and external sorting, graphs and graph algorithms, and different algorithm design technique. Prerequisites: CS 250 - Algorithms and Problem-Solving II and CS 275 - Mathematical Foundations of Algorithms.
- **CS 368 – Introduction to Bioinformatics (4 S.H.)**
This course introduces students to the fundamental concepts of bioinformatics. Topics include introduction to DNA machinery and informatics, pairwise sequence alignments, bioinformatics programming, bioinformatics tools and database searches, phylogenetics analysis, genomics and proteomics, and introduction to DNA microarray analysis, sequencing techniques and algorithms. Advanced topics such as systems biology and HMM will be introduced as necessary. Prerequisites: CS 250 - Algorithms and Problem-Solving II and BIOL 241 - Basics of Life.
- **CS 385 – Applied Database Management Systems (3 S.H.)**
A study of basic Database Management Systems (DBMS) concepts. Topics include DBMS Models-Relational and object-oriented; study of query languages; study of exiting DBMS; and data integrity, recovery, and concurrency control. Prerequisites: CS 250 - Algorithms and Problem-Solving II and ENG 111 - College Reading and Writing.
- **DSCI 210 – Data Science (3 S.H.)**
An introduction to methods and techniques commonly used in data science. The management, preparation, analysis, visualization, and modeling of data will be discussed in this class. Students will complete a data science project. Prerequisites: CS 101 – Exploring Creative Computing or permission of instructor. Offered yearly.
- **DSCI 310 – Data Summary and Visualization (3 S.H.)**
This course will focus on methods, procedures, and application tools used to summarize and visualize data. Students will design and create summaries and visualizations to transform data into information in a variety of contexts. Students will complete a visualization project. Prerequisites: DSCI 210 – Data Science or permission of instructor. Offered yearly.
- **DSCI 325 – Management of Structured Data (3 S.H.)**
This course will give students an overview of the issues related to the management of structured data. Topics to be covered in this course include: data warehousing, data integrity and quality, data cleansing, basic programming concepts, the construction of simple algorithms, and the appropriate descriptive and graphical summaries of data. Commonly used software packages for the analysis and management of data will be emphasized. Prerequisites: DSCI 210 – Data Science or permission of instructor. Offered yearly.

- DSCI 395 – Professional Skill Development for Data Science (2 S. H.)
This course will develop skills necessary to become a working professional in the field of data science. Students will critique, analyze, and evaluate several data science research projects. A student’s presentation, writing, and professional skills will be enhanced in this course. Prerequisites: Completion of GEP GOAL 1 requirements, DSCI 310 – Data Summary and Visualization, STAT 310 – Intermediate Statistics, and CS 234 – Algorithms and Problem Solving, or permission of instructor. Offered yearly.
- DSCI 425 – Supervised Learning (3 S.H.)
An introduction to machine or statistical learning techniques, covering both supervised and unsupervised methods. Supervised methods for both predicting both numeric and categorical responses will be the focus. Unsupervised learning methods such as clustering, association rules, and dimension reduction methods will be briefly discussed. Prerequisite: DATA 210 – Data Science and STAT 360 – Regression Analysis, or permission of instructor. Offered alternate years.
- DSCI 488 – Data Science Project (1 – 6 S.H.)
Practical experience working on real problems under the supervision of a faculty member experienced in data science. Prerequisite: DSCI 395 – Professional Skill Development for Data Science and permission of instructor. Offered on demand.
- DSCI 492 – Internship in Data Science (3 – 6 S.H.)
Provides the student with experience and training in data science techniques. The student will work a minimum of 100 hours (3 credits) or a minimum of 200 hours (6 credits) on a job utilizing statistics. Prerequisite: DSCI 395 – Professional Skill Development for Data Science and permission of instructor. Offered on demand.
- DSCI 495 – Communication of Capstone Outcomes (1 S.H.)
Students will disseminate their capstone outcomes in this course. Students will be required to complete a professional poster, create and present a professional presentation, and create a professional written report. Prerequisites: DSCI 395 – Professional Skill Development for Data Science and DSCI 488 – Data Science Project or DSCI 492 – Internship in Data Science, or permission of instructor. Offered yearly.
- MATH 140 – Applied Calculus (3 S.H.)
An intuitive approach to calculus. Emphasis throughout is to enhance students’ understanding of how mathematics is used in real-world applications. Meets GOAL 4. Prerequisite: Qualifying score on the mathematics placement exam, MATH 112 - Modeling with Functions, MATH 115 - College Algebra, or MATH 120 - Precalculus.
- MATH 212 – Calculus I (4 S.H.)
Differential and integral calculus of functions of a single variable. Two semesters in sequence. Meets GOAL 4. Prerequisite: Qualifying score on the mathematics placement exam or MATH 120 - Precalculus.
- STAT 210 – Statistics (3 S.H.)
First course in statistics for students with a strong mathematics background. Meets GOAL 4. Prerequisites: MATH 140 - Applied Calculus or MATH 212 - Calculus I.
- STAT 310 – Intermediate Statistics (3 S.H.)
A second course in statistics covering regression, measures of association, and analysis of variance. Interpretation of computer output and applications will be emphasized throughout. Prerequisites: STAT 110 - Fundamentals of Statistics, STAT 210 - Statistics, STAT 303 - Introduction to Engineering Statistics, STAT 305 - Biometry, ♦ PSY 231 – Statistics, ECON 222 – Statistics for Business and Economics, or equivalent.
- STAT 350 – Design of Samples and Surveys (3 S.H.)
Practical problems of surveys. Design of optimal surveys. Questionnaire design. Practical problems of sampling. Design of optimal sampling procedures. Adapting standard statistical techniques to specialized sampling design. Meets GOAL 9. Prerequisite: STAT 310 - Intermediate Statistics. Offered fall semester.
- STAT 360 – Regression Analysis (3 S.H.)
Simple linear regression, multiple regression, hypothesis testing, analysis of residuals, stepwise regression. Interpretation of computer output will be emphasized. Completion of or concurrent enrollment in MATH 130 - Matrix Algebra or ♦ MATH 314 – Linear Algebra for Differential Equations is recommended. Prerequisite: STAT 310 - Intermediate Statistics. Offered fall semester.

- **STAT 370 – Statistical Consulting and Communication (3 S.H.)**
In this course, the student will gain an understanding of the nature of applied consulting and the scientific philosophies and skills required to be successful as a statistical consultant. This course will continue to develop the oral and written communication skills that are necessary for communicating technical statistical content with non-statisticians. Students will provide statistical consulting service to the University community when projects are available. Prerequisite: STAT 360 - Regression Analysis or STAT 365 - Experimental Design and Analysis. Offered fall semesters.

Note: [Per discussions with Ed Thompson, chairperson of CPPS. Date: January 24, 2014.] The course descriptions for the interdisciplinary emphasis will not be included in this proposal as any course, chosen in consultation with their advisor, numbered 300 or above would suffice for meeting this requirement.

3. Provide the catalog narrative describing the new program.

Data scientists are responsible for data into intelligence. Data science requires expertise in a variety of fields including statistics, computer science, and a specific application area. The B.S.– Data Science degree will prepare graduates for a career as a data scientist by enhancing their analytical, computation, and communication skills.

C. Impact of this program on other departments, programs, majors, and minors

1. Clearly state the impact of this new program on other departments, programs, minors, or majors.

As the proposed B.S. – Data Science program has substantial coursework in both statistics and computer science we suspect that this program may initially draw students that may alternatively have chosen a B.S. degree in either statistics or computer science. We are hopeful that in the long run however, that this program will attract a new audience of students interested in pursuing careers as a data scientist.

2. It is the responsibility of the department submitting a new program proposal to send written notification to the department(s) or program(s) affected. Attach letter(s) of understanding from any impacted department(s).

This program was developed in close consultation with the Department of Computer Science. A memo regarding the potential impact on computer science has been submitted with this proposal. The impact on other departments should be minimal.

D. Attach to this proposal a completed

1. *Financial and Staffing Data Sheet*
2. *New and Revised Course and Program Approval Form for this course*

You will also need to fill out the MNSCU New Program Application and submit this directly to the VPAA. This program will be implemented in the fall semester following completion of the approval process.

E. Department Contact Person for this Proposal:

| | | |
|---------------------|----------|--------------------|
| Christopher Malone | 457-2989 | cmalone@winona.edu |
| Name (please print) | Phone | e-mail address |

F. Review by Department A2C2 Representative

I have reviewed this proposal and certify that it is complete



Signature of A2C2 representative

WINONA STATE UNIVERSITY
FINANCIAL AND STAFFING DATA SHEET

Course or Program B.S. – Data Science (DSCI)

Include a Financial and Staffing Data Sheet with any proposal for a new course, new program, or revised program.

Please answer the following questions completely. Provide supporting data.

1. Would this course or program be taught with existing staff or with new or additional staff? If this course would be taught by adjunct faculty, include a rationale.

The courses in this program will be taught with existing staff. The new courses, DSCI 210 and DSCI 310, represent an increase of 6 S.H. above and beyond our current staffing in the Department of Mathematics & Statistics. As each course will be offered once per year and in different semesters, we should be able to absorb this increase in staffing without hiring new faculty or adjuncts.

2. What impact would approval of this course/program have on current course offerings? Please discuss number of sections of current offerings, dropping of courses, etc.

The approval of this program will have minimal impact on current course offerings as the existing courses that comprise the major requirements are currently offered on a regular basis. Initially these courses should be able to absorb the students majoring in Data Science. This is particularly true as we expect the initial Data Science majors will come from the population of students enrolled in statistics or computer science majors. In long-term, if the number of Data Science major grows, we may need to offer additional sections of the required courses to accommodate demand.

3. What effect would approval of this course/program have on the department supplies? Include data to support expenditures for staffing, equipment, supplies, instructional resources, etc.

Negligible. The courses in this program will utilize student issued laptops and possibly tablet devices. The software that we anticipate using for this program are SAS and SAS-JMP (which we have an ongoing annual licenses for), R (which is open-source), and Tableau (which the software vendor is going to provide at no cost to WSU students and faculty). In long-term we may want a dedicated server to support software and data storage. With summer incentive monies the Department of Mathematics & Statistics should be able to provide funds for the purchase and maintenance of such a server.



Winona State University

Department of Computer Science
P.O. Box 5838, 103 Watkins Hall
Winona, MN 55987-5838
Telephone (507) 457-5385

January 27, 2014

To: Chris Malone, Mathematics and Statistics Department
From: Narayan Debnath, Computer Science Department
Re: Data Science Major and Minor Proposal

The Department of Computer Science (CS) endorses the Data Science major and minor as proposed by the Math/Stat department. CS department will be able to accommodate future students in the required and elective courses specified in this proposal.

The CS department is highly excited about this new major and minor, and appreciates the active collaboration that Math/Stat and CS have demonstrated while preparing the proposal for such a major/minor at WSU. Moreover, CS department will be pleased to maintain an active partnership towards the success of this new major/minor and will work closely with Math/Stat department in the future.

Sincerely,

Narayan Debnath, Chair
Department of Computer Science

CC: Brant Deppa, Chair, Mathematics and Statistics Department
Charla Miertschin, Dean, College of Science & Engineering

Winona State University - Department of Mathematics & Statistics
Minutes of the Department Meeting on 1/24/14

Present: Joyati Debnath, Brant Deppa (chair), Jeff Draskoci-Johnson, Eric Errthum, Tisha Hooks, April Kerby, Steve Leonhardi, Chris Malone, Mike Markegard, Barry Peratt, Sam Schmidt, Samuel Tsegai, Aaron Wangberg, Nicole Williams, Lee Windsperger

New Business: Note: All of the items below were considered after the department waived the 40-hour rule without objection.

Motions from the Statistics Subgroup

1. STAT 100 – new course proposal and GEP proposal

The new STAT 100 course proposal and GEP proposal were approved without objection.

2. New program: B.S. Data Science (DSCI) major, minor, and courses

(i) The department approved two versions of the major, both without objection. The Math department indicated a preference for Version 2, but voted to accept Version 1 if Computer Science preferred that one. Chris was directed to submit whichever one Computer Science preferred. (Their discussion was still pending as of our meeting.)

(ii) The minor was approved without objection, also with the understanding that Computer Science might want to edit certain courses in the elective list.

(iii) All new courses associated with the proposed data science major were approved without objection. These include DSCI 210, DSCI 310, DSCI 395, DSCI 488, DSCI 492, and DSCI 495.

(iv) The notifications for the conversion of STAT 325 to DSCI 325 and STAT 425 to DSCI 425 were approved without objection.

3. Program revisions: B.S. Statistics (STAT) major, minor, and courses

(i) All revisions, both to the major and to the minor were approved without objection.

(ii) STAT 395 and STAT 495, i.e. the analogous courses to DSCI 395 and DSCI 495, were approved without objections.

Supporting documentation for items 1 – 3 above were sent to the department by Tisha Hooks (STAT 100) and Chris Malone (DSCI and STAT programs) via e-mail (01/22/14).

4. Notifications re: STAT

The following notifications seek Departmental approval. 1) In Spring, 2013, the department voted to make STAT 310 the prerequisite for a number of upper-division STAT courses. Either this paperwork was not submitted, or got lost. 2) The note in the course description for STAT 305 was corrected to read STAT 305 instead of Math 305. 3) A notification to edit course description slightly and to allow ECON 222 to serve as a possible prerequisite for STAT 310. 4) Include DSCI 210 as a prerequisite for STAT 370.

The department approved the submission/resubmission of all of these notifications.

5. Notifications re: MATH courses

The following notifications were submitted for departmental approval. (i) A change in course title for MATH 112 from "Modeling with Functions" to "Applied Precalculus" (ii) A change in the catalog description of MATH 112. (See the catalog language at the end of these minutes.) (iii) A change in number for MATH 140 to MATH 132 AND a change in prerequisites from "MATH 112 - Modeling with Functions, MATH 115 - College Algebra, or MATH 120 - Precalculus" to "MATH 112 – Applied Precalculus, MATH 115 - College Algebra, or MATH 120 - Precalculus" (iv) A change in the catalog description of MATH 132. (See the catalog language at the end of these minutes.)

The department approved all of these changes without objection.

6. Proposal re: MATH 117 from Steve, Barry, and Jeff

The department approved without objection the proposal to submit MATH 117 as a new course and also the proposal to submit it as a GEP course under Goal 4. Since the Math Subgroup had not had a chance to vote on the committee's work, the department waived normal procedures without objection. (The documents were handed out in the meeting.)

Secretary's note: If there is any confusion as to what, exactly, the department agreed to in Items 1-6 above, I can supply copies of the A2C2 paperwork upon request. Summaries of the proposals re: data science and statistics are attached below.

7. Adjourn

We adjourned about 12:50 p.m.

Respectfully submitted,
Jeff Draskoci-Johnson