# WINONA STATE UNIVERSITY NEW AND REVISED COURSE AND PROGRAM APPROVAL FORM

Routing form for new and revised courses and programs.

Course or Program\_\_\_DSCI 310 - Data Summary and Visualization

| Department Recommendation  |  |  |  |
|--|--|--|--|
| Man 1/24/14 bdeppa@winona.cdu  |  |  |  |
| Department Chair Date e-mail address   |  |  |  |
| Dean's Recommendation Yes No*  |  |  |  |
| Charla SMutscher<br>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 Approved Disapproved   |  |  |  |
|  |  |  |  |
| Chair of A2C2 Date   |  |  |  |
| Graduate Council Recommendation Approved Disapproved (if applicable)   |  |  |  |
| Chair of Graduate Council Date   |  |  |  |
| Director of Graduate Studies Date  |  |  |  |
| Faculty Senate Recommendation       Approved       Disapproved   |  |  |  |
| President of Faculty Senate Date   |  |  |  |
| Academic Vice President Recommendation Approved Disapproved  |  |  |  |
| Academic Vice President     Date   |  |  |  |
| Decision of President Approved Disapproved   |  |  |  |
| President Date   |  |  |  |
| Please forward to Registrar.   |  |  |  |
| Registrar Please notify department chair via e-mail that curricular change has been recorded.  |  |  |  |

# WINONA STATE UNIVERSITY PROPOSAL FOR A NEW COURSE

This form is to be used to submit a proposal for a new undergraduate or graduate course. Every item on this form must be completed prior to submission to A2C2. The department proposing a new course must include a *Financial and Staffing Data Sheet* and a *New and Revised Course and Program Approval Form* with the department chairperson'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 <u>Mathematics and Statistics</u>   |                                  | Date1/20/14_              |   |
|--|----------------------------------|---------------------------|---|
| <u>DSCI 310</u> <u>Data Summary a</u><br>Course No. Course Title   | and Visualization                | <u>3 S.H.</u><br>Credits* |   |
| This proposal is for a(n): <u>X</u> Undergraduate Course   | Graduate Course                  |                           |   |
| Is this course for USP?Yes** _X_No Is  | this course for GEP?Yes** _X_No  | )                         |   |
| List all Major Codes to which this proposal applies as a req   | uired course: DSCI               |                           |   |
| List all Major Codes to which this proposal applies as an el   | ective course: STAT              |                           |   |
| List all Minor Codes to which this proposal applies as a rec   | uired course: DSCI               |                           |   |
| List all Minor Codes to which this proposal applies as an el   | lective course: STAT             |                           |   |
| PrerequisitesDSCI 210 or permission of instructor  |                                  |                           |   |
| Grading method Grade only P/NC only  | y <u>X</u> Grade and P/NC Option |                           |   |
| Frequency of offering <u>Yearly</u>  |                                  |                           |   |
| What semester do you anticipate that will this course be off<br>Note: The approval process for a new course typically take | fered for the first time?        |                           | - |

\* If this course will change the number of credits for any major or minor, the form *Proposal for a Revised Program* must also be submitted and approved according to the instructions on that form.

\*\*For General Education Program (GEP) or University Studies (USP) course approval, the form *Proposal for General Education Courses* or *Proposal for University Studies Courses* must also be completed and submitted according to the instructions on that form.

### Please provide all of the following information:

(Note: a syllabus or other documentation may not substitute for this)

### **A. Course Description**

1. Description of the course as it will appear in the WSU catalog, including the credit hours, any prerequisites, and the grading method. If the course can be repeated, indicate the maximum number of credit hours for which this can be done.

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.

2. Course outline of the major topics, themes, subtopics, etc., to be covered in the course. This outline should be, at a minimum, a two-level outline, i.e., consisting of topics and subtopics. This information will be submitted to MnSCU by the WSU Registrar's office.

- 1. Introduction to Data Visualization
  - a. Historical background and examples
  - b. Examples of poor graphics
  - c. Examples of modern graphics
- 2. Data Types and Formats
  - a. Data Type (categorical, ordinal, continuous)
  - b. Structured data
  - c. Unstructured data
- 3. Summarizing Data
  - a. Numerical summaries
  - b. Aggregation
  - c. Conditioning (e.g., subsetting, filtering, slicing)
- 4. Univariate Displays
  - a. Bar graphs
  - b. Pie charts
  - c. Histograms
  - d. Dot plots and charts
  - e. Gauges
- 5. Bivariate Displays
  - a. Scatterplots
  - b. Comparative boxplots and other displays
  - c. Mosaic plots and stacked bar graphs
  - d. Time series plots
- 6. Multivariate Displays
  - a. Use size, color, and markers
    - i. bubble plots
    - ii. treemaps
    - iii. use of color & glyphs to visualize an extra dimension
  - b. Scatterplot matrices
  - c. Conditional/lattice plots
  - d. Data slicing
  - e. 3-D displays
  - f. Dynamic graphics
- 7. Plotting Spatial Data
  - a. Mapping (countries, states, counties, etc.)
  - b. Latitude and longitude
  - c. Binning
  - d. Utilities in software
- 8. Linked and Interactive Displays
  - a. Brushing
  - b. Labeling and tool-tips
  - c. Highlighting
- 9. Data Dashboards
  - a. Introduction to dashboards
  - b. Creation of dashboards
  - c. Features of dashboards
  - d. Interacting with dashboards

3.a Instructional delivery methods utilized: (Please check all that apply).

| Auditorium/Classroom:    | ITV              | Online       | Web Enhanced         | X Web Supplemented |
|--------------------------|------------------|--------------|----------------------|--------------------|
| Laboratory:              | Service Learning | Travel Study | Internship/Practicum | 1                  |
| Other: (Please indicate) |                  |              |                      |                    |

3.b. MnSCU Course media codes: (Please check all that apply).

| None:        | 3. Internet     | 6. Independent Study | 9. Web Enhanced        |
|--------------|-----------------|----------------------|------------------------|
| 1. Satellite | 4. ITV Sending  | 7. Taped             | X 10. Web Supplemented |
| 2. CD Rom    | 5. Broadcast TV | 8. ITV Receiving     |                        |

4. Course requirements (papers, lab work, projects, etc.) and means of evaluation.

Course requirements will include visualization projects/assignments that will require substantial computer use. Students will also complete a final project. Grades will be determined based upon a student's performance on all assigned work.

5. Course materials (textbook(s), articles, etc.).

The Visual Display of Quantitative Information, Edward Tufte, Graphics Press, 2001.

Visual Explanations, Edward Tufte, Graphics Press, 1997.

Envisioning Information, Edward Tufte, Graphics Press, 1990.

Visualizing Data, William Cleveland, Hobart Press, 1993.

Information Dashboard Design, Stephen Few, O'Reilly Media Inc., 2006.

Show Me the Numbers, Stephen Few, Analytics Press, 2012.

Visualize This, Nathan Yau, Wiley Publishing, 2011.

Visual Revelations, Howard Wainer, Springer-Verlag, 1997.

Online tutorials in Tableau use (www.tableausoftware.com).

R and R package documentation from the Comprehensive R Network (http://cran.us.r-project.org/).

Journal articles as needed.

6. List the student learning outcomes for this course and how each outcome will be assessed.

| Learning Outcomes  | Methods of Assessment                                   |
|--|---|
| Students will be able to identify and describe methods and techniques              | • Weekly assignments                                    |
| commonly used to describe data both numerically and visually.                      | <ul> <li>Course projects (midterm and final)</li> </ul> |
|  | • Exams/quizzes   |
| Students will be able to use appropriate methods to summarize and visualize        | <ul> <li>Weekly assignments</li> </ul>                  |
| data based upon the data type and the goals of the analysis.                       | • Course projects (midterm and final)                   |
|  | • Exams/quizzes   |
| Students will be able to demonstrate the ability to clean and prepare data for the | <ul> <li>Weekly assignments</li> </ul>                  |
| summarization and visualization process.   | • Course projects (midterm and final)                   |
| Students will demonstrate the ability to summarize and visualize relationships     | <ul> <li>Weekly assignments</li> </ul>                  |
| between variables appropriately given the data type of the variables involved.     | • Course projects (midterm and final)                   |
| Students will be able to construct an interactive data dashboard to summarize and  | <ul> <li>Final course project</li> </ul>                |
| display the important features of database.  |   |

# **B.** Rationale

Provide a rationale for the new course. The rationale should include the following items.

## 1. A statement of the major focus of the course.

This course will focus on summarizing data both visually and numerically. Students will use common tools for interacting with a large database, such as aggregation and conditioning, to create informative displays and tables. Emphasis will be on methods for visualizing data and translating raw data into useable information. Students will learn a variety of methods for visualizing variables and exploring relationships between them. Also, students will learn how to package individual data summaries into a data dashboard that will allow them to explore and dynamically interact with a relational database.

## 2. A statement of how this course will contribute to the departmental curriculum.

This course will teach students integral skills that every data scientist and statistician needs to have. Visualizing data is an essential skill for any data professional that needs to convey their findings to a non-technical audience.

# 3. A statement of why this course is to be offered at this level (i.e. 100-, 200-, 300-, 400-, or 500-level)

This is the second required course in the B.S. - Data Science (DSCI) core and is a sophomore level course for B.S. – Statistics majors; thus, a 300-level designation is appropriate. In addition, in our existing curriculum (e.g., STAT and MATH), the 200-level designates foundation-type courses. As DSCI 210 is a prerequisite for this course, DSCI 310 is a logical course number.

### 4. Identification of any courses which may be dropped, if any, if this course is implemented.

None.

# C. Impact of This Course on Other Departments, Programs, Majors, and Minors

Provide a statement of the impact of this course on other departments, programs, majors, and minors.

1. Clearly state the impact of this course on courses taught in other departments. Does this course duplicate the content of any other course? Is there any effect on prerequisites for this or any other courses?

The curriculum contained in this course creates a bridge between the disciplines of statistics and computer science. Our group has worked closely with computer science to ensure the content in this course is not duplicated in their curriculum.

2. Would approval of this course change the total number of credits required by any major or minor of any department? If so, explain the effects which this course would have.

Yes, this course is part of our new Data Science major and minor (DSCI).

3. If this course has an impact on the major or minor of any other department or program, it is the responsibility of the department submitting the course proposal to send written notification to the department(s) or program(s) affected. State clearly which other programs are affected by this proposal and whether the other departments have been notified and/or consulted. Attach letter(s) of understanding from impacted department(s).

The content of this course and the greater data science curriculum was developed in consultation with the computer science department. To our knowledge, no existing curriculum will be adversely impacted by the creation of this course.

# D. Attach to This Proposal a Completed

1. Financial and Staffing Data Sheet

2. New and Revised Course and Program Approval Form

# E. Department Contact Person for this Proposal:

<u>Christopher Malone</u> Name (please print) \_<u>457-2989</u> Phone <u>cmalone@winona.edu</u> e-mail address

# F. Review by Department A2C2 Representative

I have reviewed this proposal and certify that it is complete

Definitions for codes in 3a and 3b:

01-Satellite:

02- CD ROM:

- 03- Internet: Predominately = where all, or nearly all, course activity occurs in an online environment. One to two activities may occur face-to-face in a classroom, with the maximum being two activities.
- 04 ITV Sending: a course in which students are in the classroom with the instructor, other students join via interactive television technology from other geographically separate locations
- 05 Broadcast TV:
- 06 Independent Study: a course in which the teacher develops specialized curriculum for the student(s) based on department guidelines in the University course catalog
- 07 Taped: a course in which the teacher records the lessons for playback at a later date
- 08 ITV Receiving: a course in which students are not in the classroom with the teacher, other students join via interactive television technology from other geographically separate locations
- 09 Web Enhanced- Limited Seat Time: For a course in which students are geographically separate from the teacher and other students for a majority of required activities. However, some on-site attendance is required. The course includes synchronous and/or asynchronous instruction.
- 10 Web Supplemented- No Reduced Seat Time: For a course utilizing the web for instructional activities. Use of this code may assist your college/university in tracking courses for "smart classrooms" and/or facility usage.

Signature of A2C2 representative

# WINONA STATE UNIVERSITY FINANCIAL AND STAFFING DATA SHEET

Course or Program: DSCI 310 - Data Summary and Visualization\_

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.

This course will be taught with existing staff. The creation of this course, along with DSCI 210, represents an increase of 6 S.H. above and beyond our current staffing. 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 course, along with DSCI 210, will have minimal impact on current course offerings. This course is new and will not result in the dropping of any other courses. In the short-term, we anticipate offering a single section of this course per year.

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.

None. This course will utilize student issued laptops and possibly tablet devices. The software that we anticipate using for this course is SAS-JMP (which we have an ongoing annual license for), R (which is open-source), and Tableau (which the software vendor is going to provide at no cost to WSU students and faculty).

# 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" (iv) A change in the catalog description of 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 at 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