

UNIVERSITY OF MARY WASHINGTON – PROGRAM CHANGE PROPOSAL

Electronically submit this completed form with attachments in one file to the Chair of the College Curriculum Committee.

COLLEGE (check one):	Arts and Sciences	X	Business	Education
Proposal Submitted By: Stephen Davies	Date Prepared: 27 Nov 2016			
Department /Program:	Data Science			

Note: for any program change entailing the addition any new courses, or revisions to existing courses, separate proposal for those course actions must also be submitted.

PROPOSAL TO CHANGE EXISTING PROGRAM (check no than one of the following)	
Revise requirements for existing major	<input type="checkbox"/>
Revise requirements for a concentration within an existing major	<input type="checkbox"/>
Revise requirements for an existing degree program	<input type="checkbox"/>
Revise requirements for existing certificate program	<input type="checkbox"/>
Revise requirements for existing minor	<input checked="" type="checkbox"/>
Implementation Date: FALL semester, year:	FALL 2017

REQUIRED ATTACHMENTS FOR CHANGES TO EXISTING PROGRAMS:

1. **Rationale statement** (Why is this program change needed? What purposes will it serve?)
2. **Impact Statement** (Provide details about the Library, space, budget, technology, and impacts created by this program change. Supporting statements from the Library, IT Department, etc. evaluating the resource impact and feasibility of the program change are required.)
3. **Catalog Copy** (Provide the *existing* Catalog Description **and** the complete statement of the *proposed* new Catalog description that reflects the program changes)

PROPOSAL TO CREATE NEW PROGRAM NOT REQUIRING STATE ACTION (check no more that one of the following)	
New concentration within existing major	Name: _____
New minor	Name: _____
New Major but NOT a new degree*	Name: _____
*Use ONLY for interdisciplinary majors that will be grouped as part of the "Special Majors/General Liberal Arts and Sciences" degree (CIP Code 24.0101) or reported as a BLS degree (CIP Code 24.0199)	
Implementation Date (semester and year):	_____

REQUIRED ATTACHMENTS FOR NEW PROGRAMS NOT REQUIRING STATE APPROVAL:

1. **Rationale statement** (Why is this additional program needed? What purposes will it serve?)
2. **Impact Statement** (Provide details about the Library, space, budget, technology, staffing and curricular impacts created by this program change. Supporting statements from the Library, IT Department, etc. evaluating the resource impact and feasibility of adding the new program are required.)
3. **Catalog Copy** (Provide the complete Catalog Description for the proposed new program)
4. **Any change that impacts another Department must have a written statement (such as a copy of an email) from the Chair(s) agreeing to the change.**

Department Chair Approval: Stephen Davies Date: 11/29/16

CCC Chair Approval: _____ Date: _____

Dean Approval: _____ Date: _____

UCC Chair Approval: Patricia Reynolds Date: 2/18/2017

*Provost Approval: _____ Date: _____

**Required only in cases of proposals for new concentrations, new minors, or new majors that do not involve a new degree*

The Data Science minor continues to evolve as UMW (and other institutions) learn more about the best way to teach this burgeoning new field.

We propose the following changes to the minor requirements for the next academic year.

Existing Catalog Copy

Requirements for the Data Science Minor

Fifteen (15) credits to include MATH 200; CPSC/DSCI 219, and any three (3) of the following: DSCI 401, 402; CPSC 419, 420; MATH 300, or any BUAD, DSCI, CPSC, ECON or MATH course numbered 300 or higher, approved by the program director.

Proposed New Catalog Copy

Requirements for the Data Science Minor

Fifteen (15) credits to include:

- a) **STAT 280, DSCI 259, ECON 361, PSYC 360, or SOCG 364**
- b) **DATA 101**
- c) **DATA 219**
- d) **Any DATA course numbered 300 or higher, or STAT 320**
- e) **Any second DATA course numbered 300 or higher, or any course from the following list:
ECON 462, PSCI 471C4**

Rationale Statement

This comprises the following changes:

1. More rigorous statistics requirement. We have recognized that Statistics' central role to the Data Science discipline should be reflected in a more rigorous exposure for our minors. Instead of only MATH 200, an introductory course with no prerequisites, we will require the second course in the sequence, STAT 280 (formerly MATH 280) or an alternative, see below. This will provide minors with a more comprehensive understanding of basic statistical techniques and concepts that is suitable to the kind of data analysis they may eventually pursue.

2. More flexible statistics requirement. The Data Science minor is intended to complement a variety of different majors, some of which have their own statistics courses. We want to allow these courses to count for requirement "a" in place of STAT 280 in some cases, for two reasons: (1) to not force students to repeat material they have already passed, and (2) to make the minor more attractive for majors in those disciplines (a major in, say, Psychology may see that he or she has already completed one of the minor requirements, and may elect to explore the minor as a result).

The specific topics that each of the various UMW statistics courses cover varies a bit, and is dependent on the specific discipline. (For instance, the Economics department's courses focus on regression analysis, while the Psychology department's courses favor ANOVA.) The criteria we have decided upon for the minor is that the statistics course must be a *second* course; *i.e.*, it must have a statistics-related prerequisite. This rules out, for instance, GEOG 252. The courses in the proposed list have all been thoroughly vetted by Debbie Hydorn as being appropriate to the minor.

3. Incorporate "DATA" prefix. We wish to establish a new course prefix, "DATA," specifically for the Data Science program. This is for three reasons: (1) Over the past decade or two, Data Science has become a discipline in its own right, and we feel it deserves recognition as such. (2) It gives the Data Science minor a clearer "footprint" in the catalog, which should improve recognition of Data-Science-related coursework for current and prospective students and attract warranted attention to the program. (3) It significantly simplifies students' interpretation of the requirements. On numerous

occasions over the past couple of years, members of our committee have had to answer questions from well-meaning students who wonder why one BUAD or CPSC or DSCI or MATH course counts for the minor when another one doesn't. The existing requirements invite such investigations, especially since they state that "any" course in a variety of disciplines may count "with permission of the Program Director." All confusion on these points can be immediately cleared up by simply anointing courses that do count towards the minor with their own intuitive prefix and explicitly enumerating exceptions.

(Note: one common confusion prevalent among students and even faculty pertains to the prefix "DSCI," which is used by the College of Business to denote their "Decision Sciences" courses. **The "DSCI" prefix does not refer to the Data Science minor, and never has.** Even more confusing is the fact that two of the Decision Sciences courses (DSCI 401 and DSCI 402) do in fact count towards the Data Science minor, yet others don't. All of this is yet another reason that an explicit "DATA" prefix makes sense for our courses.)

4. **DATA 101.** As explained in the accompanying new course proposal for DATA 101, we wish to provide an introductory course *before* CPSC/DSCI/soon-to-be-DATA 219 that all prospective minors will take. This course, inspired by a "Big Ideas" course at William & Mary that we became aware of at a Governor's Summit, will provide both a broad framework of what the Data Science discipline encompasses, and also hands-on experience with some of the tools of Data Science (including the Python programming language) that will be built on in CPSC/DSCI/DATA 219. The course thus serves two purposes: to orient (and inspire) newcomers, and to expand the skill-building time beyond what the single course CPSC/DSCI 219 currently does.

5. **Eliminate MATH 300 as an elective.** Currently, we allow MATH 300 to count as a Data Science elective course, but after much discussion, we have decided to remove this. Although it is certainly true that linear-algebra-in-general is relevant to data-science-in-general, we believe that MATH 300 isn't really the right course for the minor. The course is taught from a pure math perspective, with a focus on proofs. The construction of proofs is of course vital to the discipline of mathematics, but not very relevant to the focus on practical application that we want our minors to experience. Students would be better served with one of the other electives.

6. **Require one "core" elective, and allow only one "application" elective.** One curricular challenge with the minor is what to do with discipline-specific, data-centric courses like ECON 462 and PSCI 471C4 (taught by Chad Murphy). On the one hand, we most certainly want to encourage our students to explore such courses, since they represent the very heart of interdisciplinary Data Science. On the other hand, we don't want students to miss out on "core" Data Science material – taught by members of the committee from a Data-Science-as-discipline perspective – by choosing too many electives that aren't integrated into our common vision. The current minor requirements permit a student to entirely "avoid" the CPSC 419, 420, DSCI 401, 402 set of core courses that we are designing specifically for the minor.

Our solution is to split up the elective requirement into two subsets (requirements "d" and "e"), one of which must be a core course, and the other of which can be an outside elective like ECON 462 or PSCI 471C4. (We consider STAT 320 part of the "core" even though the Mathematics department has not elected to cross-list it as DATA at this time.) This is a good compromise between exploration and integration.

7. **Explicitly list application electives.** In response to the aforementioned confusion (point 3, above), we will explicitly list the application electives that count towards the minor, rather than using the looser wording "or any ... course approved by the Program Director." At present, this is only ECON 462 and PSCI 471C4, but we plan to solicit additional options in the coming years, and the proposed wording of requirement "e" gives us an easy way to expand this list.

Impact statement

The net result of most of these changes is to clarify the program's requirements, not to expand them. The one exception is the DATA 101 course, which can be staffed entirely by the Computer Science department, at the expense of one or two sections of CPSC 110 per semester (i.e., offering only 6 of those CPSC 110 sections instead of 8.) In discussions with the Computer Science faculty, we believe that adding this DATA 101 course is worth that "expense." Students who wish to pursue Computer Science as a major will still have six sections of 110 to choose from. Students who currently take CPSC 110 for a Quantitative Reasoning General Education credit will be able to choose from CPSC 110 or DATA 101 (to be proposed as QR), and we frankly believe that many students will prefer the latter (and find it more applicable to their future careers).