

## **MCDS Enrollment Guide for Incoming Class of 2018**

### **Registration:**

Students can begin to register for courses at the beginning of registration week for the Fall semester (April 23rd, 2018). Be forewarned that some courses will not process registrations until late August – do not panic if you are placed on a waitlist. Please visit:

<http://www.cmu.edu/hub/registration/graduates/index.html>

The registration process can be completed within SIO (Student Information On-line) by following 4 easy steps:

1. Plan your course schedule after reading the guidelines below;
2. Verify that your planned schedule complies with this document;
3. Check your registration time in SIO;
4. Register for classes.

For more detail on how to complete these steps, see:

<http://www.cmu.edu/hub/registration/docs/4-easy-steps.pdf>

### **MCDS Program Requirements**

Students must complete 144 eligible units of study. This includes eight 12-unit courses, two 12-unit seminar courses and one 24-unit capstone course. Students must complete four MCDS core courses and choose at least 3 concentration courses. The remainder of the 12-unit courses with course numbers 600 or greater can be electives chosen from the SCS course catalog. Any additional non-prerequisite units taken beyond the 144 units are also considered electives. Students must maintain full-time status in all semesters (a minimum of 36 units per semester).

### **Preparation Prerequisite: 15-513 Summer Course**

15-513 Introduction to Computer Systems must be completed (as a 6-unit course, remotely and online) with a grade of "B" or better during the Summer semester before starting at CMU in Pittsburgh. This course is a required prerequisite for the MCDS core (and most other courses), so you are unlikely to complete the MCDS program in three semesters unless you pass 15-513 before you come to campus. Newly admitted students take this course via distance education during the summer before attending CMU. This course will not be waived, even if you have used the same book and similar course material in past courses, unless you have previously passed 15-513 (or 213) at CMU's Pittsburgh campus.

## MCDS Program Requirements

The MCDS program consists of four main components: 1) MCDS core courses (required for all students), 2) concentration courses (chosen by each student from a set of pre-approved courses), 3) capstone course sequence (required for all students), and 4) electives (any graduate course with a number xx-6xx or above).

**MCDS Core Courses.** Incoming students are expected to complete four (4) courses during their first semester on campus (Fall semester; see table). Students who have previously completed one of the core courses or an equivalent course may seek permission to substitute a higher-level course. For students who are advanced in Machine Learning, 10-701 and 10-715 are possible substitutions for 10-601. For students who are advanced in Cloud Computing, 15-719 or another 700-level systems course are possible substitutions. Contact your academic advisor (Eric Nyberg, ehn@cs.cmu.edu) if you have questions regarding core course selection and/or substitution.

Course #	Title	Fall	Spring
10-601	Machine Learning	*	*
15-619	Cloud Computing	*	*
05-839	Interactive Data Science	*	
11-631	MCDS Seminar	*	

**Concentration Requirements.** Students must satisfy at least one concentration area (Analytics, Systems and Human-Centered Data Science), as detailed below.

**Analytics Concentration.** Students select three courses (see table): one (1) machine learning (ML) course, one (1) software systems (SS) course, and one (1) big data (BD) course.

	Title	Category	Fall	Spring
10-701	Introduction to Machine Learning	ML	*	
10-705	Deep Reinforcement Learning & Control	ML	*	*
10-715	Advanced Intro to Machine Learning	ML	*	
10-725	Convex Optimization	ML	*	
36-705	Intermediate Statistics	ML	*	
11-755	Machine Learning for Signal Processing	ML	*	
10-608	Conversational Machine Learning	ML		*
10-708	Probabilistic Graphical Models	ML		*
10-702	Statistical Machine Learning	ML		*
11-785	Introduction to Deep Learning	ML		*
11-641	Machine Learning for Text Mining	ML	*	*
11-761	Language and Statistics	ML	*	

11-777	Advanced Multimodal Machine Learning	ML or SS	*	
11-775	Large-Scale Multimedia Analysis	BD or SS	*	
11-791	Design and Eng. of Intelligent Info. Sys.	SS	*	*
11-792	Intelligent Info. Systems Project	SS	*	*
11-642	Search Engines	SS	*	*
11-747	Neural Networks for NLP	ML or SS		*
11-797	Question Answering	SS		*
10-605	Machine Learning with Large Data Sets	ML or BD		*
10-805	Machine Learning with Large Data Sets	ML or BD		*

**Systems Concentration.** Students select 3 courses (see table):

Course #	Title	Fall	Spring
15-605	Operating Systems Implementation	*	*
15-618	Parallel Computer Architecture and Programming	*	*
15-640	Distributed Systems	*	*
15-641	Computer Networks	*	
15-645	Database Systems	*	
15-746	Advanced Storage Systems	*	
15-719	Advanced Cloud Computing		*
15-721	Advanced Databases		*
15-712	Adv. and Distributed Operating Systems	*	
15-821	Mobile and Pervasive Computing	*	

**Human-Centered Data Science Concentration.** Students select one (1) Research Methods (RM) course, and two (2) HCI Courses (see table):

	Title	Category	Fall	Spring
05-816	Applied Research Methods	RM	*	
94-834	Applied Econometrics I & II	RM	*	*
05-891	Designing Human Centered Systems	HCI	*	
05-821	Social Web	HCI	*	
05-823	E-Learning Design Principles and Methods	HCI	*	
05-840	Tools for Online Learning	HCI		*
05-833	Applied Gadgets, Sensors and Activity Recognition in HCI	HCI		*
05-836	Usable Privacy and Security	HCI		*
05-872	Rapid Prototyping of Computer Systems	HCI		*
05-899	Crowd Programming	HCI	*	
05-899	Learning Analytics and Educational Data Science	HCI		*

05-899	Design of Large-scale Peer Learning Systems	HCI	*	
05-899	Learning with Peers at Massive Scale	HCI	*	
05-899	Mobile Health	HCI	*	
05-899	Special Topics in HCI: Sensemaking	HCI		*

**Capstone Course Sequence (required for all students).** This includes 11-634 Capstone Planning Seminar (12 units) in Spring 2019, and 11-632 MCDS Capstone (24 units) in Fall 2019.

**Electives.** Students complete at least two (2) elective courses in SCS – any graduate level course numbered 600 or above in the School of Computer Science (SCS).

**Waitlists:**

Many courses will not clear their waitlist until the first week of classes. Do not worry about waitlists until the semester starts. We have no control over course waitlists. We do have verbal agreements with core courses in the School of Computer Science to admit MCDS students. However we cannot guarantee admittance from the waitlist when course demand exceeds capacity. Please see waitlist policy here:

<http://www.cmu.edu/hub/registration/undergraduates/waitlist.html>

**Piazza:**

We use Piazza for Q&A about the MCDS program. Please participate by reading the questions and answers other people write, as well as asking your MCDS-related questions on Piazza whenever possible:

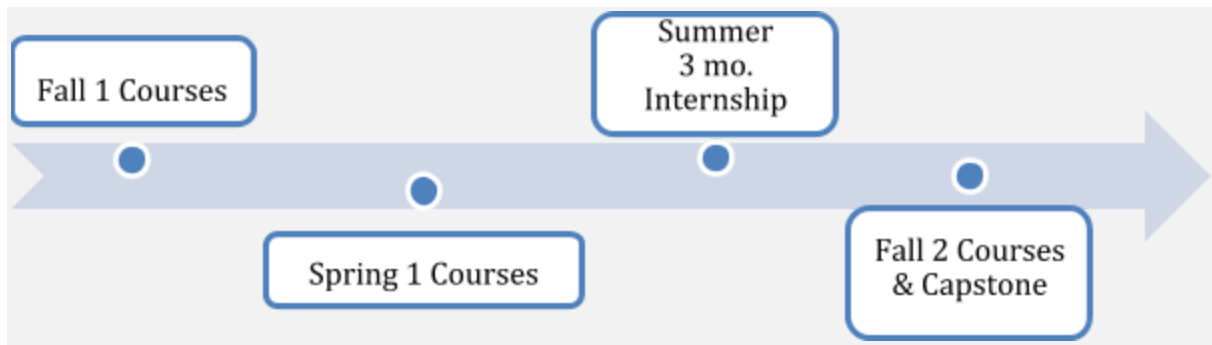
<https://piazza.com/cmu/other/mcdsclassof20182019/>

You should already be invited to Piazza and registered as a student. Piazza should be used for general / public questions. If you have a personal or private question, please contact Jennifer or your academic advisor directly.

**Program Duration:**

Students can choose to complete the MCDS Program through two possible paths. In one path, the students take 16 months and the other students take 20 months. Both paths have a 3-month summer internship. Both paths have the same requirements for total number of units, concentrations, etc. The primary difference is the per-semester course load, total cost, and the total time available to take courses. Details on the internship will be provided to you when you get to campus.

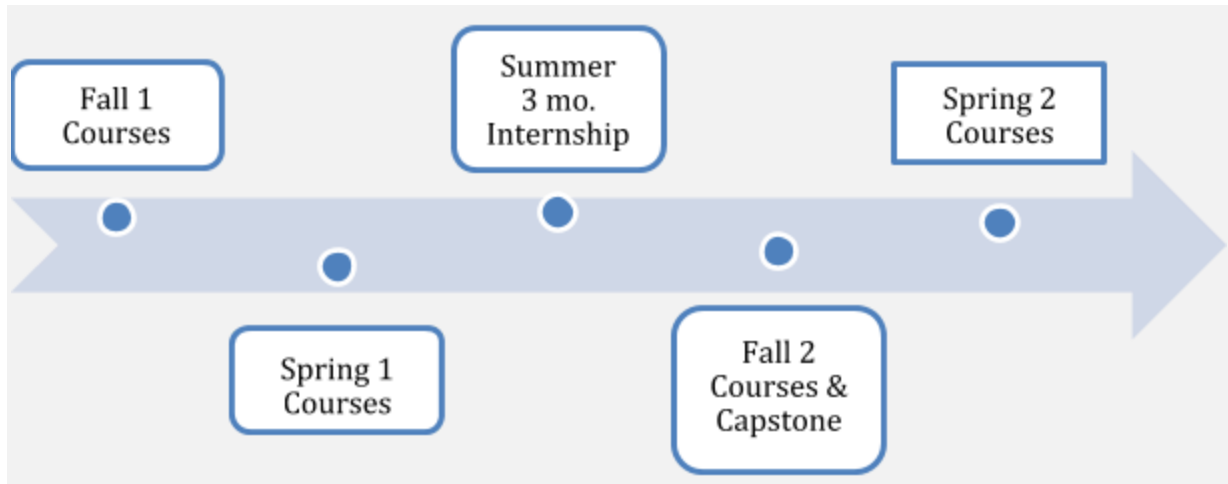
Example of the **16-month** MCDS Program with a 3-month internship:



Course choices for the **16-month** MCDS Program with a 3-month internship:

Standard, 16 months	Courses
Fall 1	10-601 Machine Learning
Fall 1	15-619 Cloud Computing
Fall 1	05-839 Interactive Data Science
Fall 1	Concentration Requirement or Elective
Fall 1	11-631 MCDS Seminar
Spring 1	Concentration Requirement
Spring 1	Concentration Requirement
Spring 1	Concentration Requirement or Elective
Spring 1	Elective
Spring 1	11-632 Capstone Planning Seminar
Summer 1	Industry or On-Campus Internship
Fall 2	11-634 MCDS Capstone
Fall 2	Extra or Replacement Course
Fall 2	Extra or Replacement Course

Example of the **20-month** MCDS Program with a 3-month internship:



Course choices for the **20-month** MCDS Program with a 3-month internship:

Extended, 20 months	Courses
Fall 1	10-601 Machine Learning
Fall 1	15-619 Cloud Computing
Fall 1	05-839 Interactive Data Science
Fall 1	11-631 MCDS Seminar
Spring 1	Concentration Requirement
Spring 1	Concentration Requirement or Elective
Spring 1	Independent Study or TA
Spring 1	11-632 Capstone Planning Seminar
Summer 1	Industry or On-Campus Internship
Fall 2	11-634 MCDS Capstone
Fall 2	Concentration Requirement or Elective
Fall 2	Independent Study or TA
Spring 2	Concentration Requirement or Elective
Spring 2	Concentration Requirement or Elective
Spring 2	Independent Study or TA

## Detailed Notes on Course Enrollment:

- 1) For most 15-xxx courses, the instructor may want to know what grade you got in 15-513. Make sure to pass it with a B or better. If you skip the last few projects in 15-513, it will become impossible for you to pass the course and take any course that requires a "B" or better grade in 15-513 and you will have to retake the course in your first semester.
- 2) If a course is overfilling (10-601 or 15-640 is likely to have this problem), the course instructor may have to make a choice between people on the waitlist. You should send email to the instructor, a week before the course starts, making sure they know you are in the MCDS Systems major being advised by Eric Nyberg, the grade you got in 15-513, and what preparation you have for taking their course. Note that you will have three chances to take 10-601 or 15-640, for example.

What usually happens with **waitlists** is as follows:

- a course is not full but many students are put on the waitlist anyway, probably to give the instructor the ability to make careful choices (for example, in some courses all MS students are put on the waitlist to start with, then we check prerequisites before anyone gets in)
- when an instructor is happy with admitting someone, she or he notifies the course administrator for the course being taught
- the course administrator tries to admit the student but finds either that the student is already taking more than 48 units or has a time slot conflict
- at this point there is a risk that the course administrator moves onto the next name without taking any further action; mostly however, course administrators will immediately send the student email saying "if you want in, free up the time slot or number of units asap"
- if you are lucky the course administrator and instructor will hold the seat in the class for you for a day or two, but this is not guaranteed; you should respond to these email messages quickly, even if all you say is "thank you, I'll do it tonight and reply again"

If you get on the waitlist now, do not panic and do not start sending email to the instructor expecting them to make changes now. Most instructors will not sort out the waitlist until the beginning of the course. It is a good idea to send the instructor email a week before the course starts.

- 3) If you are still on the waitlist for a course by the first day of classes, attend its meetings, do the readings and initial homework, for as much as the first 3-4 weeks. Make sure the instructor knows that you are doing this and are committed to being ready to do the course.
- 4) The seminar course 11-631 in the first Fall semester + 11-634 Capstone Planning Seminar + 11-632 in the second Fall semester form a three-stage capstone, and a forum for advising MCDS students. In Fall 1 you will attend and write reports on research lectures, read recent papers and write reports on these, and perhaps start into projects that might become capstone projects in Fall 2. In Fall 1 this is not a heavy load, though it will involve activities and communication that may be new to you.
- 5) The project work in 15-605, Operating System Design and Implementation, is perhaps the single most time consuming programming course you might take while at CMU. Most OS courses give their students a mostly functional OS kernel and ask for a few carefully selected changes. CMU gives you a simulator for Intel x86 instructions, a few small routines, the hardware manual and the spec for the kernel. You design and build the entire thing in groups of two. Very good masters students, taking a 50% heavier course load than the senior division CMU undergrads, are doing quite well to get a B, and most get a C. Even with a C, we are usually pleased. However, lots of people take 15-605 with too many other courses and not enough low-level programming preparation. They do not do well, and often have trouble with their other courses. We recommend getting an A in 15-513 and 15-640 before trying 15-605. 15-605 instructors will have a concern about your preparation and course load, because its projects are such a large amount of work. You will need to persuade the instructor to believe that you are well enough prepared for the project that you will be able to do it while also carrying your other courses.
- 6) 15-619 Cloud Computing is an online project-based non-PhD course, offered every semester, teaching practical understanding and use of cloud computing. The course includes five themes of individual (10) and team (1) projects which are completed on AWS, Azure and GCP. There are no regular classroom meetings, the students interact with the teaching staff either by attending recitations or by asking questions on a public forum. 15-719 Advanced Cloud Computing is an in-class PhD course, offered in the Spring, teaching research issues involved in the design and implementation of cloud computing. 15-619 is a core-requirement and 15-719 is a systems concentration project course. 15-619 emphasizes project work and 15-719 emphasizes paper reading.



- 7) All courses start at the beginning of the fall semester except for courses that are intended primarily for PhD students, typically xx-7xx or xx-8xx.
- For example, although the first day of classes is typically a Monday in August, the first day of xx-7xx courses might be delayed by a week.
  - Courses like 10-601 will start on the first day of classes.
  - If you are not sure, and the instructor has not posted a web page with the date of the first class, or has not answered your email request for this date, then go to the room of the class meeting the first week and check.
- 8) Courses are numbered in a manner to identify the department that sponsors or co-sponsors a course as well as the level of the course. Here are a few that are relevant to you:
- 10-xxx: The Machine Learning Department (MLD)
  - 15-xxx: The Computer Science Department (CSD)
  - 11-xxx: The Language Technologies Institute (LTI)
  - 05-xxx: The Human Computer Interaction Institute (HCII)

Notes:

- xx-1xx and xx-2xx are lower division undergraduate courses.
- xx-3xx and xx-4xx are upper division undergraduate courses.
- xx-5xx and xx-6xx are masters level courses, although we do not count xx-5xx courses for MCDS credit (15-513 is a prerequisite that you must complete, but does not count toward the 144 units of graduate study you must complete on campus to earn the degree).
- xx-7xx and xx-8xx are PhD level courses.

- 9) Course Sections and Days of Week:  
Some courses offer multiple sections due to the capacity of classroom sizes. The difference between sections could be the instructor, when and where the class meets. Courses could meet once, twice or more each week. Here are the codes used by the Registrar for the day(s) of the week when a course meets:

M = Monday; T = Tuesday; W = Wednesday; R = Thursday; F = Friday

Most 12-unit courses taken by MCDS students meet on Mondays and Wednesdays ("MW") or Tuesdays and Thursdays ("TR").

- 10) Adding and dropping courses:

CMU's drop deadline is 6 weeks into the semester. If you drop before the drop deadline date, the course does not appear on your transcript. If you drop after this date, but before the end of the semester, your transcript shows the course and a grade of "withdrawn". CMU's add deadline is early (about two weeks into the semester). Before this date, you are free to add a course through SIO if you meet the automated constraints. After this date, you may still be able to add a course, but you'll need a form to be signed by an Associate Dean. <http://www.cmu.edu/hub/calendar.html>

- 11) This comment is with respect to your course load and taking extra courses. You may take up to 60 units per semester, or five 12 unit courses. This means you could do 180 units in three semesters if you choose. However, many students overestimate their preparation and capacity for work. For example, most PhD students do two courses in a semester; most undergrads do three or four; and most masters students do three or four. Five courses per semester is a significantly higher load than the bulk of the (very good) students at CMU. We recommend that you register and start with five courses, but pay attention to how heavily loaded you are, and be prepared to drop a course early, if needed (if you do it late, you may simply do poorly in multiple courses). We designed the MCDS program for superlative students who are able to finish a 144-unit masters in three semesters (instead of the usual four semesters), by taking on an exceptional workload that will leave you limited time for research, teaching, intellectual curiosity, social interaction and probably sleep. By the way, this starts in a small way this summer with 15-513. Many students underestimate the time it takes to do this well, even if you have done it before. They fail to complete projects, fail the course, have to retake it in the fall, and can't get into many desired courses. Don't let this happen to you.
  
- 12) Maintain a proper identity and modes of address. Use your formal name for all university systems and communication.
  - a. Make sure to use your formal (or family) name when registering on university systems. Do not use a nickname or an American name.
  - b. If you have already given the wrong name to the university, please ask them to correct it as soon as you notice.
  - c. The reason we are sharing this is that the university registration records often include names of people that are not names we find on other university records. An instructor's registration data could say Hsi, Fu, for example, but the class roster says Hsi, Bob. Sometimes this can cause a lot of confusion especially with grade assignment.
  - d. Your Andrew ID is unique across the university. So if your Andrew ID is `username@andrew.cmu.edu`, always write your Andrew ID on anything you hand into a class -- exams, reports, projects!
  - e. It is also important to send all your outgoing email from your [username@andrew.cmu.edu](mailto:username@andrew.cmu.edu) even if you use Gmail as your server.

- f. Modes of address: How to refer to others, especially in verbal communication? For example, Prof. Eric Nyberg’s first name is Eric and his family name is Nyberg. His family will call him Eric. Other people call him Mister Nyberg, Doctor Nyberg, Professor Nyberg, or Eric. No one calls him Nyberg, or Dr. Eric or Professor Eric.

13) We have prepared a few example schedules for each of the concentration areas which include a few recommendations on what courses to take, including electives (see following sections). You have a large amount of choice on the electives, and a fair amount of choice on the core courses, so our recommendations should be seen as suggestions, not rules or expectations. Some overall things to keep in mind:

- When you are choosing your own schedule, make sure that you have at least five core courses and three project courses.
- In your first Fall semester, you need to register for 11-631.
- In your first Spring semester, you need to register for 11-634.

**Systems Concentration Course Suggestions.** Below are a few example course schedules for the Systems Concentration students. Three examples are provided for the 16-month MCDS option and the three examples are provided for the 20-month MCDS option. The example schedules are listed for either “Standard”, and “Back-loaded” course load scenarios. The “Alt” column suggests alternate courses. In the “Prototype” 16-month option, we also provided suggestions of courses to drop if you found the course load to be too heavy.

Standard 16 months		Hacker Heaven	Alt	Web 2.0	Alt	Sys & Apps	Alt
	F1	10-601		10-601		10-601	
	F2	15-619		15-619		15-619	
	F3	05-839		05-839		05-839	
drop candidate	F4	15-645	15-746	15-637	11-791	15-746	15-645
Seminar 1	F5	11-631		11-631		11-631	
	S6	15-618		15-640		15-618	
	S7	15-721	15-640	15-719		15-640	
	S8	15-719		15-721	15-637	15-721	
drop candidate	S9	15-605		11-642		10-605	15-826
Seminar 2	S10	11-634		11-634		11-634	
Capstone	F11	11-632		11-632		11-632	
extra/repl	F12	15-712		15-821		15-641	10-605
extra/repl	F13	10-605	15-688	11-791		11-642	15-826

Back Loaded 16 months		Hacker Heaven	Alt	Web 2.0	Alt	Sys & Apps	Alt
	F1	10-601		10-601		10-601	
	F2	15-619		15-619		15-619	
	F3	05-839		05-839		05-839	
	F4						
Seminar 1	F5	11-631		11-631		11-631	
	S6	15-618		15-721		15-618	
	S7	15-721		15-719	15-640	15-640	
	S8	15-719		15-637	15-826	15-721	
	S9						
Seminar 2	S10	11-634		11-634		11-634	
Capstone	F11	11-632		11-632		11-632	
	F12	15-605	15-746	15-821		15-746	15-641
	F13	11-791	15-641	11-791	11-642	10-605	15-826

Time for Research 20 months		Hacker Heaven	Alt	Web 2.0	Alt	Sys & Apps	Alt
	F1	10-601		10-601		10-601	
	F2	15-619		15-619		15-619	
	F3	05-839		05-839		05-839	
	F4	Research 1		Research 1		Research 1	
Seminar 1	F5	11-631		11-631		11-631	
	S6	15-618		15-721		15-640	
	S7	15-605		15-637		10-605	15-826
	S8	Research 2		Research 2		Research 2	
	S9	Research 3		Research 3		Research 3	
Seminar 2	S10	11-634		11-634		11-634	
Capstone	F11	11-632		11-632		11-632	
	F12	15-746		15-821		15-746	15-645
	F13	Research 4		Research 4		Research 4	
	S14	15-721		15-719		15-721	
	S15	10-605		11-791		15-826	10-605
	S16	15-719		11-642		11-642	
		Research 5		Research 5		Research 5	
		Research 6		Research 6		Research 6	

Back Loaded 20 months		Hacker Heaven	Alt	Web 2.0	Alt	Sys & Apps	Alt
	F1	10-601		10-601		10-601	
	F2	15-619		15-619		15-619	
	F3	05-839		05-839		05-839	
	F4						
Seminar 1	F5	11-631		11-631		11-631	
	S6	15-618		15-721		15-640	
	S7	15-605		15-637		10-605	15-826
	S8	Research 1		Research 1		Research 1	
	S9	TA		TA		TA	
Seminar 2	S10	11-634		11-634		11-634	
Capstone	F11	11-632		11-632		11-632	
	F12	15-746		15-821		15-746	15-645
	F13						
	S14	15-721		15-719		15-721	
	S15	10-605		11-791		15-826	10-605
	S16	15-719		11-642		11-642	
	S17						

### Analytics Concentration Course Suggestions

- Fall 2018: a) Consider replacing 10-601 and/or 15-619 with a higher-level course, as appropriate (note that 15-719 is only offered in Spring); b) Consider enrolling in a fifth course as a stretch goal (to be dropped if you can't handle the load). A good choice for a fifth course in the Fall is 10-605 Machine Learning with Large Datasets (or 10-805, the Ph.D. equivalent course).
- Spring 2019: Aim to complete all concentration requirements, if possible. If you didn't take a big data (BD) class in Fall, take one now, and pick up one more software systems (SS) and machine learning (ML).
- Fall 2019: Capstone (24 units) plus two electives.

General Organization of Analytics Courses (ML, SS, BD), 2018-2019

Fall 2018	Spring 2019	Fall 2019
<b>10-601 (or 701, 715)</b>	<i>10-703, 10-608, 10-708, 36-702, 11-641, 11-785 (ML)</i>	<i>11-777, 10-703, 10-725, 36-705, 36-725, 11-755 (ML)</i>

<b>15-619</b>	<b>(or 15-719)</b> 11-642, 11-791, 11-792, 11-775, 11-747, 11-797 (SS)	11-777, 11-791, 11-792, 11-642 (SS)
<b>05-839</b>		
<b>11-631</b>	<b>11-634</b>	<b>11-632 (24 units)</b>
10-605 (or 805) (BD)	11-775 (BD)	10-605 (or 805) (BD)

Courses Which Focus on Core Machine Learning and Related Tasks

Fall 2018	Spring 2019	Fall 2019
<b>10-601 (or 701, 715)</b>	10-703, 10-708, 36-702, 11-641, 11-785 (ML)	10-725, 36-725, 11-755 (ML)
<b>15-619</b>	<b>(or 719)</b> 11-747, 11-797 (SS)	11-777 (SS)
<b>05-839</b>		
<b>11-631</b>	<b>11-634</b>	<b>11-632 (24 units)</b>
10-605 (or 805) (BD)	11-775 (BD)	10-605 (or 805) (BD)

Courses Which Focus on AI and Intelligent Information Systems

Fall 2018	Spring 2019	Fall 2019
<b>10-601 (or 701, 715)</b>	10-608, 10-708, 11-641, 11-785 (ML)	11-777, 36-705, 11-755 (ML)
<b>15-619</b>	<b>(or 719)</b> 11-642, 11-791, 11-792, 11-775, 11-747, 11-797 (SS)	11-777, 11-791, 11-792, 11-642 (SS)
<b>05-839</b>		
<b>11-631</b>	<b>11-634</b>	<b>11-632 (24 units)</b>
	11-775 (BD)	

## Human-Centered Data Science Concentration Course Suggestions

Example 1: Empirical Analysis of Interactive Systems		
RM	05-816	Applied Research Methods
HCI	05-891 05-821 05-899	Designing Human Centered Systems Social Web Psychological Foundations for Designing Impact in HCI
Electives	94-832 xx-xxx	Business Analytics and Data Mining Elective

Example 2: Social Web Analytics & Design		
RM	05-816	Applied Research Methods
HCI	05-891 05-821 05-836	Designing Human Centered Systems Social Web Usable Privacy and Security
Electives	05-899 11-643	Crowd Programming Machine Learning for Text Analysis

Example 3: Ubiquitous Computing		
RM	05-816	Applied Research Methods
HCI	05-891 05-872 05-833	Designing Human Centered Systems Rapid Prototyping of Computer Systems Applied Gadgets, Sensors and Activity Recognition in HCI
Electives	05-899 xx-xxx	Crowd Programming Elective

Example 4: Educational Software Design		
RM	05-816	Applied Research Methods

HCI	05-899	Learning Analytics and Educational Data Science
	05-823	E-Learning Design Principles and Methods
	05-899	Learning with Peers at Massive Scale
Electives	11-643	Machine Learning for Text Analysis
	xx-xxx	Elective