

BOARD OF HIGHER EDUCATION
REQUEST FOR COMMITTEE AND BOARD ACTION

COMMITTEE: Academic Affairs

NO: AAC 15-03

COMMITTEE DATE: October 14, 2014

BOARD DATE: October 21, 2014

APPLICATION OF UNIVERSITY OF MASSACHUSETTS DARTMOUTH TO AWARD THE BACHELOR OF SCIENCE AND MASTER OF SCIENCE DEGREE IN DATA SCIENCE

MOVED: The Board of Higher Education hereby approves the application of **University of Massachusetts Dartmouth** to award the **Bachelor of Science in Data Science** and the **Master of Science in Data Science**.

Upon graduating the first class for these programs, the University shall submit to the Board a status report addressing its success in reaching program goals as stated in the application and in the areas of enrollment, curriculum, faculty resources, and program effectiveness.

Authority: Massachusetts General Laws Chapter 15A, Section 9(b)

Contact: Winifred M. Hagan, Ed.D., Director for Educator Policy

BOARD OF HIGHER EDUCATION

October 2014

University of Massachusetts Dartmouth Bachelor of Science and Master of Science in Data Science

INTENT AND MISSION

The proposed Bachelor of Science in Data Science and the Master of Science in Data Science (B.S./M.S. DSC) programs are intended to align with the mission of the University of Massachusetts Dartmouth (UMD) and prepare diverse students for success in technology careers through education, research, economic development, and public service. The proposed programs are intended to establish a new interdisciplinary BS/MS DSC. The majors are intended to provide undergraduate and graduate students with advanced education and training in the rapidly emerging fields of data analytics and discovery informatics. Emphasis is placed on merging strong foundations in information theory, mathematics and computer science with current methodologies and tools to enable data-driven discovery, problem solving, and decision making.

The purpose of the proposed program is to prepare students for employment in professional fields that require data analysis and representation, and a flexible, broad understanding of informatics. It is intended to appeal to students who want to learn about the technological and analysis tools used by science, engineering, business, academic, government and social organizations. The proposed programs are expected to accommodate students with career or education backgrounds in business, engineering, computer and other sciences, mathematics, liberal arts and education and provide the opportunity to learn data analytics and develop information science skills.

The proposed program has obtained all necessary governance approvals on campus and was approved by the University of Massachusetts' Board of Trustees on June 18, 2014. The required letter of intent was circulated on April 22, 2014. No comments were received.

NEED AND DEMAND

National and State Labor Market Outlook

UMD holds that the demand for graduates of information/data science programs both in-state and nationally is high and predicted to grow rapidly in the years ahead. The US Department of Labor employment projections in data science related fields include a 41% increase in market research analysis, a 31% increase in data base administrators, a 30% increase in software developers, a 22% increase in computer systems analysts and a 19% increase for computer and information research scientists.¹ A recent survey done by EMC underscores the emerging

¹ *Occupational Outlook Handbook 2012-13 ed.*, Bureau of Labor Statistics, 2012.

talent gap for data scientists and the need for university programs to train the workforce for an 83% increase in the need for data scientist.²

Student Demand

The proposed B.S. program is expected to draw a significant number of undergraduates from the more than 200 students currently enrolled in mathematics and computer science at UMD. It is also expected that the program will attract transfer students from community colleges. The current articulation agreements in place for our computer science program with Bristol Community College, Massasoit Community College, Benjamin Franklin Institute of Technology, and Framingham State are expected to be extended to include the proposed BS program. The proposed M.S. program is expected to draw students from the more than 50 graduate students currently enrolled in mathematics and computer science.

OVERVIEW OF PROPOSED PROGRAM

Duplication

UMD reports that there are no equivalent baccalaureate level big data programs in the University of Massachusetts system or in New England. The proposed interdisciplinary M.S. in Data Science is characterized as working like a bridge between big data analytics and information science. University of Massachusetts Boston offers a Graduate Certificate in Database Technology, which emphasizes data management software systems rather than the big data analytics focus of the proposed program. Other Massachusetts programs offerings for an M.S. in Big Data Analytics or Data Science include Bentley University, Boston University, Brandeis University and Northeastern University.

ACADEMIC AND RELATED MATTERS

Admission

Admission requirements for the proposed B.S. program in Data Sciences include those for all UMD students meeting general eligibility requirements. It is expected that in addition, students will demonstrate an aptitude for mathematics and computer science. It is planned that mathematics readiness will be determined by the ACCUPLACER® test results. Articulation agreements are planned for transfer students to enter with up to 70 course credits.

Admission requirements for the proposed M.S. program in Data Sciences include those for all UMD graduate students meeting general eligibility requirements. Additional admissions criteria for the MS program include completion of an undergraduate degree with quantitative coursework in calculus, linear algebra and statistics and either coursework or work experience in computer programming. Students admitted to the M.S. DSC program must have earned a minimum GPA of 3.00 (on a 4.00 scale) as an undergraduate. Applications must also include a

² EMC Data Science Study, December 11, 2011. <http://www.emc.com/collateral/about/news/emc-data-science-study-wp.pdf>

statement of purpose including career goals, resume, GRE scores, TOEFL scores (for international students), and three letters of recommendation.

**Program Enrollment Projection
B.S. Data Science**

	# of Students Year 1	# of Students Year 2	# of Students Year 3*	# of Students Year 4*
New Full-Time	10	15	20	25
Continuing Full-Time	0	8	20	36
New Part-Time	0	0	0	0
Continuing Part-Time	0	0	0	0
Totals	10	23	40	61

+ includes transfer students

M.S. Data Science

	# of Students Year 1	# of Students Year 2	# of Students Year 3*	# of Students Year 4*
New Full-Time	5	7	10	10
Continuing Full-Time	0	5	8	10
New Part-Time	0	5	5	5
Continuing Part-Time	0	0	5	10
Totals**	5	17	28	35

Curriculum (Attachment A)

The Data Science programs offer an array of learning and discovery opportunities aimed at drawing insights from extremely large amounts of data, including data collection, preparation and integration, statistical methods and modeling, and other sophisticated techniques for analyzing and displaying complex data. The Data Science curricula blend statistics, applied mathematics, computer science and application domains.

Requirements for the proposed B.S. DSC include completion of 120 credit hours of coursework with at least 45 credits taken in courses at the 300-level or above. The core requirements for the proposed major consist of interdisciplinary courses in mathematics statistics, computer science, and data science. Requirements for the proposed M.S. DSC include completion of 30 credit hours of coursework and passing a comprehensive examination; 24 credits must be

earned at UMD; 24 credits must be earned at the 500-level or above; 9 credits may be earned at UMD before formal admission to the program. The minimum required GPA in all coursework applicable to the degree is 3.00 out of 4.00.

Internships or Field Studies

UMD has established student internships with the Indian Institute of Technology (IIT) Bhubaneswar, and an internship host relationship with IIT Kharagpur. Senior undergraduate students from Indian Institute of Technology (IIT) spend eight weeks at UMD each summer working on various research projects with faculty supervision. One of the UMD goals of the program is to recruit highly qualified students into graduate programs. Once the MS in Data Science program is approved, data science will be part of the recruitment effort and faculty with data science expertise will have the opportunity to host IIT students and recruit them to join the MS in Data Science program.

RESOURCES AND BUDGET

Fiscal (Attachment B)

It is expected that the demand for programs in the general area of data science will grow rapidly and UMD plans for 60 students in the proposed B.S. program in three to four years and an intake of 10 new students per year in the proposed M.S. program projecting an enrollment of 35 students in the program within three to four years. UMD also plans that the number of faculty solely associated with these programs will be kept small until the number of students justifies an increase. New costs for the B.S. and M.S. programs are estimated by the institution to begin at \$144,000 in year one and include program administration, supplies and materials, new course development, one teaching assistant, and one graduate assistant. The program director will be given a course release, so coverage by a part-time lecturer is included (\$4,000). The total estimate for new costs for the first four years is estimated at \$307,000 for the proposed B.S. program operations and \$253,000 for the proposed M.S. program operations.

Faculty and Administration (Attachment C)

UMD has committed to increasing research capacity through strategic hiring in key research areas. No new faculty lines, over and above those positions already planned, are required for the addition of the proposed B.S./ M.S. DSC programs because of prior plans that are currently underway and provide for hiring faculty into research clusters (e.g. computational mathematics/science/engineering), which will be supported by the proposed programs.

Facilities, Library and Information Technologies

UMD has allocated ~\$150,000 for a Data and Visual Analytics Laboratory to support instruction and collaborative research in data science. Approximately 600sf of floor space is needed to accommodate work/collaboration stations for 12 students (with expansion up to 24). It is expected that funding for computing and visualization equipment and software will be available through a number of federal granting agencies, corporations and foundations that support innovative programs that wed technology and informatics. UMD asserts that Google, Microsoft, SAS, EMC, MathWorks, Nvidia, Department of Education, National Science Foundation, James

S McDonnell Foundation, and the Alfred P. Sloan Foundation have grant programs for this purpose and plan to aggressively seek funding for equipment and programmatic support for the proposed B.S./ M.S. DSC programs.

UMD maintains that adequate computer laboratories currently exist on campus and the campus network of virtual laboratories provides remote access to instructional software.

Affiliations and Partnerships

The marketing department, the Office of Graduate Studies and the External Advisory Board at UMD are collaborating on strategies for increasing affiliations with Massachusetts businesses, state agencies, and other Massachusetts colleges and universities. UMD plans to develop a B.S./ M.S. DSC website. UMD has established a collaborative relationship with the Indian Institute of Technology (IIT) Bhubaneswar, which includes student and faculty exchange, and has an MOU to establish joint degrees with VIT in Vellore, India. UMD participates with the Brazilian *Science Without Borders* exchange and it is expected that the proposed B.S./ M.S. DSC programs will draw significant further interest in this.

**PROGRAM EFFECTIVENESS
B.S. Program**

Goal	Measurable Objective	Strategy for Achievement	Timetable
Achieve total enrollment of 60 full time students by Fall 2017	Number of enrolled students	Engage well funded faculty who support graduate students at the master's level and provide assistantship support for entering students to aid recruitment	2018
Retain 80% of freshmen students in DSC major	Retention rates	Monitor student progress on an ongoing basis and provide effective advising and student support	2016
Produce 15 graduates per year by Fall 2017	Graduation rates	Provide outstanding instruction and an engaging learning environment	2018
Have 95% of graduates employed in field or in graduate school	Career Placement	Provide outstanding career guidance and internship opportunities for students	2018

M.S. Program

Goal	Measurable Objective	Strategy for Achievement	Timetable
Achieve total enrollment of 20 full time & 20 part-time students by Fall 2017	Number of enrolled students	Active recruitment and an engaging academic program with outstanding faculty	2018
Have 1/3 of students enrolled/graduated in DSC major be from underrepresented groups	Diversity	Focused recruitment and support for women and minority students	2016
Produce 10 graduates per year by Fall 2018	Graduation rates	Provide outstanding instruction and an engaging learning environment	2018
Have 90% of graduates be employed in the field or in graduate school	Career Advancement	Provide outstanding learning opportunities aligned with industry needs	2018

EXTERNAL REVIEW AND INSTITUTIONAL RESPONSE

The proposed program review included a site visit and was conducted by Jeffrey M. Stanton, Ph.D., Professor and Senior Associate Dean, School of Information Studies, Syracuse University and Jeremy Teitelbaum, Ph.D., Professor and Dean, College of Arts and Sciences, University of Connecticut. The external reviewers supported the proposed program and cited alignment of mission with strategic goals, evidence of the need and demand for the program, innovative learning and research through interdisciplinary collaborations, and adequacy of resources to be strong indicators of sustainability.

Particularly regarding the BS DSC, the reviewers emphasized the importance of coursework in the liberal arts core, faculty advising outside of mathematics and computer science, and experiential learning in applied data science. A required internship was also recommended. Deeper engagement with industrial partners, and the development of an advisory board was strongly encouraged for both BS and MS DSC programs. The reviewers recommended enlisting an advisory board for promoting and tailoring internships and co-op learning experiences.

UMD responded that an advising team of participatory faculty from different departments, and favorable to interdisciplinary collaborations, will be established to provide guidance to undergraduate and graduate majors. A subset of highly recommended applications courses in

humanities, social sciences, nursing and business will also be generated. UMD agreed that students need hands-on experience and responded that the capstone experience is planned to be central to the degree. UMD plans that most of the capstone projects will derive from external sponsors representing key data intensive sectors in commerce, industry or government.

UMD agreed to further develop data science internships for our students suggesting that many opportunities with organizations in finance, retail, social networking, data service providers, government agencies are expected. It is planned that internships will also originate with research projects being conducted by faculty members. UMD reported that many of the organizations providing letters of support for the proposed B.S./ M.S. DSC program indicated an interest in providing internships and career opportunities. UMD will also explore dividing the two-semester capstone experience into one semester of experiential learning and one semester of capstone work. Or alternatively, UMD will consider accepting an internship having academic merit for elective credit.

STAFF ANALYSIS AND RECOMMENDATION

Staff thoroughly reviewed all documentation submitted by the **University of Massachusetts Dartmouth** and external reviewers. Staff recommendation is for approval of the proposed **Bachelor of Science in Data Science** and the **Master of Science in Data Science**.

ATTACHMENT A: CURRICULUM

Undergraduate Program Curriculum Outline

<i>Required (Core) Courses in the Major (Total # courses required = 19)</i>		
<i>Course Number</i>	<i>Course Title</i>	<i>Credit Hours</i>
MTH 231	Elementary Statistics I: Exploratory Data Analysis	3
MTH 331	Probability	3
MTH 332	Mathematical Statistics	3
MTH 111	Calculus 1	4
MTH 112	Calculus 2	4
MTH 181	Introduction to Discrete Structures I	3
MTH 221	Linear Algebra	3
MTH 280	Introduction to Scientific Computation	3
CIS 180	Object-Oriented Programming I	4
CIS 181	Object-Oriented Programming II	4
CIS 280	Software Specification & Design	4
CIS 360	Algorithms and Data Structures	3
CIS 430 <i>or</i> CIS 452	Data Mining & Knowledge Discovery <i>or</i> Database Systems	3
CIS 381	Social and Ethical Aspects of Computing	3
DSC 101	Introduction to Data Science	3
DSC 201	Data Analysis & Visualization	3
DSC 301	Matrix Methods for Data Analysis	4
DSC 498	Data Science capstone project I	2
DSC 499	Data Science capstone project II	2
	<i>Subtotal Required Credits</i>	61
<i>Major Elective Courses (Total # courses required = 4)</i>		
MTH 350	Applied Discrete Structures	3
MTH 361	Numerical Analysis I	3
MTH 463	Math Modeling	3
CIS 362	Empirical Methods for Computer Science	3
CIS 431	Human and Computer Interaction	4
CIS 454	Computer Graphics	3

CIS 455	Bioinformatics	3
CIS 490	Machine Learning	3
MIS 315	Information Systems	3
MIS 432	Business Data Systems	3
	Subtotal Major Elective Credits	12
Free Elective Courses (Total # courses required = 4)		
various	<i>Free electives</i>	12
	Subtotal Free Elective Credits	12
<i>Distribution of University Studies (General Education) Requirements</i> Attach List of University Studies (General Education) Offerings (Course Numbers, Titles, and Credits)		# of Gen Ed Credits
English and Technical Writing		9
Arts and Humanities, including Literature and Foreign Languages		6
Mathematics and the Natural and Physical Sciences		11
Social Sciences		9
Subtotal General Education Credits		35
<i>Curriculum Summary</i>		
Total number of courses required for the degree		38
Total credit hours required for degree		120
<i>Prerequisite, Concentration or Other Requirements:</i>		

Graduate Program Curriculum Outline

Major Required (Core) Courses (Total # of courses required = 5)		
Course Number	Course Title	Credit Hours
MTH 522	Computational Statistics	3
CIS 452 or CIS 552	Database Systems Database Design	3 3
DSC 520/EAS520	High Performance Scientific Computing	3
DSC 530	Data Visualization Workshop	3
DSC 550	Data Science Practicum	3
	Subtotal Core Credits Required	15
Elective Course Choices (Total courses required = 5)		
MTH 463	Math Modeling	3
MTH 464/564	Simulations	3
MTH 550	Applied Discrete Mathematics	3
MTH 473/573	Numerical Linear Algebra	3
MTH 474/574	Numerical Optimization	3
CIS 430	Data Mining and Knowledge Discovery	3
CIS 431	Human and Computer Interaction	4
CIS 454	Computer Graphics	3
CIS 455	Bioinformatics	3
CIS 467	Image Analysis and Processing	3
CIS 490	Machine Learning	3
CIS 554	Advanced Computer Graphics	3
CIS 555	Advanced Bioinformatics	3
CIS 563	MultiAgent Systems	3
CIS 581	Design and Verification of Information Systems	3
CIS 585	Image Processing and Machine Vision	3
MIS 432	Business Data Systems	3
MKT 671	Marketing Research	3
POM 500	Statistical Analysis	3
PSY 502	Statistical Methods in Psychology	3
	Subtotal Elective Credits Required	15

<i>Curriculum Summary</i>	
Total number of courses required for the degree	10
Total credit hours required for degree	30
<i>Prerequisite, Concentration or Other Requirements:</i>	

ATTACHMENT B: BUDGET

B.S. Program Budget - Revenues

UMass New Program Approval Budget

Campus: Dartmouth

Program: B.S. in Data Science

REVENUE ESTIMATES										
	Year 1		Year 2		Year 3		Year 4		Year 5	
	2014		2015		2016		2017		2018	
<i>Full-Time Tuition Rate: In-State</i>										
<i>Full-Time Tuition Rate: Out-of-State</i>										
<i>Mandatory Fees per Student (In-state)</i>	10359		10359		10359		10359		10359	
<i>Mandatory Fees per Student (out-state)</i>										
<i>FTE # of New Students: In-State**</i>	10		13		17		21		20	
<i>FTE # of New Students: Out-of-State</i>										
<i># of In-State FTE Students transferring in from the institution's existing programs</i>										
<i># of Out-of-State FTE Students transferring in from the institution's existing programs</i>										

	Newly Generated Revenue	Revenue from existing programs	Newly Generated Revenue	Revenue from existing programs	Newly Generated Revenue	Revenue from existing programs	Newly Generated Revenue	Revenue from existing programs	Newly Generated Revenue	Revenue from existing programs
Tuition and Fees										
<u>First Year Students</u>										
Tuition										
In-State	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Out-of-State	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Mandatory Fees	\$103,590	\$0	\$134,667	\$0	\$176,103	\$0	\$217,539	\$0	\$207,180	\$0
<u>Second Year Students</u>										
Tuition										
In-State			\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Out-of-State			\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Mandatory Fees			\$103,590	\$0	\$134,667	\$0	\$176,103	\$0	\$217,539	\$0
<u>Third Year Students</u>										
Tuition										
In-State					\$0	\$0	\$0	\$0	\$0	\$0
Out-of-State					\$0	\$0	\$0	\$0	\$0	\$0
Mandatory Fees					\$103,590	\$0	\$134,667	\$0	\$176,103	\$0
<u>Fourth Year Students</u>										
Tuition										
In-State							\$0	\$0	\$0	\$0
Out-of-State							\$0	\$0	\$0	\$0
Mandatory Fees							\$103,590	\$0	\$134,667	\$0
<u>Fifth Year Students</u>										
Tuition										
In-State									\$0	\$0
Out-of-State									\$0	\$0
Mandatory Fees									\$103,590	\$0

Gross Tuition and Fees	\$103,590	\$0	\$238,257	\$0	\$414,360	\$0	\$631,899	\$0	\$839,079	\$0
Grants	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Contracts	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Campus budget allocation	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Other Revenues	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total	\$103,590	\$0	\$238,257	\$0	\$414,360	\$0	\$631,899	\$0	\$839,079	\$0

B.S. Program Budget - Expenditures

UMass New Program Approval
Budget

Campus: Dartmouth

Program: B.S. in Data Science

EXPENDITURE ESTIMATES										
	Year 1 2015		Year 2 2016		Year 3 2017		Year 4 2018		Year 5 2019	
	New Expenditures required for Program	Expenditures from current resources	New Expenditures required for Program	Expenditures from current resources	New Expenditures required for Program	Expenditures from current resources	New Expenditures required for Program	Expenditures from current resources	New Expenditures required for Program	Expenditures from current resources
Personnel Services										
Faculty (Part Time)	\$4,000	\$0	\$4,000	\$0	\$4,000	\$0	\$4,000	\$0	\$4,000	\$0
Administrators	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Support Staff	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Others	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Fringe Benefits ____%	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Personnel	\$4,000	\$0	\$4,000	\$0	\$4,000	\$0	\$4,000	\$0	\$4,000	\$0
Operating Expenses										

Supplies	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Library Resources	\$0	\$0	\$4,000	\$0	\$4,000	\$0	\$4,000	\$0	\$4,000	\$0
Marketing/Promotional Expenses	\$10,000	\$0	\$10,000	\$0	\$6,000	\$0	\$3,000	\$0	\$3,000	\$0
Laboratory Expenses	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
General Administrative Overhead	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Other	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Operating Expenses	\$10,000	\$0	\$14,000	\$0	\$10,000	\$0	\$7,000	\$0	\$7,000	\$0
Net Student Assistance										
Assistantships	\$35,000	\$0	\$35,000	\$0	\$35,000	\$0	\$75,000	\$0	\$75,000	\$0
Fellowships	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Stipends/Scholarships	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Student Assistance	\$35,000	\$0	\$35,000	\$0	\$35,000	\$0	\$75,000	\$0	\$75,000	\$0
Capital										
Facilities / Campus recharges	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Equipment	\$25,000	\$0	\$15,000	\$0	\$15,000	\$0	\$15,000	\$0	\$15,000	\$0
Other	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Capital	\$25,000	\$0	\$15,000	\$0	\$15,000	\$0	\$15,000	\$0	\$15,000	\$0
Total Expenditures	\$74,000	\$0	\$68,000	\$0	\$64,000	\$0	\$101,000	\$0	\$101,000	\$0

BUDGET SUMMARY OF NEW PROGRAM ONLY

	Year 1	Year 2	Year 3	Year 4	Year 5
	2015	2016	2017	2018	2019
Total of newly generated revenue	\$103,590	\$238,257	\$414,360	\$631,899	\$839,079
Total of additional resources required for program	\$74,000	\$68,000	\$64,000	\$101,000	\$101,000
Excess/ (Deficiency)	\$29,590	\$170,257	\$350,360	\$530,899	\$738,079

M.S. Program Budget - Revenues

UMass New Program Approval Budget

Campus: Dartmouth

Program: M.S. in Data Science

REVENUE ESTIMATES										
	Year 1		Year 2		Year 3		Year 4		Year 5	
	2015		2016		2017		2018		2019	
<i>Full-Time Tuition Rate: In-State</i>										
<i>Full-Time Tuition Rate: Out-of-State</i>										
<i>Mandatory Fees per Student (In-state)</i>	8402		8402		8402		8402		8402	
<i>Mandatory Fees per Student (out-state)</i>										
<i>FTE # of New Students: In-State **</i>	5		9		7		4		2	
<i>FTE # of New Students: Out-State</i>										
<i># of In-State FTE Students transferring in from the institution's existing programs</i>										
<i># of Out-of-State FTE Students transferring in from the institution's existing programs</i>										

	Newly Generated Revenue	Revenue from existing programs	Newly Generated Revenue	Revenue from existing programs	Newly Generated Revenue	Revenue from existing programs	Newly Generated Revenue	Revenue from existing programs	Newly Generated Revenue	Revenue from existing programs
Tuition and Fees										
First Year Students										
Tuition										
In-State	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Out-of-State	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Mandatory Fees	\$42,010	\$0	\$75,618	\$0	\$58,814	\$0	\$33,608	\$0	\$16,804	\$0
Second Year Students										
Tuition										
In-State			\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Out-of-State			\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Mandatory Fees			\$42,010	\$0	\$75,618	\$0	\$58,814	\$0	\$33,608	\$0
Third Year Students										
Tuition										
In-State					\$0	\$0	\$0	\$0	\$0	\$0
Out-of-State					\$0	\$0	\$0	\$0	\$0	\$0
Mandatory Fees					\$42,010	\$0	\$75,618	\$0	\$58,814	\$0
Fourth Year Students										
Tuition										
In-State							\$0	\$0	\$0	\$0
Out-of-State							\$0	\$0	\$0	\$0
Mandatory Fees							\$42,010	\$0	\$75,618	\$0
Fifth Year Students										
Tuition										
In-State									\$0	\$0
Out-of-State									\$0	\$0
Mandatory Fees									\$42,010	\$0

Gross Tuition and Fees	\$42,010	\$0	\$117,628	\$0	\$176,442	\$0	\$210,050	\$0	\$226,854	\$0
Grants	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Contracts	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Campus budget allocation	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Other Revenues	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total	\$42,010	\$0	\$117,628	\$0	\$176,442	\$0	\$210,050	\$0	\$226,854	\$0

M.S. Program Budget - Expenditures

UMass New Program Approval Budget

Campus: Dartmouth

Program: M.S. in Data Science

EXPENDITURE ESTIMATES										
	Year 1 2015		Year 2 2016		Year 3 2017		Year 4 2018		Year 5 2019	
	New Expenditures required for Program	Expenditures from current resources	New Expenditures required for Program	Expenditures from current resources	New Expenditures required for Program	Expenditures from current resources	New Expenditures required for Program	Expenditures from current resources	New Expenditures required for Program	Expenditures from current resources
Personnel Services										
Faculty (Part Time)	\$4,000	\$0	\$4,000	\$0	\$4,000	\$0	\$4,000	\$0	\$4,000	\$0
Administrators	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Support Staff	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Others	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Fringe Benefits ____%	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Personnel	\$4,000	\$0	\$4,000	\$0	\$4,000	\$0	\$4,000	\$0	\$4,000	\$0
Operating Expenses										
Supplies	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Library Resources	\$0	\$0	\$4,000	\$0	\$4,000	\$0	\$4,000	\$0	\$4,000	\$0

Marketing/Promotional Expenses	\$6,000	\$0	\$3,000	\$0	\$3,000	\$0	\$3,000	\$0	\$3,000	\$0
Laboratory Expenses	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
General Administrative Overhead	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Other	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Operating Expenses	\$6,000	\$0	\$7,000	\$0	\$7,000	\$0	\$7,000	\$0	\$7,000	\$0
Net Student Assistance										
Assistantships	\$35,000	\$0	\$35,000	\$0	\$35,000	\$0	\$35,000	\$0	\$35,000	\$0
Fellowships	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Stipends/Scholarships	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Student Assistance	\$35,000	\$0	\$35,000	\$0	\$35,000	\$0	\$35,000	\$0	\$35,000	\$0
Capital										
Facilities / Campus recharges	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Equipment	\$25,000	\$0	\$15,000	\$0	\$15,000	\$0	\$15,000	\$0	\$15,000	\$0
Other	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Capital	\$25,000	\$0	\$15,000	\$0	\$15,000	\$0	\$15,000	\$0	\$15,000	\$0
Total Expenditures	\$70,000	\$0	\$61,000	\$0	\$61,000	\$0	\$61,000	\$0	\$61,000	\$0

BUDGET SUMMARY OF NEW PROGRAM ONLY

	Year 1	Year 2	Year 3	Year 4	Year 5
	2015	2016	2017	2018	2019
Total of newly generated revenue	\$42,010	\$117,628	\$176,442	\$210,050	\$226,854
Total of additional resources required for program	\$70,000	\$61,000	\$61,000	\$61,000	\$61,000
Excess/ (Deficiency)	(\$27,990)	\$56,628	\$115,442	\$149,050	\$165,854

ATTACHMENT C: Faculty Form

Summary of Faculty Who Will Teach in Proposed Program							
Name of faculty member (Name, Degree and Field, Title)	Check if Tenured	Courses Taught Put (C) to indicate core course. Put (OL) next to any course currently taught online.	Number of sections	Division of College of Employment	Full- or Part- time in Program	Full- or part-time in other department or program (Please specify)	Sites where individual will teach program courses
Balasubramanian, R. PhD, Computer Science Professor	y	• Pattern recognition (C)	1	computer and information science (CIS)	part time	full time in CIS	• main campus
Bergandy, J. PhD, Computer Science Professor	y	• software development (C)	1	computer and information science (CIS)	part time	full time in CIS	• main campus
Bergstein, P. PhD, Computer Science Assoc. Professor	y	• software development (C)	1	computer and information science (CIS)	part time	full time in CIS	• main campus
Chen, Y PhD, Applied Math Assistant Professor	n	• applied math(C)	1	mathematics	part time	full time in math	• main campus
Davis, G PhD, Mathematics Professor	y	• chaos and complexity • statistics	1	mathematics	part time	full time in math	• main campus
Dong, B. PhD, Mathematics Assistant Professor	n	• Galerkin methods • Multi-scale	1	mathematics	part time	full time in math	• main campus
Gottlieb, S PhD, Applied Math Professor	y	• computational methods (C) • applied math (C)	1	mathematics	part time	full time in mathematics	• main campus
Heryudono, A PhD, Applied Math Assistant Professor	n	• numerical methods (C)	1	mathematics	part time	full time in mathematics	• main campus
Khatib, Firas PhD, Bioinformatics	n	• informatics (C)	1	computer and information	part time	full time in CIS	• main campus

Assistant Professor				science (CIS)			
Kim, S PhD, Mathematics Professor	y	<ul style="list-style-type: none"> • computational methods (C) • math modeling 	1	mathematics	part time	full time in mathematics	• main campus
Narayan, A PhD, Applied Math Assistant Professor	n	<ul style="list-style-type: none"> • numerical analysis (C) • uncertainty quant. 	1	mathematics	part time	full time in mathematics	• main campus
Valova, I PhD, Engineering Professor	y	<ul style="list-style-type: none"> • machine learning (C) • neural networks 	1	computer and information science (CIS)	part time	full time in CIS	• main campus
Wang, C PhD, Mathematics Assistant Professor	n	<ul style="list-style-type: none"> • applied math (C) • numerical methods (C) 	1	mathematics	part time	full time in mathematics	• main campus
Xu, H PhD, Computer Science Associate Professor	y	<ul style="list-style-type: none"> • software development (C) • distributed processing 	1	computer and information science (CIS)	part time	full time in CIS	• main campus
Zhang, X PhD, Computer Science	y	<ul style="list-style-type: none"> • information syst • Multi agent systems (C) 	1	computer and information science (CIS)	part time	full time in CIS	• main campus