

Routing for On-Campus Approval of Degree Program Actions

Type of Action: Enter "X" for Action Type(s) and list Title and Prefix(s) as indicated

<input checked="" type="checkbox"/> New Degree Program	Proposed Program Title <u>Master of Science in Data Science</u>
<input type="checkbox"/> New Certificate Program	Proposed Certificate Program Title _____
<input type="checkbox"/> New Minor Program	Proposed Minor Program Title _____
<input type="checkbox"/> Change in Degree Program Title	Current Degree Program Title _____
<input type="checkbox"/> Change in Certificate Program Title	Current Certificate Program Title _____
	Proposed Certificate Program Title _____
<input type="checkbox"/> Change in Minor Program Title	Current Minor Program Title _____
	Proposed Minor Program Title _____
<input type="checkbox"/> Change in Course Prefix	Current Course Prefix _____ Proposed Course Prefix _____
<input type="checkbox"/> Program Discontinuation	

Proposed Effective Date Fall 2018 Program Contact: George Rouskas, CS, COE, rouskas@ncsu.edu

Proposed CIP Code (see <https://nces.ed.gov/ipeds/cipcode/default.aspx?v=55>): _____

Routing of Action: Indicate date when the following occurs

Completed Request to Plan and 1-page Concept Paper

9/22/16 Council of Dean's- Approval to Plan

Completed Proposal

11/10/16 Department Head endorses*

12/2/16 College Curriculum Committee (undergraduate or graduate) recommends*

12/14/16 College Dean endorses*

Proposal moves to Undergraduate or Graduate office for routing

1/18/17 Recommended by Vice Provost, DELTA, if applies*

_____ Substantive Change Review Team (SCRT) informed

_____ If SACS notification is required, SCRT prepares letter for Chancellor to send to SACS

_____ University Courses & Curriculum Committee or Administrative Board of the Graduate School recommends

_____ Associate Deans Council or Graduate Operations Council informed

_____ Dean (Graduate School or DASA) approves*

Proposal move to the Executive Vice Chancellor Provost's office for routing

_____ Vice-Provosts informed

_____ Deans' Council recommends*

_____ Executive Vice Chancellor and Provost approves*

_____ Chancellor's Executive Officer's (EOM) recommend

_____ University Council informed

_____ Board of Trustees subcommittees recommend

_____ Chancellor approves*

_____ Accreditation Liaison notifies SACS, if applicable

_____ Submitted to UNC-General Administration by Provost's Office

* Signature is required on the signature page for the action


**Master of Science in Data Science
North Carolina State University**

This request has been reviewed and approved by the appropriate campus committees and authorities.


Endorsed By:

 MAREN VOLK 11/3/16

Head, Department of Computer Science (Printed Name and Signature) Date

 ALINA CHERTOCK 11/10/16

Head, Department of Mathematics (Printed Name and Signature) Date

 Leonard A. Stefanski 11-10-2016

Head, Department of Statistics (Printed Name and Signature) Date

Recommended By:

 John J. Classen 12/15/2016

Chair, College Graduate Studies Committee, COE (Printed Name and Signature) Date

 ALVIN L. LLOYD 12/7/2016

Chair, College Graduate Studies Committee, COS (Printed Name and Signature) Date

Endorsed By:


 Douglas S. Reeves 12/14/16

College Dean, COE (Printed Name and Signature) Date

 DAVID BRISTOL 1/5/17

College Dean, COS (Printed Name and Signature) Date

Recommended By:

 Thomas K. Miller III 1/18/17

Vice Provost, DELTA (if DE degree) (Printed Name and Signature) Date

Approved By:

Dean of the Graduate School (Printed Name and Signature) Date

Recommended By:

Dean's Council (Printed Name and Signature) Date

Approved By:

Executive Vice Chancellor and Provost (Printed Name and Signature) Date

Approved By:

Chancellor (Printed Name and Signature) Date

UNIVERSITY OF NORTH CAROLINA

REQUEST TO PLAN

A NEW DEGREE PROGRAM – ANY DELIVERY METHOD

THE PURPOSE OF ACADEMIC PROGRAM PLANNING: Planning a new academic degree program provides an opportunity for an institution to make the case for need and demand and for its ability to offer a quality program. The notification and planning activity described below do not guarantee that authorization to establish will be granted.

Date: September 16, 2016

Constituent Institution: North Carolina State University

Is the proposed program a joint degree program? Yes No

Joint Partner campus _____

Title of Authorized Program: Master of Science in Data Science Degree Abbreviation: MS

CIP Code (6-digit): 30.3001 Level: B M Yes I D

CIP Code Title: Multi / Interdisciplinary Studies: Computational Science

Does the program require one or more UNC Teacher Licensure Specialty Area Code? Yes No

If yes, list suggested UNC Specialty Area Code(s) here _____

If master's, is it a terminal master's (i.e. not solely awarded en route to Ph.D.)? Yes No

Proposed term to enroll first students in degree program: Fall _____ Year 2018

Provide a brief statement from the university SACSCOC liaison regarding whether the new program is or is not a substantive change.

Identify the objective of this request (select one or more of the following)

- Launch new program on campus
- Launch new program online; Maximum percent offered online 50%
 - Program will be listed in UNC Online
 - One or more online courses in the program will be listed in UNC Online
- Launch new site-based program (list new sites below; add lines as needed)
 - Instructor present (off-campus delivery)
 - Instructor remote (site-based distance education)

Site #1 _____

(address, city, county, state)

(max. percent offered at site)

Site #2

(address, city, county, state)

(max. percent offered at site)

Site #3

(address, city, county, state)

(max. percent offered at site)

Supply basic program information for UNC Academic Program Inventory (API) and UNC Online

Minimum credit hours required __ 30 __
Expected number of full-time terms to completion __ 3 - 4 __

1. Review Status.

- a. List the campus bodies that reviewed and commented on this request to Plan proposal before submission to UNC General Administration. What were their determinations? Include any votes, if applicable.

Discussion with Michael Rappa from Institute of Advanced Analytics. It was agreed that this program was distinct from the Masters in Advanced Analytics, see section 5 (c) for details on the differences.

- b. Summarize any issues, concerns or opposition raised throughout the campus process and comment periods. Describe revisions made to address areas of concern.

N/A

2. Description and Purpose

- a. Provide a 250-word or less description of the proposed program, including target audience, delivery method, hours required, program core and concentrations (if applicable), post-graduate outcomes for which graduates will be prepared, and other special features. For programs with an online component, describe whether the delivery is synchronous with an on-campus course, partially synchronous, asynchronous, or other.

The proposed Master of Science in Data Science is an interdisciplinary program offered by the Departments of Computer Science, Mathematics, and Statistics that will train the next generation of professionals for careers in industry, government, and academia. The program will provide students with advanced skills in the components, methods and tools of data science and their application to a variety of tasks related to knowledge discovery and computational and statistical data analysis. The program will not only provide a solid understanding of the foundational concepts of the field but also emphasize

collaboration among the field’s key disciplines, as advocated by the American Statistical Association, namely, database management, statistics and machine learning, and distributed and parallel systems. The program is intended to contribute to the economic development of North Carolina by providing a pipeline of experienced data scientists.

Target Audience.

Professionals in a variety of fields having some formal training in Computer Science, Mathematics, and/or Statistics, but with or without professional experience specific to any of these fields.

Delivery Method.

The degree will be offered both on-campus and online. Online delivery will be asynchronous with on-campus courses.

Hours required.

30 credit hours (10 courses).

Program Core and Concentrations (credits).

- Statistics core: – 6: ST 503 (Fundamentals of Linear Models and Regression), ST 517 (Applied Statistics)
- Mathematics core: – 6: MA 523 (Linear Transformation and Matrix Theory), MA 797 (Convex Optimization in Data Science)
- Computer science core: – 6: CSC 505 (Algorithms), CSC 540 (Databases)
- Statistical/machine learning core: – 3: choose one of: ST 563 (Statistical Learning) or CSC 522 (Automated Learning)
- Concentration (in statistics, mathematics, computer science, or application field): – 9

Post Graduate Outcomes For Which Graduates Will Be Prepared

- In-depth understanding of the mathematical, statistical and computational aspects of data science going beyond the use of existing tools.
- Ability to design and implement new methods for emerging applications in diverse scientific disciplines.
- Enhanced potential for higher salaried employment

b. How does the proposed program align with system, institutional and unit missions and strategic plans?

Our Time Our Future – UNC COMPACT: The Commitment to North Carolina – 2013-18

No.	Commitments	Alignment (H, M, L)
1	Academic excellence and the opportunity for success for all students	H
2	Value for students and for North Carolina	H
3	Solutions to North Carolina’s biggest challenges	H

4	Connection and engagement with North Carolina communities	H
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The proposed program advances the broader UNC system directives: Goal 3: “serving the people of NC,” and Goal 4: “maximizing efficiencies” by combining and leveraging existing strengths at NC State in the Statistics, Mathematics and Computer Science programs.

NC State – The Pathway to the Future – Strategic Plan 2011 – 2020

No.	Goals	Alignment (H, M, L)
1	Enhance the success of our students through educational innovation	H
2	Enhance scholarship and research by investing in faculty and infrastructure	L
3	Enhance interdisciplinary scholarship to address the grand challenges of society	H
4	Enhance organizational excellence by creating a culture of constant improvement	H
5	Enhance local and global engagement through strategic partnerships	H

The proposed program also fulfills NC State’s strategic focus areas in “health & well-being, “energy & environment,” and “educational innovation” by building upon strengths in “advanced computing” platform technologies; and it builds broad interdisciplinary graduate education, leveraging current programs, faculty, and curriculum across the NC State campus. The areas of emphasis of the proposed program parallel that of NC State’s Data-Driven Cluster, which has Computer Science, Mathematics, and Statistics as its building blocks.

c. What student-level educational objectives will be met by the proposed program?

Students completing the program will:

- Design efficient data modeling and processing methods by using mathematical and algorithmic tools.
- Construct conceptual data models, optimize query languages, and implement principles of information integrity, security and confidentiality.
- Quantify appropriate measures of uncertainty associated with the methods of analysis.

- Perform core predictive/descriptive data mining tasks and design and implement strategies for real-world data mining problems.
- Develop appropriate data structures and algorithm design techniques including recursion, divide-and-conquer, distributed and parallel optimization, and dynamic programming for analysis of emerging data types.
- Apply statistical learning principles to a variety of data analysis problems.
- Use relevant software packages and tools and gain insight into how knowledge discovery and data use occurs in practice.

3. Student Demand. Provide documentation of student demand. Discuss the extent to which students will be drawn from a pool of students not previously served by the institution.

The DGPs of the Statistics, Mathematics and Computer Science programs regularly receive a sustained number of inquiries from students who would be best served by the proposed degree. While both the Computer Science and Statistics Departments offer a Data Science concentration within their Masters program, these concentrations only consist of a few elective courses within the discipline. The concentrations, while giving more focus on Data Science than the traditional Masters degree in Computer Science or Statistics, are still single discipline degrees, and do not encompass the truly interdisciplinary nature of Data Science, which can only be met by a program that is developed across disciplines.

We expect that most students will be drawn from a pool of professionals with interests at the intersection of Computer Science, Mathematics, and Statistics. As an example, Computer Science and Statistics currently offer a Data Science Certificate program through NC State Executive Education that is designed for Cisco employees and enrolls approximately 100 students from various Cisco sites around the world every Spring semester. Even if only 10% of these students express interest in a Masters degree in Data Science, that would represent a significant new pool of applicants given that these numbers represent a single company in one industry sector. These professionals are not currently served by the University. Moreover, few programs nationwide cater to this pool of students (refer also to Section 5c below).

A recent study http://www.cs.rpi.edu/TFoDS/TFoDS_v5.pdf sponsored by the National Science Foundation concludes that “*theoretical foundations are necessary in all aspects of data science, from the generation and collection of data to the analysis and decision making processes*” and goes on to say that “*particular emphasis should be placed on interdisciplinary collaborations between computer scientists, mathematicians, and statisticians*”. The present proposal addresses these needs head on through innovative graduate training at the cutting edge of this scientific arena.

4. Societal demand. Provide evidence of societal demand and employability of graduates from each of the following source types.

- a. Labor market information (projections, job posting analyses, and wages)
 - i. specific to North Carolina (such as ncworks.gov, nctower.com, outside vendors such as Burning Glass)
 - ii. available from national occupational and industry projections (such as BLS).

Currently, there is no job classification for the data science or analytics field, hence state or national projections are not available.

- b. Projections from professional associations or industry reports

Glassdoor has named Data Scientist as the best job in America for 2016 (https://www.glassdoor.com/List/Best-Jobs-in-America-LST_KQ0,20.htm) with a median base salary of \$116,840. McKinsey has estimated that the US will face a shortage of 140-190K persons with analytics skills by 2018 (<http://www.mckinsey.com/business-functions/business-technology/our-insights/big-data-the-next-frontier-for-innovation>).

- c. Other (alumni surveys, insights from existing programs, etc.)

The Computer Science department offers a Data Science concentration within its Masters program that became official in the 2015-2016 academic year. Eight Fall 2015 graduates, sixteen Spring 2016 graduates, and eighteen Fall 2016 graduates completed this concentration. We expect these numbers to continue to increase during this academic year. The Statistics department has just received approval to begin a Data Science concentration within its Masters program as of Fall 2016. As discussed in section (3), these concentrations do not yet capture the full interdisciplinary nature of the foundations of Data Science.

As described in section 3, the NC State Executive Education Data Science Certificate that is designed for Cisco employees enrolls approximately 100 students from various Cisco sites around the world every Spring semester.

5. Unnecessary duplication.

- a. List all other public and private four-year institutions of higher education in North Carolina currently operating programs similar to the proposed new degree program, including their mode of delivery. Show a four-year history of enrollments and degrees awarded in similar programs offered at other UNC institutions (using the format below for each institution with a similar program); describe what was learned in consultation with each program regarding their experience with student demand and job placement. Indicate how their experiences influenced your enrollment projections.

Although there exists a growing number of Data Science and/or Analytics programs, both within the UNC system, and nationwide, our proposed program fills a glaring void in this area. Existing programs in Data Science and/or Analytics provide training

in the usage of Data Science techniques and applications. The proposed program will instead target the rigorous underpinnings of Data Science providing a full mathematical viewpoint into the field. This will enable the graduates from this program to gather a more in-depth understanding of not only the usage, but also the development of the methods, and the field itself. To the best of our knowledge, the MS program in Data Science at Stanford University is the only other program whose curriculum aligns with our proposed training (refer also to Section 5c below).

For completeness, however, we list 2 current programs in the UNC system that are most similar to the proposed program, noting the fact that they are very distinct in their learning objectives and target audience.

Institution: North Carolina State University

Program Title: Master of Science in Analytics (MSA)

	2015	2014	2013	2012
Enrollment	115	88	78	82
Degrees-awarded	86	79	81	38

Institution: UNC Charlotte

Program Title: PSM in Data Science and Business Analytics (DSBA)

	2015	2014	2013	2012
Enrollment	61	15		
Degrees-awarded				

- b. Identify opportunities for collaboration with institutions offering related degrees and discuss what steps have been or will be taken to actively pursue those opportunities where appropriate and advantageous.

There are no identifiable opportunities for collaboration. All programs are designed as terminal Masters degree with a specific curriculum, with our focus on foundations, while the others are focused more on applications.

- c. Present documentation that the establishment of this program would not create unnecessary program duplication. In cases where other UNC institutions provide similar online, site-based distance education, or off-campus programs, directly address how the proposed program meets unmet need.

This collaboration between Computer Science, Mathematics, and Statistics creates a unique and well-positioned MS in Data Science. Existing programs in Data Science and/or Analytics provide training in the usage of Data Science techniques and applications. The proposed program will instead target the rigorous underpinnings of Data Science providing a full mathematical viewpoint into the field. This will enable the graduates from this program to gather a more in-depth understanding of not only the usage, but also the development of the methods, and the field itself.

Although there exists a growing number of Data Science and/or Analytics programs, both within the UNC system, and nationwide, our proposed program fills a glaring void in this area. To the best of our knowledge, the MS program in Data Science at Stanford University is the only other program whose curriculum aligns with our proposed training.

NC State is well-positioned to fill this void, and be a leader in this important and unique formal training with this collaboration between the departments of Computer Science, Mathematics, and Statistics, which has already been established by the Data Science Initiative and the Data-Driven Science Cluster.

6. Enrollment. Estimate the total number of students that would be enrolled in the program during the first year of operation and in each delivery mode (campus, online, site – add lines as needed):

Delivery Mode_Campus_ Full-Time 15 *Part-Time* _____
Delivery Mode_Online_ Full-Time _____ *Part-Time* 10

Estimate the total number of students that would be enrolled in the program during the fourth year of operation and in each delivery mode (campus, online, site – add lines as needed):

Delivery Mode_Campus_ Full-Time 30 *Part-Time* _____
Delivery Mode_Online_ Full-Time _____ *Part-Time* 20

7. Resources. Will any of the resources listed below be required to deliver this program? (If yes, please briefly explain in the space below each item, state the estimated new dollars required at steady state after four years, and state the source of the new funding and resources required.)

- a. New Faculty: Yes _____ No X
- b. Faculty Program Coordination: Yes Y No _____

- c. Additional Library Resources: Yes _____ No __N__
- d. Additional Facilities and Equipment: Yes _____ No __N__
- e. Additional Other Program Support: Yes __Y__ No _____
 (for example, additional administrative staff, new Master's program graduate student assistantships, etc.)

All additional support will come from the tuition differential (premium tuition) generated by the program, no additional funds are needed.

8. Curriculum leverage. Will the proposed program require development of any new courses? If yes, briefly explain.

The Masters program will build upon the interdisciplinary Graduate Certificate in Data Science Foundations offered by the departments of Computer Science and Statistics and on existing or already planned courses of the Mathematics department. No new courses are required from any of the departments.

9. Funding Sources. Does the program require enrollment growth funding in order to be implemented and sustained? If so, can the campus implement and sustain the program should enrollment growth funding be unavailable? Letters of commitment should be provided.

Tuition differential (premium tuition) will allow for the implementation and sustainment of the program. Enrollment growth funding will also be requested, but is not required for implementation and sustainment.

- 9a. For graduate programs only:

Does the program require a tuition differential or program specific fee in order to be implemented and sustained?

- i. If yes, state the amount of tuition differential or fee being considered, and give a brief justification.

We request a tuition differential (premium tuition) at the same level as for all other degrees within the Computer Science graduate program (including the Data Science Foundations Graduate Certificate), currently at \$2400/semester for full-time students, with a pending increase to \$2800/semester.

- ii. Can the campus implement and sustain the program if the tuition differential or program fee is not approved? Letters of commitment from the Chancellor and/or Chief Academic Officer should be provided.

No, unless the University re-allocates resources to support the program.

10. For doctoral programs only:

- a. Describe the research and scholarly infrastructure in place (including faculty) to support the proposed program.
- b. Describe the method of financing the proposed new program (including extramural research funding and other sources) and indicate the extent to which additional state funding may be required.
- c. State the number, amount, and source of proposed graduate student stipends and related tuition benefits that will be required to initiate the program.

11. Contact. List the names, titles, e-mail addresses and telephone numbers of the person(s) responsible for planning the proposed program.

George Rouskas, Computer Science DGP, rouskas@ncsu.edu, 919-515-3860
Pierre Gremaud, Mathematics DGP, gremaud@ncsu.edu, 919-515-3085
Howard Bondell, Statistics DGP, bondell@stat.ncsu.edu, 919-515-1914

This request for authorization to plan a new program has been reviewed and approved by the appropriate campus committees and authorities.

Chancellor: _____ Date: _____

Chancellor (Joint Partner Campus): _____ Date: _____

Master of Science in Data Science

SUMMARY OF ESTIMATED ADDITIONAL COSTS FOR PROPOSED PROGRAM

INSTITUTION	North Carolina State University	DATE	25-Feb-17	
Program (CIP, Name, Level)	30.3001			
Degree(s) to be Granted	Master of Science in Data Science	Program Year	Year 1 (2018-2019)	Year 4
Differential tuition requested per student per academic yr	\$5,600			
Projected annual FTE students			23	46
Projected annual differential tuition			\$112,000	\$224,000
Percent differential tuition for financial aid			15%	15%
Differential tuition remainder			95200	190400

ADDITIONAL FUNDS REQUIRED - BY SOURCE

	Reallocation of Present Institutional Resources	Projected Differential Tuition	Enrollment Increase Funds	Other New Allocations (Identify)	Total
EPA/SPA Regular Salaries					
graduate service coordinator		\$ 33,250.00	\$ -	\$ -	\$ 33,250.00
EPA Academic Salaries					
director of graduate program		\$ 55,417.00	\$ -	\$ -	\$ 55,417.00
faculty fellow		\$ 20,000.00			\$ 20,000.00
Social Security (fringe included above)	\$ -	\$ -	\$ -	\$ -	\$ -
State Retirement	\$ -	\$ -	\$ -	\$ -	\$ -
Medical Insurance	\$ -	\$ -	\$ -	\$ -	\$ -
	\$ -				
Graduate Stipends					
(3 Tas @ \$22K+fringe)		\$ 76,560.00	\$ -	\$ -	\$ 76,560.00
	\$ -				
Supplies and Materials					
office supplies and computer for GSC		\$ 2,500.00	\$ -	\$ -	\$ 2,500.00
Current Services	\$ -				

Master of Science in Data Science

	(Identify)	\$	-	\$	-	\$	-	\$	-
Travel		\$	-	\$	-	\$	-	\$	-
Communications		\$	-	\$	500.00	\$	-	\$	500.00
Printing and Binding		\$	-	\$	500.00	\$	-	\$	500.00
Advertising		\$	-	\$	1,000.00	\$	-	\$	1,000.00
Fixed Charges		\$	-						
	(Identify)	\$	-	\$	-	\$	-	\$	-
Capital Outlay (Equipment)		\$	-						
	(Identify)	\$	-	\$	-	\$	-	\$	-
		\$	-						
Libraries		\$	-	\$	-	\$	-	\$	-
		\$	-						
TOTAL ADDITIONAL COSTS				\$	189,727.00	\$	-	\$	-
		\$	-						

Narrative:

The program will be managed by a Director who will be compensated through 1 Summer month of salary and a yearly 1 course buyout. The Director will be assisted by a graduate service coordinator (.5 FTE).

The teaching will be supported by three teaching assistantships (\$22K each), one in each of CS, Math and Stat. In addition, the program will have available a \$20K for buyout available to CS, Math and Stat faculty interested in developing or updating courses relevant to the Program.

It is expected that the program will ramp up to a size of about 50 by year 4 at which time it will be entirely self-supported.



College of Sciences

College of Engineering

March 8, 2017

Dear Colleagues:

On behalf of the College of Sciences and the College of Engineering, this letter is in full support of the Request to Plan for the Master of Science in Data Science degree program.

The proposed joint MS degree in Data Science is a proposal that we believe is extremely timely, inherently interdisciplinary, highly in-demand, and builds on the strengths and initiatives of NC State University in multiple areas.

Given our current offerings and expertise in Computer Science, Mathematics, and Statistics, and the already existing joint Certificate in Data Science, the implementation of the program will require no new resources to get it running immediately. Meanwhile, this new degree will continue to push us forward on the leading edge of Data Science, and aligns perfectly with the NC State University Data Science Initiative, Data Science Cluster, and the University's strategic goals, as well as the broader UNC System directives. The demand for this degree program will also help provide an additional stream of revenue to the colleges, the university, and the UNC system as a whole.

The proposed degree program is unique in its focus on the foundational aspects of Data Science, and aligns with the initiatives of the National Science Foundation, as well.

Please feel free to let us know if you have any questions or comments.

Sincerely,

A handwritten signature in black ink, appearing to read "W. Ditto".

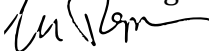
William Ditto, PhD
Dean, College of Sciences

A handwritten signature in black ink, appearing to read "Louis A. Martin-Vega".

Louis A. Martin-Vega, PhD
Dean, College of Engineering

DATE: March 30, 2017

TO: Administrative Board of The Graduate School

FROM: Michael Rappa, Goodnight Director and Distinguished University Professor
Institute for Advanced Analytics 

SUBJECT: M.S. in Data Science Request to Plan – Consultation

Due to the short time given to me to provide this review, I cannot speak to each and every detail in the Request to Plan. Therefore, I will limit the present discussion to the single most important issue: the unnecessary duplication and potential adverse impact of the proposed degree on the Master of Science in Analytics. A frequent reviewer of data science and analytics degree proposals—at Hofstra University, Ohio State University, and the University of Washington in the last year alone—I am accustomed to the review process and what it takes to provide a fair and thorough evaluation.

Background – The Master of Science in Analytics

More than a decade ago, I proposed the creation of the Master of Science in Analytics (MSA) to address the growing shortage of talent with data savvy skills needed for drawing insights from large volumes of rapidly streaming data. In an April 2006 presentation the proposal gained instant support with the Chancellor (at the time, Jim Oblinger), and the backing of a distinguished alumnus who agreed to provide three-year seed funding. A few months later the Office of the Provost launched the Analytics Initiative with myself as the director.

The proposed MSA degree won approval of the UNC Board of Governors in February 2007. The Institute for Advanced Analytics was authorized a few months later as an interdisciplinary platform for collaboration among two-dozen faculty across six colleges. In June 2007, NC State became the first university in the nation to enroll students in a full-fledged master's degree in analytics, melding together a novel and integrated curriculum in applied mathematics, statistics, computer science, and various business disciplines.

Today the MSA is one of NC State's largest graduate programs, enrolling up to 120 full-time students in a 10-month intensive residential format. The program receives over 1,000 applications annually and is one of the University's most selective, with an acceptance rate under 14% and an enrollment rate above 80%. Its graduates are among the most sought-after by employers from coast to coast.

Since 2007, over 120 similar graduate programs have been launched across the U.S. alone. Numerous faculty, several department heads and deans, a provost, and two presidents, from countless universities around the globe have come to the Institute to learn about the MSA and review its curriculum. It's fair to say NC State's program is considered by many to be among the best of its kind, and has gained formal recognition as such by professional societies and journals.

The MSA program operates entirely on tuition revenue and has maintained solid financial solvency throughout the Institute's decade long history.

Timeline – Master of Science in Data Science Request to Plan

*NB: As tedious as it is, I find it necessary to provide a timeline with respect to the Request to Plan. In recounting events of the past year, I want the Board to understand, **contrary to what's written in the planning document**, at no time did I hold the opinion the proposed data science degree would be "distinct" in any meaningful way from the Master of Science in Analytics.*

In early 2016, I became aware of discussions on campus to propose a new degree, the Master of Science in Data Science (MSDS). Naturally it caught my attention. The terms "analytics" and "data science" are frequently used in tandem. My concern was deep enough to include it as one of the future challenge to the MSA outlined in the Institute's 2016 Annual Report published in June, which stated: "Various programs emerging from within the university create confusion among prospective students and employers, and will potentially harm its position as a recognized leader in analytics."

On August 17, 2016, I received a message from Dr. George Rouskas (DGP, Computer Science):

"As you may know, Computer Science and Statistics recently established a joint Graduate Certificate in Data Science Foundations (DSF). The natural next step would be to create a joint Masters program in Data Science. The two departments have had some preliminary discussions, and we have put together a one-page concept paper that we have submitted to the Deans of Engineering and Sciences.

Howard Bondell, Statistics DGP, (copied) and I would like to meet with you to discuss our proposal and get your comments and suggestions."

On August 24, I met with Drs. Rouskas and Bondell. No proposal was shared at the time or anytime thereafter. In our meeting the details were few. I expressed concern a new degree in data science at NC State would potentially create confusion with the MSA. Should the departments proceed with a proposal, I said a bar should be set as high as (or higher than) the MSA. To do otherwise would only diminish NC State's

leading brand. I also recall asking who were the faculty in each department behind the proposal, to which no reply was given (and none are mentioned in the planning document).

A day later, at a prearranged meeting with Provost Warwick Arden and Vice Provost Duane Larick, the topic of the proposed MSDS came up for discussion, and again I expressed my concern regarding the potential adverse affect on MSA enrollment. The financial stability of the Institute depends on tuition revenue from MSA students, who pay full tuition (and a premium) to attend the program. Even a small decline in enrollment would limit the Institute's ability to meet its financial commitments, including servicing its 10-year lease contract on Centennial Campus.

After six months without having heard a word about the MSDS proposal, I received a message from Melissa Nosbisch (The Graduate School) on March 7, 2017 with the following request:

“The Graduate School is currently reviewing the attached proposal for a Master of Science in Data Science. As part of the review process, we request formal consultations from degree programs with similar or related interests.

Please review the attached proposal and reply to this email with your consultation summary. I know you've seen an earlier draft of the proposal, but we ask you to review the latest version of the proposal for the formal consultation. Please let us know if you have any questions.”

Ms. Nosbisch's assertion about having “seen an earlier draft” was erroneous. I had not seen the proposal in any form prior to her message. Nor was the draft shared earlier with the faculty in the Department of Computer Science. Had it been, I would have seen it.

After a quick look at the proposal, I was startled to see the following statement on page 2 under section 1(a):

“Discussion with Michael Rappa from Institute of Advanced Analytics. It was agreed that this program was distinct from the Masters in Advanced Analytics [sic], see section 5 (c) for details on the differences.”

The statement is false. At no time had I agreed with anyone (including Drs. Rouskas and Bondell) the proposed MSDS was distinct from the Master of Science in Analytics. I couldn't have agreed for the simple reason that I had not seen the planning document prior to it being sent to me by Ms. Nosbisch. And if someone believes I did, it would be helpful to know with whom (the planning document is unclear in this regard). Anyone who spoke with me in 2016 would have walked away knowing I had concerns about the notion of NC State offering an MSDS. Now that I have read the proposal, I am all the more convinced the degree represents an unnecessary duplication of the MSA.

In response to Ms. Nosbisch, I sent a request to Dr. Peter Harries (The Graduate School) on March 10, 2017 asking the statement in section 1(a) be removed from the proposal; a more accurate statement would be:

“A brief discussion in August 2016 with Dr. Michael Rappa from Institute of Advanced Analytics. Dr. Rappa expressed his concern the proposed program would adversely affect the Master of Science in Analytics by creating an unnecessary duplication.”

Section 1(b) of the proposal should be amended to reflect my concerns as outlined below. Given my view was factually misrepresented on this one very important point (unnecessary duplication), it would be appropriate for The Graduate School to notify the signatories of these changes, as it may alter their decision to endorse the planning document.

Analytics and Data Science: A Distinction Without a Difference

“Analytics” and “data science” are used more or less interchangeably across the academic landscape as labels for a genre of interdisciplinary professional master’s degree programs aimed at addressing the shortage of talent with the skills for wrangling what is commonly referred to today as “big data” (itself a widely used term with its own ambiguity). As someone who has chronicled the creation of every single analytics and data science program in the country (and peer-reviewed many while in the proposal stage), it’s fair to say that I am in a good position to know.

For this reason, I believe the proposed MSDS may create confusion between it and the MSA in ways that may ultimately diminish NC State’s leadership position.

A topic-by-topic comparison of analytics and data science programs nationwide would yield, at most, minor variations in content. But those differences would be rooted in how programs are situated within the department/college organizational structure of the university and not by well-defined parameters of “analytics” and “data science” as substantively different fields of graduate study.

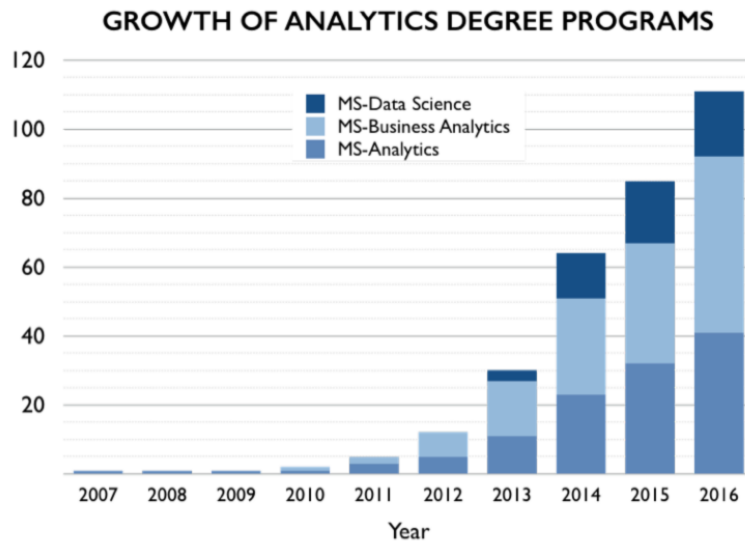
Of more significance than slight variations in curricula are the perceptions of prospective applicants and employers. Both constituencies tend to view analytics and data science graduate programs as one and the same. I will illustrate this point in four ways:

1. The interchangeable use of analytics and data science in degree nomenclature
2. How analytics and data science graduate programs describe themselves
3. How prospective applicants view the programs
4. How employers view analytics and data science graduates

1. Data Science and Analytics degree nomenclature

When it comes to naming conventions, there are three basic categories for overlapping degree programs: **Analytics** (sometimes with an adjective, such as “Data Analytics” or “Predictive Analytics”), **Business Analytics** (which are almost always offered within business schools), and **Data Science**. NC State was the originator when it launched the Master of Science in Analytics in 2007. It remained the only program for three years until 2010 when the University of Tennessee at Knoxville business school renamed an existing master’s degree program from “Business Statistics” to “Business Analytics.” The UTK program floundered until eventually the curriculum was redesigned into something akin to the MSA and other MSBA programs today.

With support from the same benefactor, Louisiana State became the second university to offer a Master of Science in Analytics in 2011. The LSU program closely followed our MSA curriculum blueprint, but is organized as a collaboration of the College of Agriculture (home to their Department of Statistics) and the LSU business school. In 2011, the University of Cincinnati business school renamed its Master of Science in Quantitative Studies to the Master of Science in Business Analytics. Over time it was revamped to meet the standard model for graduate analytics degree programs. Then from 2012 onward, the number of programs grew rapidly.



It wasn’t until 2013 when the first Master of Science in Data Science program emerged (there are now more than 20 programs with that moniker). The new nomenclature reflected the growing use of the term “data scientist” as an occupational category in industry. The term was popularized on the cover of the *Harvard Business Review* in October 2012, highlighting the looming shortage of analytics professionals needed to grapple with the rapidly increasing size and complexity of data. An influential article in the issue by Tom Davenport and D.J. Patil, titled “Data Scientist: The Sexiest Job of the 21st Century,” posed the question

“how to find data scientists.” The authors gave the Institute’s MSA program high praise as one of only “a few sources of talent with proven strengths” alongside Stanford, MIT, Berkeley, Harvard, and Carnegie Mellon. The authors made no distinction between analytics and data science (or other programs for that matter) and today each university uses a different naming convention for its degree:

- **Berkeley:** Master of Information and Data Science
- **Carnegie Mellon:** Master of Information Systems Management with a concentration in Business Intelligence & Data Analytics
- **Harvard:** Master of Science in Computational Science and Engineering
- **MIT:** Master of Business Analytics
- **Stanford:** Master of Science in Statistics with Data Science Track

Closer to home, there is the example of UNC-Charlotte, which chose to merge analytics and data science into a single name—the M.S. in Data Science and Business Analytics—launched in 2015. Another example, Georgetown University, left nothing (or everything) in doubt by calling its degree the “Master of Science in Analytics, Concentration in Data Sciences.” It’s awkward for no reason, since there is one and only one concentration in the curriculum. Georgetown and UNCC underscore the recent trend for new programs to cover all bases by heavily salting both terms, analytics and data science, in the name or description of the degree.

Most recently, in January 2017, the interchangeable use of analytics and data science reached a veritable apex when the Board of Regents of a California-based university officially changed the name of its MS degree program after two years of operation, simply replacing “Analytics” for “Data Science” without a single alteration in the curriculum. The decision could be implemented within minutes by searching-and-replacing text on the program’s website.

2. Analytics and Data Science program descriptions

To understand the similarity of analytics and data science graduate degrees you need look no further than the descriptions on program websites. How universities describe their programs has a big influence in how prospective students perceive degrees in analytics and data science, as similar or different. Very few prospective applicants actually visit the schools or speak directly with faculty.

Below are excerpts from each of a dozen graduate programs in analytics and data science (from their respective websites), with the degree names removed. Half of are from MSDS and half are from MSA degrees. As you read them you’ll see many terms are used in common. For example, programs always describe themselves as **interdisciplinary**, and typically call out mathematics, statistics, computer science and business. Almost all express a professional orientation (i.e., they are not research degrees leading to a doctorate). Try to identify which of the programs are masters in data science and which are analytics.

- a. In the master's degree in _____ program you learn how to explore data using high-level mathematics, statistics, and computer science. You will learn how to analyze data, visualize your results, and articulate your discoveries. You will learn to think critically and communicate your insights. You will become a better decision-maker by knowing which questions to ask and by understanding the ethics of working with data. You will approach data using scientific methods. You will learn to question underlying premises and reformulate issues, explore and improve the structure of available data, create and evaluate models, construct and test hypotheses, draw conclusions, and determine if the results make sense in the real world. You will leave the program with the ability to think about the real problems that need to be solved, not to simply find technical solutions.
- b. Corporations are overwhelmed by a fire hose of data that they don't have the capability to sort, manage or interpret. They are faced with a critical shortage of talent who can synthesize huge amounts of information from multiple sources, derive new insights, convert data into actionable information, and articulate their findings. With our long history of research in data management, statistics, and business analytics, ours is one of a handful of universities ready to prepare graduates for the challenges of this rapidly expanding field. The program brings together a trifecta of faculty mentors from computer science, mathematics, and business.
- c. The master's in _____ takes a comprehensive approach, with a curriculum that integrates statistics, computer science and business—skill areas crucial to succeeding in the emerging field of big data. This innovative approach is designed to prepare students to acquire the necessary technical skills in statistics, analytical methods and programming tools while simultaneously developing vital business skills. And you'll get hands-on experience with emerging software tools allowing for analytical methods to be applied to large and unstructured datasets.
- d. The Master of Science in _____ is an interdisciplinary curriculum that draws from the College of Humanities and Sciences, School of Engineering and School of the Arts. Classes and coursework focus on statistics, computer science, strategic behavior and data visualization skills so you can drive decision-making and advance in careers across industries. Designed for working professionals, the program provides flexibility that enables you to maintain current responsibilities while earning your degree in two years or less. Through a combination of interactive coursework, collaborative group activities and online face-to-face classes, you will gain the technical, analytical and communication skills you need to make meaningful data-driven decisions.

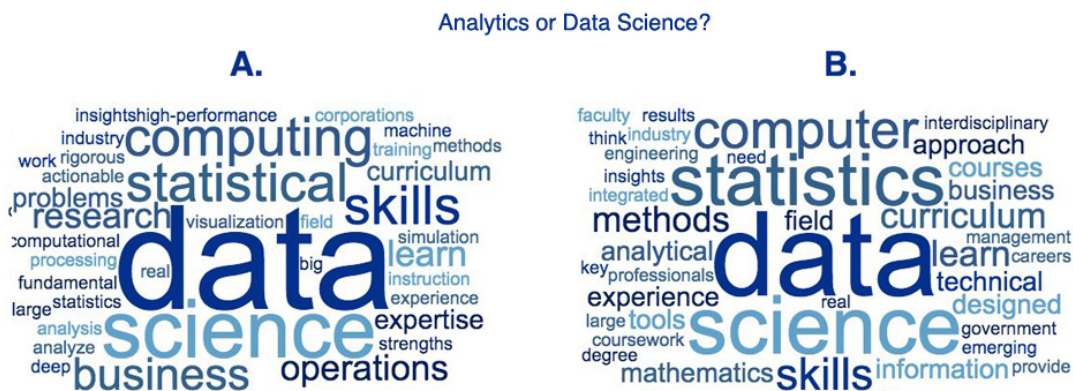
- e. The Master of Science in _____ is an interdisciplinary program offered by the Departments of Computer Science, Mathematics, and Statistics that will train the next generation of professionals for careers in industry, government, and academia. The program will provide students with advanced skills in the components, methods and tools and their application to a variety of tasks related to knowledge discovery and computational and statistical data analysis. The program will not only provide a solid understanding of the foundational concepts of the field but also emphasize collaboration among the field's key disciplines: database management, statistics and machine learning, and distributed and parallel systems.
- f. The Master of Science in _____ is an 11-month professional masters program, designed to meet the increasingly data-intensive needs of industry and government. The program starts near the beginning of July and ends the next year in mid-May. Core courses will be taught by faculty from Computer Science, Statistics, and Systems and Information Engineering. Three key features of this program are (a) an integrated curriculum and data experience; (b) the compressed duration; and (c) a cohort experience. The curriculum is integrated across courses, with several large complicated data sets woven across courses to increase program cohesion.
- g. The Master of Science in _____ program teaches students the skills that drive business success in today's hyper-competitive, data-driven world. Drawing on the expertise of renowned professors and lecturers from major corporations, we combine mathematical and statistical studies with instruction in advanced information technology and data management. Students are immersed in a comprehensive and applied curriculum as they learn to: Identify patterns and trends; derive optimized recommendations evaluated through simulations; interpret and gain insight from vast quantities of structured and unstructured data; communicate their findings in practical and useful terms.
- h. The one-year Master of Science in _____ program delivers a rigorous curriculum focused on mathematical and computational techniques in the emerging field of data science. The curriculum emphasizes the careful formulation of business problems, selecting effective analytical techniques to address those problems and communicating solutions in a clear and creative fashion. Our faculty represent the fundamental multidisciplinary nature of the big data industry. They're traditional academics and data scientists actively working in the field, using real industry experience to inspire their instruction. Their areas of expertise include deep learning, natural language processing, databases, statistical modeling, network analytics, algorithms, unsupervised learning, machine learning, optimization, and signal processing.

- i. The Master of Science in _____ is an interdisciplinary degree program that leverages our strengths in statistics, operations research, computing, and business by combining the world-class expertise of the Colleges of Business, Computing, and Engineering. By blending the strengths of these nationally ranked programs, graduates will learn to integrate skills in a unique and interdisciplinary way that yields deep insights. Our interdisciplinary approach gives students the opportunity to learn cutting-edge techniques in statistics, operations research, and high-performance computing. Students will use state-of-the-art high-performance computing infrastructure for massive-scale data, work in cross-disciplinary teams to solve real problems for a range of companies and organizations, and more.
- j. The explosion of modern computing power and data acquisition techniques has created a job market which seeks people with a strong background in fundamental statistical analysis, operations research, management of information systems, and computer science. Today, corporations have come to realize that the collection and storage of large amounts of business operations data has become increasingly easy and inexpensive. However, having the ability to analyze, make sense of the data, and use it as a predictive tool is what gives a corporation a competitive edge. The MS in _____ is designed to position students for a successful career.
- k. The Master of Science in _____ provides students with a rigorous training in computational, mathematical, and statistical methods to prepare them for careers in data science and analytics. Data science can generate products that provide actionable information. Students will build a solid knowledge in data analytics fundamentals and then add skills in visualization, big data computing, and machine learning. Important soft skills such as communication, teamwork, and problem solving techniques will be part of the training throughout.
- l. The Master of Science in _____ is designed for students with a strong background in mathematics, computer science, engineering, or economics who are looking to learn the specific techniques and tools and the business skills to apply this knowledge effectively and strategically. It combines mathematical and statistical study with instruction in advanced computational and data analysis. Students learn to identify patterns and trends; interpret and gain insight from vast quantities of structured and unstructured data; and communicate their findings in practical, useful terms.

MSDS: Illinois IT (a); WPI (b); Elmhurst (c); Southern Methodist (d); NCSU (e); Virginia (f).
MSA: Northwestern (g); San Francisco (h); Georgia Tech (i); Bowling Green (j);
Georgetown (k); Harrisburg (l).

It's striking how similarly the programs describe themselves, and how often each school uses both terms (analytics and data science) on their websites regardless whether it offers the MSDS or MSA. In case you missed it, the list includes the description of NC State's proposed MSDS as provided in the planning document. It's reasonable to conclude at least some readers mistakenly labeled it as one of the MSA programs.

Below are two word clouds using text from the program descriptions. One cloud is based on the half-dozen data science programs, and the other cloud on the analytics programs. With so many terms used in common, a knowledgeable group of observers (such as program directors) would be unlikely to tell the difference. Notice how prominent terms like **data** and **science**, or **statistics** and **statistical**, or **computer** and **computing** are in each cloud.



3. Prospective applicants to MSDS and MSA programs

A critical question is whether or not prospective applicants perceive a difference in MS programs that use the analytics or data science in the degree title. The previous section provides evidence to suggest it would be difficult, because program descriptions blend together and the disciplinary structures and goals are similar.

Further evidence can be seen in how prospective applicants apply to programs: do they apply strictly to programs that use one or the other designation, or do they apply to both analytics and data science programs. If prospective students apply to both, then presumably they don't perceive a difference in the degrees or the potential career outcomes upon graduation.

A survey sent to the 118 students in the Institute's MSA Class of 2017 shows that among students who applied for admission to other schools, 46% also applied to at least one MSDS program (the MSDS at the University of Virginia and Columbia University being the two most common). This result clearly underscores the extent to which the Institute's MSA is competing for students with MSDS programs, and

how prospective applicants don't necessarily make application decisions based on how the program is named, whether its analytics or data science.

Another example can be seen in the enrollment losses for the Institute (i.e., accepted applicants who decline admission), and where they eventually decide to go to school. In the past two admissions cycles, what few competitive losses we had, several were to MSDS programs. Virginia and Columbia figure prominently here, as well, as the programs we encounter most frequently in competition (and lose) candidates. Thankfully, the Institute has far more in the win column.

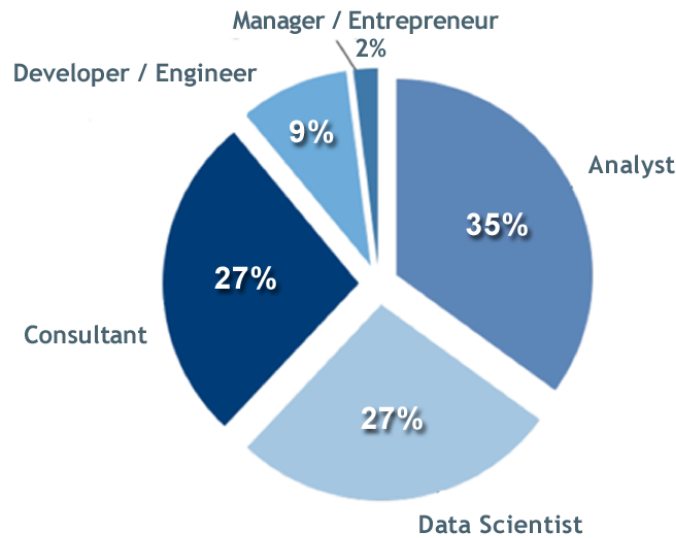
The proposed MSDS degree would likely create confusion among prospective applicants. They will wonder about which program, the MSDS or MSA, is the appropriate one for achieving their career goals to become a data scientist. To the extent the new MSDS has lower admission standards (higher acceptance rates and lower enrollment rates are common in the Computer Science and Statistics MS programs) the likelihood will be that prospective applicants begin to view NC State as a less competitive offering when compared to the preeminent institutions we now regularly compete with, and frequently win against.

4. Employer perceptions of MSDS and MSA graduates

Since 2012 the use of "data scientist" as an occupational category and job title has grown dramatically, thanks in part to the HBR article. Although the MSA predates the use of "data scientist," today many of our graduates are employed each year as data scientists (specifically with that as a job title). Job outcomes of the MSA Class of 2016 (n=113) shows the data scientist category as one of the "big three" job buckets for our students, with 27% of the Class employed as data scientists upon graduation. In the last four MSA classes over 100 students accepted jobs as data scientists, and nearly 25% of the entire MSA alumni population (n=533) now work in positions labeled data scientist. Each year more and more alumni migrate or are promoted into data scientist positions. (See the attached MSA 2016 Employment Report for further details on placement.)

Employers looking to hire data scientists visit the Institute regularly to recruit our graduates. They do not make fine distinctions in terminology when it comes to the use of analytics and data science in position titles and job descriptions. What follows are open positions for "data scientists." I would argue the positions could be filled by MSA graduates (see if you can identify which ones). Read the descriptions closely. It will give you insight into what MSA students actually learn and the capabilities they bring to the job as data scientists. Notice also in how many instances both "data scientist" and "analytics" occur together in the same job description.

MAJOR TYPES OF JOB POSITIONS OFFERED TO
CANDIDATES IN THE CLASS OF 2016



a. **RTI International, Entry Level Data Scientist**

The Center for Data Science at RTI International is seeking an Entry Level Data Scientist with skills in data mining, statistical learning, predictive modeling, mathematical and simulation modeling, forecasting, data visualization, text analytics, social media analytics, and natural language processing to work on projects in the domains of public health, health care, health communications, global health, social science research, sample surveys, engineering, and the environment. The successful candidate will work with a growing team of RTI data scientists and domain experts on government and commercial analytics projects and also on projects to build internal tools and capacity. The mission of the Center for Data Science is to advance and support scientific research conducted at RTI in many different domains. Our goal is to solve problems and inform decision-making through innovation, collaboration, and technical expertise. We take our mission “to improve the human condition” seriously and seek staff who resonate with it. Collaborate with a team of data scientists, statisticians, computer scientists, and subject matter experts to solve problems using data science approaches, techniques, and methods

Responsibilities:

- Participate in projects, tasks, and staff in activities related to data integration, data cleaning, descriptive analyses, exploratory analyses, predictive modeling, data mining, text analytics, social media analytics, social network analysis, rapid prototyping, and data visualization
- Collect, store, access, and analyze data from a variety of sources
- Assist in developing static and interactive data visualizations

- Develop predictive models and simulations using a variety of software and tools.
- Assist in expanding predictive analytics business: participate in meetings with clients (internal and external), assist in framing projects and designing solutions based on client needs and problems to be solved
- Communicate results through presentations, reports, tools, and data visualizations for clients, internal staff, scientific journals, and other publications
- Assist teams in proposal writing
- Participate in professional development and scientific stature efforts

b. Genworth, Modeling Analyst (Data Science Analyst)

The Data Science Analyst will be part of a highly analytical team that provides business critical intelligence and advice for decision support. Reporting to the Director of Data Science, Resource Optimization and Enterprise Data Management, this role will provide analytical support to US Mortgage Insurance (USMI) Operations areas (Underwriting, HOA, Loss Management) through effective use of business intelligence reporting, predictive analytics and forecasting methods to improve operational visibility and efficiencies. This position will also support cross functional as well as cross platform (including international) advanced modeling and promote best practice sharing at Genworth.

Responsibilities:

- Support the “Data Scientist” vision of the group by participating in planning and development of analytic projects in response to business needs of functional areas. The areas include Operations functions of Underwriting, HOA, Loss Management as well as cross functional and international support.
- Perform business intelligence reporting tasks with the focus on diagnosing risks and opportunities in business functional areas. Report value stream to define functional metrics for “what matters” and resulting business improvement/actions.
- Develop and perform preliminary exploratory analysis on datasets associated with building advanced statistical models. Ability to work with structured and unstructured data.
- Support the team members in determining requirements, evaluate analytical approaches and create predictive models to optimize decision making for functional areas of support.
- Communicate and document business intelligence tasks, statistical analyses and methods in a logical and understandable manner for non-analytical business users and executive decision makers.
- Ensure accuracy of results and analytic methods. Perform regular validation and collaborations of the BI metrics and analytical models.

- Collaborate with peer analysts to ensure the use of models for optimized decision making.
- Work with IT and Data Reporting team on the evaluation of data management.
- Demonstrate strong business acumen.
- Fulfill ad-hoc requests in a timely and efficient manner.

c. Siemens, Population Health Sr. Data Scientist

The Data Scientist will work with the Professional Services implementation team designing and developing advanced analytical Siemens solutions. Having the ability to understand healthcare business requirements, design an efficient solution that enables actionable technical implementation steps is a key requirement. You must develop expert knowledge of the Siemens product portfolio and use this knowledge to deliver high quality solutions for Siemens customers. You will work with a growing and dynamic team that requires wearing multiple hats and multi-tasking across projects. This role will serve as a key contributor in delivering actionable, business changing analytics solutions.

Responsibilities:

- Lead the design and development of complex data-driven operational and business solutions, as well as predictive model-based solutions for Healthcare delivery systems
- Ensure developed solutions drive key performance metrics for Healthcare customers
- Creation of customer-specific predictive modeling solutions
- Serve both internally to Siemens and externally to customers as the trusted advisor across analytics, data mining and big data intelligence
- Stay current and knowledgeable to market technology ensuring most effective and efficient solutions for Siemens customers
- Effectively build relationships, collaborate and partner with Healthcare providers and x-functional teams worldwide

Competencies & Capabilities:

- Become an expert on Siemens business processes, applications and associated data structures
- Understanding of analytics and statistics, machine learning and data modeling
- Superior conceptual and analytical problem solving skills; pragmatic implementation in organization
- Knowledge and experience in working with claims and clinical data
- Self-starter, self-motivated, high level of initiative within a fast-paced, constantly evolving Healthcare environment
- Result focused, ability to solve complex problems and resolve conflicts in a timely manner
- Communicates and presents effectively; ability to communicate with customers' C-level, and with internal Management

- Eagerness and ability to learn new concepts and analytical approaches
- Entrepreneurial spirit, passion for Digital Health Services

d. MetLife, Lead Data Scientist

The Enterprise Center of Excellence in Analytics is a group of data scientists whose goal is to provide mathematically and statistically based insight to major decision-based processes at Metlife. As a Lead Data Scientist, your job will be to lead advanced analytical efforts in project based work, delivering quality results in the fields of Descriptive, Predictive, and Prescriptive analysis. This work can include:

- Error and Outlier analysis
- Data imputation
- Unstructured data/Contextual Analysis
- Metric creation and evaluation
- Regression and other predictive analytics
- Time Series Forecasting
- Optimization
- Production builds of predictive analytics

Additionally, as an Enterprise data scientist, you will work to building collaboration across countries, creating best practices for common analytical projects, and delivering value across the globe.

Responsibilities:

- Understand business needs and create well defined analytical engagements to drive value.
- Lead analytics team on project work providing measurable ROI to the company.
- Build best advanced analytics solutions around common business needs across the world.
- Develop associate data scientist talent, creating increased capabilities for the team.
- Build collaboration and awareness in global analytics community.

Essential Business Experience And Technical Skills

- Masters or Doctorate in Quantitative Field (Physics, Math, Statistics, Operations Research, Engineering, etc.)
- ≥ 3 years of experience as a data scientist/analytical consultant or similar delivery position (≥ 2 years for doctorate level)
- Programming proficiency in at least one statistical tool language: SAS, SPSS, R, Python. Preference towards at least one open and one closed source.
- High proficiency in classical statistical and mathematical modeling methods required.
- Proven proficiency in delivering technical results to key stakeholders.

e. **MaxPoint, Senior Data Scientist - Machine Learning**

MaxPoint is a leader in the business intelligence space, processing over 12 trillion calculations and analyzing more than 40 billion digital bid opportunities daily. As a Senior Data Scientist, your work is central to keeping us at the forefront of our industry. We are seeking data experts who are passionate about using cutting edge technology to solve unique problems. The ideal candidate is innately curious about how data can be used to tell a story and inform decisions. You enjoy searching for datasets to explore. You have honed your skills through a combination of education, work experience, and hobbies. You can embrace the messiness of creating new things. If this describes you, we are interested. You can be an integral part of a cross-disciplinary team working on highly visible projects that improve performance and grow our product suite. On any given day you'll be... Using your deep knowledge of numerical and statistical packages (Pandas, Numpy, Sklearn, R) to...

- Implement a gradient-boosting classifier to predict whether a person is likely to visit a car dealership based on the advertising signals they've received.
- Use a Bayesian dynamic time series model to estimate the causal impact of an advertising campaign on sales at your neighborhood grocery.
- Model the complex interactions between system architecture components to refactor and rethink key components and models in an advertising system.
- Develop algorithms to optimize the setting of every lever in our advertising infrastructure.
- Analyze data to better understand how a neighborhood's consumption of web pages correlates with visits to a local big box store.
- Build a time series model to forecast future sales of diapers for one of our clients.
- Model the effects of environmental changes on promotion effectiveness with multiple regression.

Writing complex database queries using distributed computing frameworks: MapReduce, Hadoop, Impala and Spark to establish links between large datasets in order to...

- Find the handful of outliers in billions of transactions.
- Evaluate competing bidding models for RTB auctions to inform our bid pricing strategy.
- Feed data into your latest ensemble model aimed at maximizing the return on a client's online advertising budget.

Leveraging your experience with real world data to...

- Derive a set of new features that will help us better understand the interplay between geography and audience features to improve our model performance.

- Discover and explore third party data sources to determine their value for improving our model performance.
- Build new data-driven products and bring them to market.

Provide technical leadership to ...

- Mentor other data scientists in algorithms, models, tools, and products that make the team more efficient.
- Participate in planning, roadmap, and architecture discussions to help evolve our data science into revenue-generating products.
- Engage in code and model reviews to continually raise the bar on our work.
- Draw data flows and architecture designs on the white board to encourage understanding and cohesive development towards your solution.
- Meet with customers and help map business needs into product requirements.

Positions filled by MSA graduates: **All of the above.**

One specious justification offered in the MSDS proposal is that its graduates will have a “more in-depth understanding, of not only the usage, but of the development of the methods and the field itself,” insinuating that students in other programs (presumably the MSA) have a superficial understandings of the “usage of techniques and tools” alone. No one hired for any of these positions, with salaries hovering around six figures, would be tagged as having superficial knowledge. The planning document’s authors go on to draw a comparison between their proposal and the MS in Data Science at Stanford as “the only other program whose curriculum aligns with our proposed training,” which would be presumptuous at best, if Stanford actually offered an MS in Data Science. The Stanford degree is an MS in Statistics with a track in Data Science. Perhaps that is what the authors should set their sights on instead.

Market Demand for Data Scientists

It is widely believed there are hundreds of thousands of job openings for data scientists, with starting salaries through the roof. Much of it based on an outdated study published by McKinsey in 2011, which continues to be cited to this day as evidence of the need for yet another new analytics and data science program. And then there are Internet bulletin boards and non-scientific web-based polls with fact free claims about fortunes to be made as a data scientist—nothing more than hearsay. Those of us in the business of producing talent know better. The Institute has a decade of experience placing 650 students in the profession—over 90% of the class, year after year since our inception. We collect comprehensive data on every placement, and indeed every job offer, and keep track of our graduates as they progress in their careers. The Institute’s lengthy 11-page annual employment report (attached) is the only one of its kind to be found among the 100+ analytics and data science MS programs. NC State is uniquely positioned to know more than just about anyone about market demand for graduates with these skills.

The bottom line is there aren't as many jobs for data scientists as you might think given all the media hype. A search of job listings in LinkedIn yields only about 1,437 openings **nationwide** for entry-level data scientists. This is nowhere close to the popular perception. A random perusal of the listings show individual positions have attracted anywhere from a few applicants to 500 (that looks like the rare tenure-track opening in some fields). Big cities like New York and San Francisco show little more than 100 entry-level data scientist openings. Admittedly, LinkedIn is only one such site with job listings, but it's a very popular one.

Should NC State begin graduating another 50 data science students annually, they would not be readily absorbed within the Triangle job market (along with Charlotte, the most concentrated areas for data scientist employment in North Carolina). Currently, students who look to remain in the Triangle can find it challenging to land a data scientist job at a premium pay grade. For example, today the Job section of LinkedIn shows 22 results for "data scientist" openings in the Triangle. Between graduates of the MSA (about 40% of whom will remain in the Triangle), other graduates locally or regionally, and experienced professionals migrating between employers or into the Triangle, most of the openings will be filled in due time.

I don't hear employers lamenting anymore about the shortage of talent. What they fret about is the scarcity of high quality, well-prepared graduates. The market is flooded with so-called data science graduates from programs that are poorly designed to meet the need. Why? For a good number of schools the degree is purely a revenue generator—not a reputation builder. They admit everyone who applies and can pay the full tuition. Already there are two programs (not online) with enrollments reaching a total of 500 students and several more residential programs with one hundred or more enrolled. The advent of inexpensive online degrees will only accelerate the growing pool of graduates. Georgia Tech announced an Online MSA **with tuition under \$10,000** to begin later this year. It's almost certain to collapse the financial underpinning and marketability for online analytics and data science degrees (including the MSDS proposed at NC State).

The Institute led the academic community in mapping the field of analytics (and now data science) graduate education. For over a decade the Institute set its sights to be the leader, and has consistently produced some of the most sought after graduates. The Institute is as successful as it is because we have the highest standards for admission among our peer institutions (careful applicant screening that includes hundreds of admissions interviews—see attached the MSA 2017 Admissions Report for more details), and we have a unique learning format that is proven to produce high quality results. Our students are the kind of graduates employers look to recruit. None of the Institute's peers have come close to consistently producing our level of student outcomes. Given the market demand, no one should be fooled into thinking it's easy or automatic to achieve placement rates approaching 100% year after year for 50 or 100 students simply by labeling a degree "data science."

Conclusion

This memo provides evidence to support the following conclusions:

1. The terms “analytics” and “data science” are used interchangeably in degree nomenclature among the 100+ graduate programs in the U.S.;
2. Analytics and data science graduate programs describe themselves in similar, if not indistinguishable, terms;
3. Prospective students apply to both analytics and data science graduate programs, and view them as similar pathways for furthering their education;
4. Employers seeking to hire data scientists make little or no distinction between graduates of analytics and data science programs—and there are not as many job openings as generally believed.

As the Administrative Board considers its action on the Request to Plan for the M.S. in Data Science, it should fully understand the new degree’s potential to unnecessarily duplicate the Master of Science in Analytics. It won’t be known for a few years, but the new MSDS could diminish NC State’s well-established leadership position. The Institute is already competing fiercely with the country’s best universities. Having an overlapping program on our own campus won’t help. As much as we can debate the merits of how similar or different the proposed MSDS curriculum will be, the reality is that both prospective applicants and employers do not recognize analytics and data science as substantively different degree programs.

Should the Administrative Board of The Graduate School approve the MSDS request to plan, the new degree should be held to the same high standards the MSA has already achieved. A quick comparison of the performance metrics for MSA with the existing MS degrees in Computer Science and Statistics suggests it may be difficult. And if the new program does not aim, or is not held, to perform at the highest level, then why do it? NC State is already home to one of the country’s leading programs with a proven track record of success.

Recommendations

Overlooked in the discussion swirling around the MSDS proposal is the Institute for Advanced Analytics is, by design, a university wide collaboration. The Institute brings together faculty in the fields of mathematics, statistics, computer science, operations research, and business disciplines, among other areas, to work together to develop, refine and deliver the Master of Science in Analytics. The result is, by every measure, a resounding success for NC State that has placed it on the map as a leader in the academic world’s hottest new field of study.

As a member of both the AACSB and INFORMS committees on data science and analytics education, I frequently talk with program directors around the country. NC

State is the envy of almost everyone I encounter. It's a common refrain I hear: "my university struggles to bring our colleges and departments together, and only then with little success—what NC State has done with the Institute is remarkable!" Many are struck by how NC State had the foresight to create a platform for campus-wide collaboration in analytics (or data science, if you prefer) years ahead of every other university, and which has proven itself to be extremely effective.

Of course, the irony won't be lost on our peers, if and when the day comes that NC State announces its new MS in Data Science and, perhaps a year or two later, its new MS in Business Analytics (anyone who doubts a request to plan won't soon be next in line, hasn't been a close observer of what's happening on campuses around the country). Then we'll have proven we're like every other university in our rank: prone to splintering into factions, pulling the university in every which direction, squandering rather than focusing our energy and resources, all to achieve merely average results no better or worse than the rest.

My recommendation to the Board is to return the request to plan to the proposers for their reconsideration. A better path forward would be to have the Departments of Computer Science and Statistics embrace the Institute in the spirit of collaboration on which it was founded. If there are faculty in either department who want to work together to further refine the Master of Science in Analytics to accomplish shared goals, I am more than open to the conversation. With its well-established track record, the Institute is in the best position to lead NC State in developing new programs in analytics and data science graduate education, whether it's a new concentration or other programmatic formats. The outcomes are almost certain to be more successful when faculty members from across the university work in partnership with the Institute instead of around it.

Finally, whoever the faculty members are behind the MSDS, it's almost certain they have not actually visited the Institute to talk with its faculty, staff and students about the Master of Science in Analytics. Whatever argument is to be made for the MSDS being distinct from the MSA, sadly it is not grounded in firsthand knowledge of the Institute and what it does. Among the many ironies of the proposal, it is perhaps the biggest. Should they (whoever they are) wish to learn more, I warmly welcome them to arrange a visit and to add their name to the Institute's long list of distinguished visitors. The good news: it's a short walk, the coffee's good, and the people, friendly.

Thank you for granting me the opportunity to express my view. If there are specific questions or need for clarification, please feel welcome to follow-up with me. Should you want my full review of the proposal, I will be glad to commit to a deadline for delivery in late June.

Recent visitors to the Institute:

Aalto University, Finland
Aarhus School of Business and Social Sciences, Denmark
American University
Anahuac University, Mexico
Arkansas Tech University
Auckland University of Technology, New Zealand
Beijing Wuzi University, China
Birmingham City University, UK
Campbell University
Capital University of Economics and Business, China
Carnegie Mellon University
Central University of Finance and Economics, China
CIMAT Universidad Aguascalientes, Mexico
College of William & Mary
Colorado State University
Dartmouth University
Drexel University
Duke University
East Carolina University
Elon University
European Centre for Soft Computing
Georgia Institute of Technology
Harvard University
Indiana University
Inner Mongolia Finance and Economics College, China
Kennesaw State University
Lanzhou University of Finance and Economics, China
Liaoning University, China
Louisiana State University
McMaster University, Canada
Melbourne Business School, Australia
M.I.T.
Mapua Institute of Technology, The Philippines
Nanyang Tech University, Singapore
National Technical University, Singapore
NMIMS University, India
North-West University, South Africa
Renmin University, China
R.P.I.
School of Economics in Warsaw, Poland
Shandong Economic University, China
Shaw University
Southern New Hampshire University
Stevens Institute of Technology
SUNY - College at Old Westbury
Technische Universität Darmstadt, Germany
Technological Institute of the Philippines
Tennessee State University
Texas A&M University
University of Akron
University of Chicago
University of Nebraska at Omaha
University of New Hampshire
University of North Carolina at Charlotte
University of Pennsylvania, Wharton School
University of San Francisco
University of South Carolina
University of Texas, San Antonio
University of the Andes, Colombia
University of the West Indies
University Western Cape, South Africa
University of the Witwatersrand, Johannesburg, South Africa
Virginia Commonwealth University
ZHAW Zurich University of Applied Sciences, Switzerland
Zhongnan University of Economics and Law, China

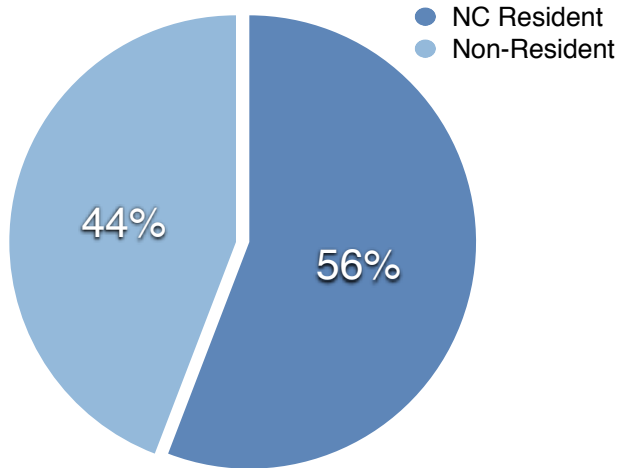
MASTER OF SCIENCE IN ANALYTICS ADMISSIONS REPORT – CLASS OF 2017

ADMISSIONS SUMMARY	
Applications for admission received:	1,140
Applicants offered admission:	147
Acceptance rate:	12.9%
Number of candidates enrolled:	120
Enrollment rate:	81.6%
U.S. citizens/permanent residents enrolled:	90%
North Carolina residents enrolled:	56%
Women enrolled:	43%
Countries of origin of enrolled students:	19
Number of years since undergraduate degree:	4
Average undergraduate grade point average (GPA):	3.60
Graduated with academic honors:	66%
Previously employed full-time (3 or more years):	45%
Average age / median age:	26 / 24
Range in age:	21 – 51

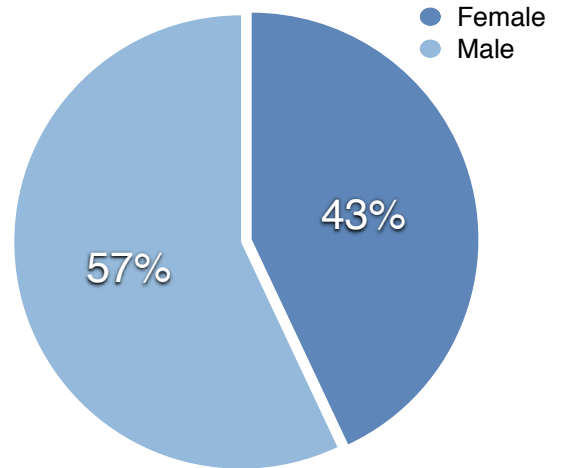
Admissions results for Class of 2017 reported as of June 21, 2016.

BASIC DEMOGRAPHICS – MSA CLASS OF 2017

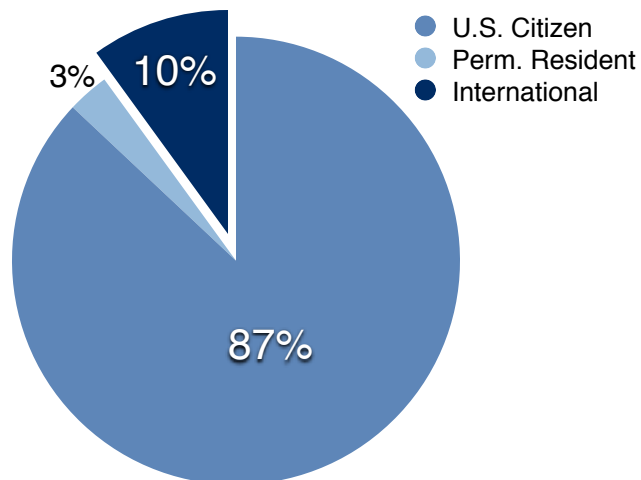
RESIDENCY



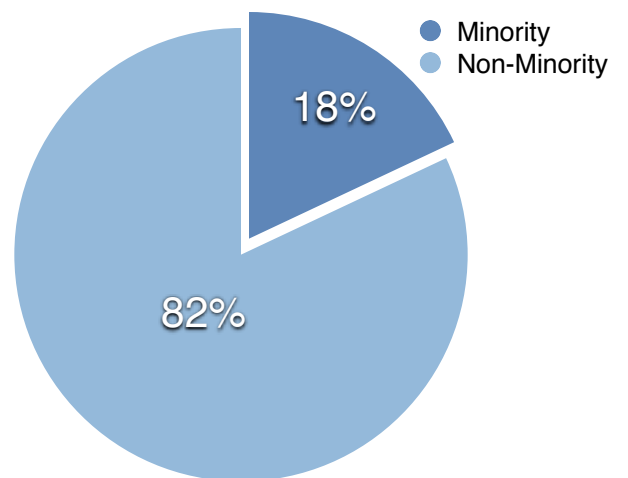
GENDER



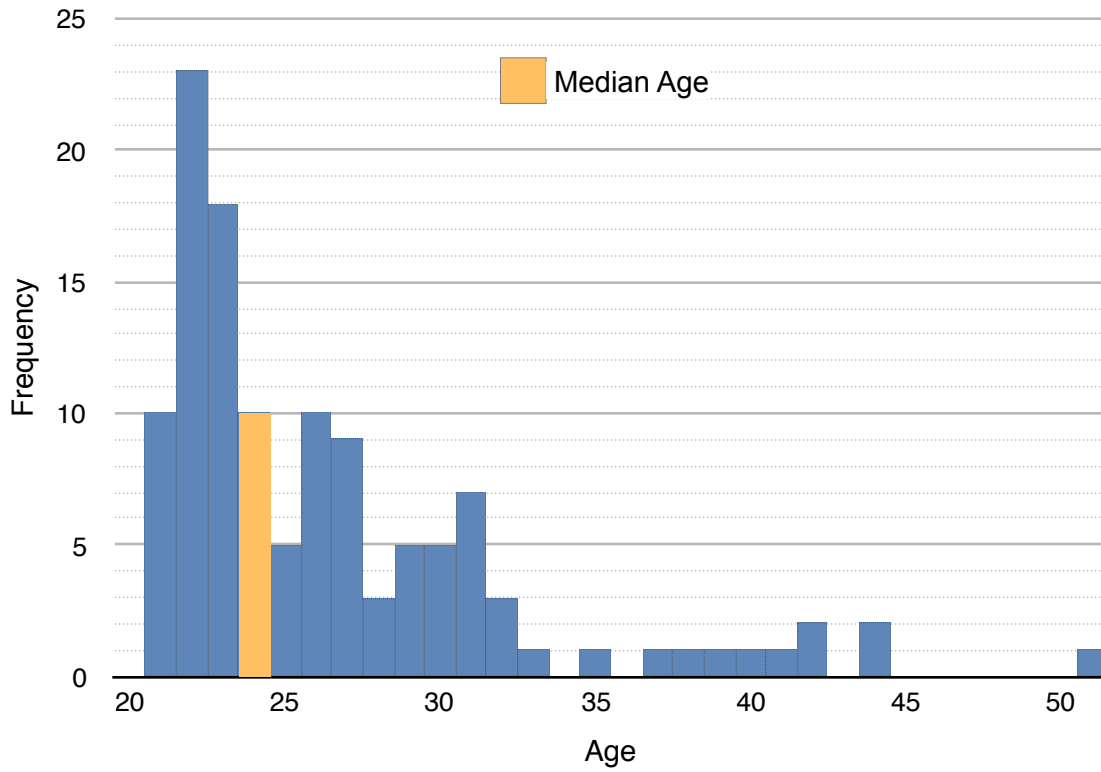
CITIZENSHIP



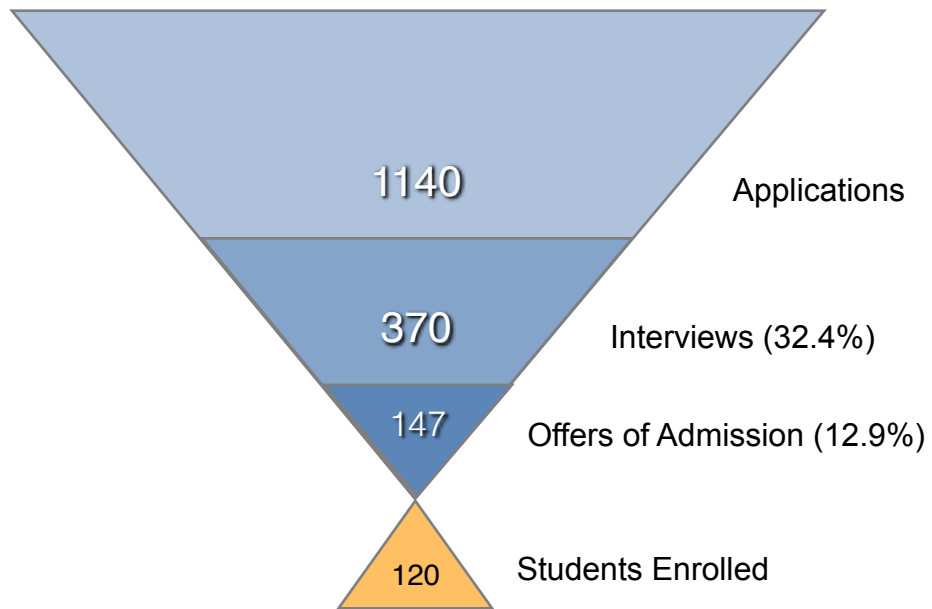
MINORITY STUDENTS



AGE DISTRIBUTION



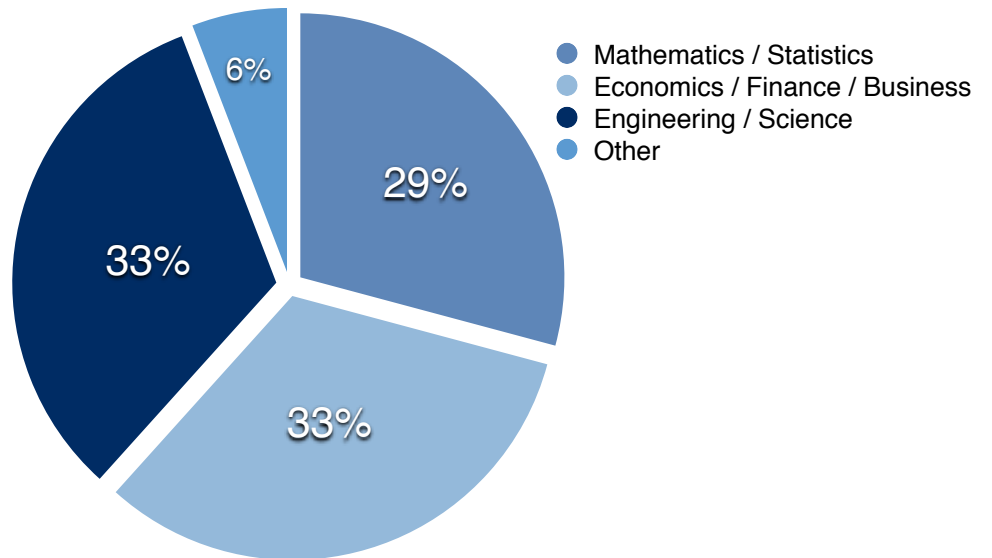
ADMISSIONS FUNNEL – MSA CLASS OF 2017



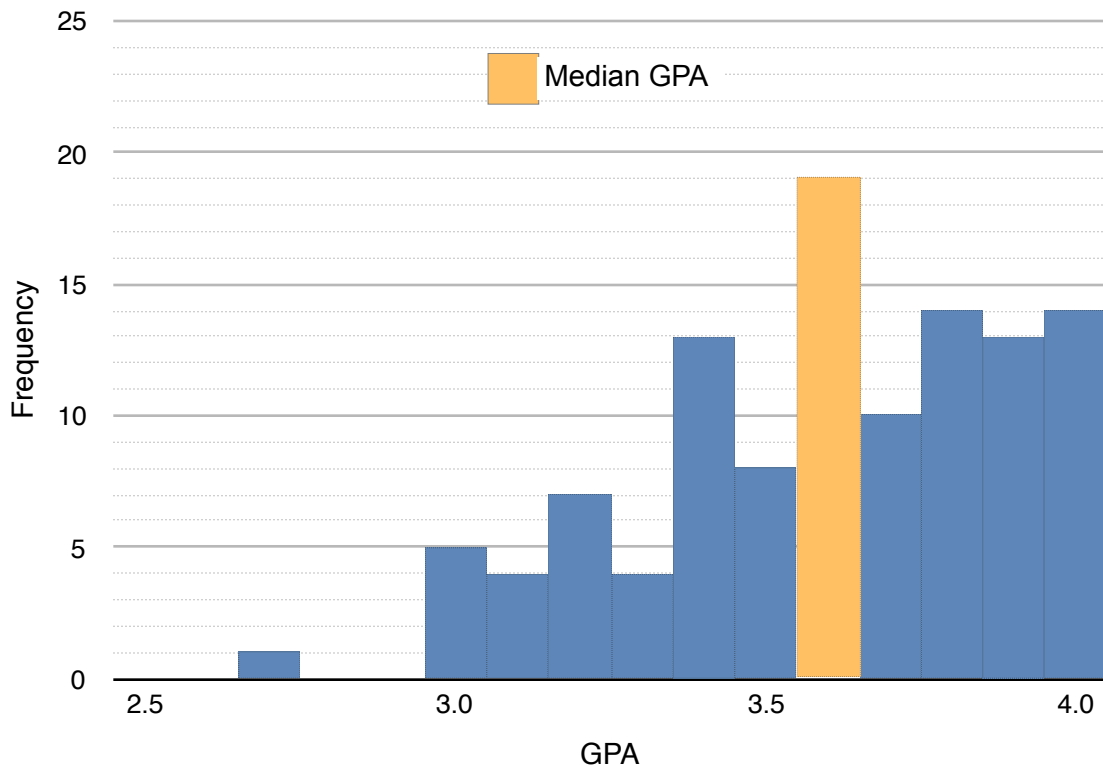
**UNDERGRADUATE SCHOOLS ATTENDED
MSA CLASS OF 2017**

Abilene Christian University	Seattle University
Ashland University	Shanghai Jiao Tong University
Brandeis University	St. Andrew's Presbyterian College
Brigham Young University	Stonehill College
Brown University	SUNY College at Buffalo
Bryn Mawr College	United States Military Academy at West Point
Campbell University	United States Naval Academy
Canisius College	Universidad de Navarra
Clemson University	University of Arizona
College of Charleston	University of California at Berkeley
College of William and Mary	University of California at Santa Barbara
Cornell University	University of Central Arkansas
Davidson College	University of Connecticut
Drexel University	University of Georgia at Athens
Duke University	University of Illinois at Chicago
East Carolina University	University of Lucknow
Elon University	University of Maryland at College Park
Emory University	University of Massachusetts at Amherst
Furman University	University of New Hampshire at Durham
Grinnell College	University of North Carolina at Chapel Hill
Harvard University	University of North Carolina at Charlotte
Instituto Tecnológico de Santo Domingo	University of North Carolina at Greensboro
Jawaharlal Nehru Technological University	University of North Carolina at Wilmington
Johns Hopkins University	University of Notre Dame
Kalamazoo College	University of Piraeus
Marymount University	University of Queensland
Mercer University	University of Richmond
Monmouth University	University of South Florida
National University of Tres de Febrero	University of Texas at Austin
North Carolina A&T University	University of Vermont
North Carolina State University	Utah State University
Northwestern University	Vienna University of Economics
Oklahoma State University at Stillwater	Virginia Tech
Old Dominion University	Washington University in St. Louis
Rensselaer Polytechnic Institute	West Virginia University
Rice University	Western Carolina University
Roanoke College	Worcester Polytechnic Institute

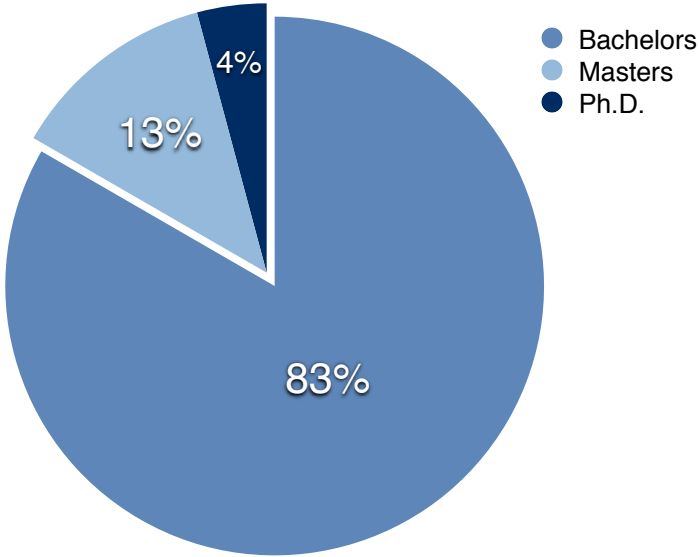
**UNDERGRADUATE MAJOR
MSA CLASS OF 2017**



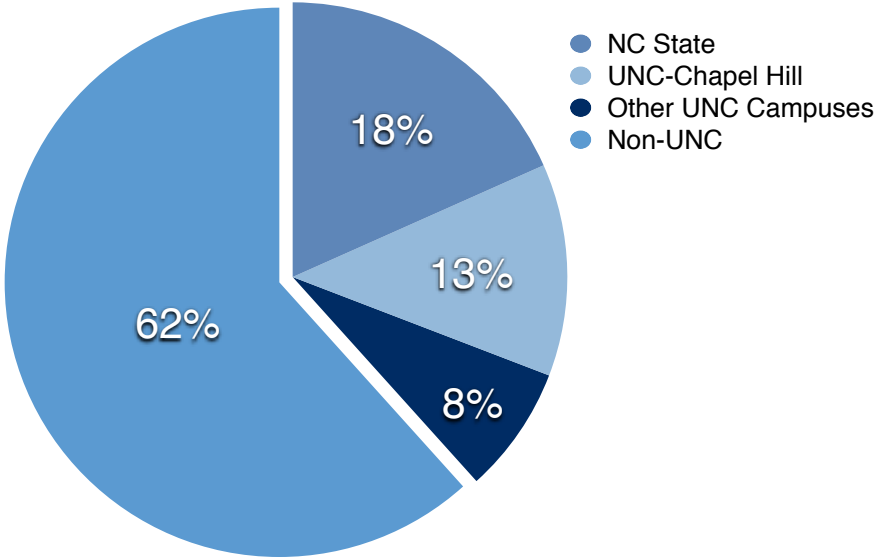
**GRADE POINT AVERAGE (GPA) DISTRIBUTION
MSA CLASS OF 2017**



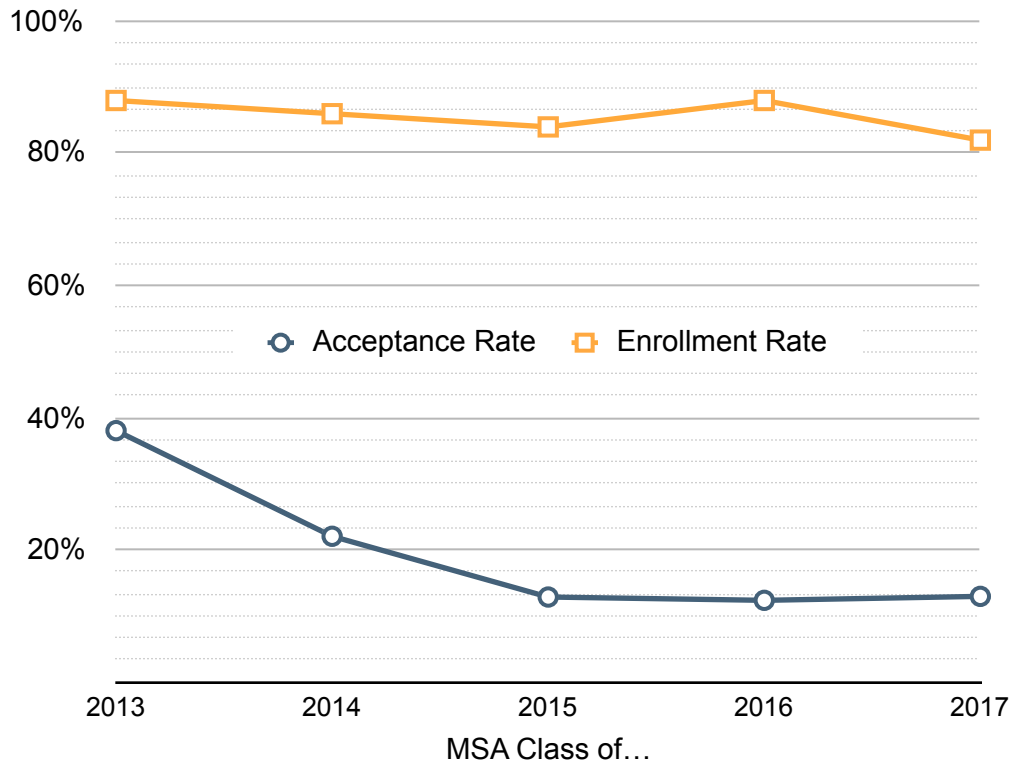
**HIGHEST DEGREE ATTAINMENT
MSA CLASS OF 2017**



**UNC SYSTEM GRADUATES
MSA CLASS OF 2017**



RECENT TRENDS IN ACCEPTANCE RATE AND ENROLLMENT RATE

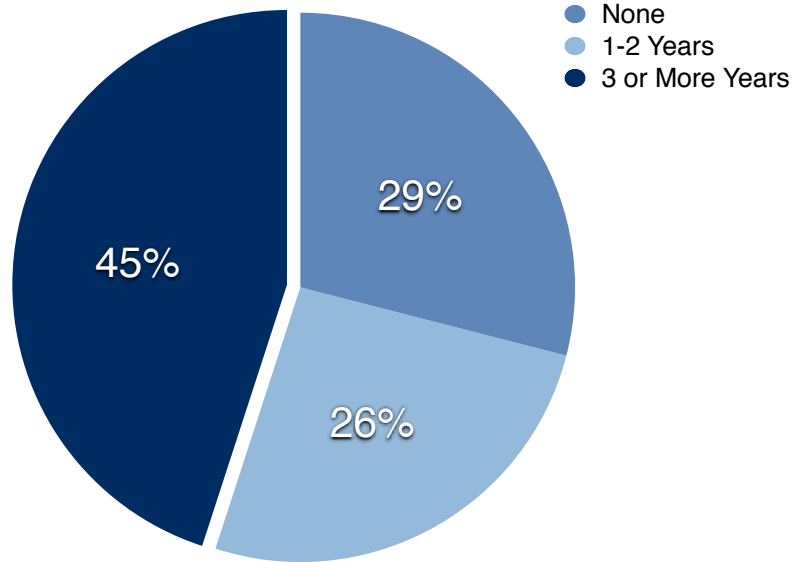


COUNTRIES OF ORIGIN MSA CLASS OF 2017

- | | |
|--|---|
| <ul style="list-style-type: none"> • Argentina • Australia • Canada • China • Dominican Republic • Germany • Greece • Ghana • India • Mexico | <ul style="list-style-type: none"> • Peru • Poland • Republic of Korea • Russia • Singapore • Spain • United Kingdom • U.S.A. • Uzbekistan |
|--|---|



**PRIOR WORK EXPERIENCE
MSA CLASS OF 2017**



ADMISSIONS TIMETABLE – MSA CLASS OF 2018	
Applications open	June 1
1st round decisions by:	December 1
International student application deadline:	December 15
2nd round application deadline:	February 1
2nd round decisions completed:	March 15
Final round application deadline:	April 1
Final round decisions completed:	May 15
Program begins:	June 2017

Source URL: analytics.ncsu.edu/reports/admission/MSA2017.pdf

<http://analytics.ncsu.edu>

NC STATE UNIVERSITY

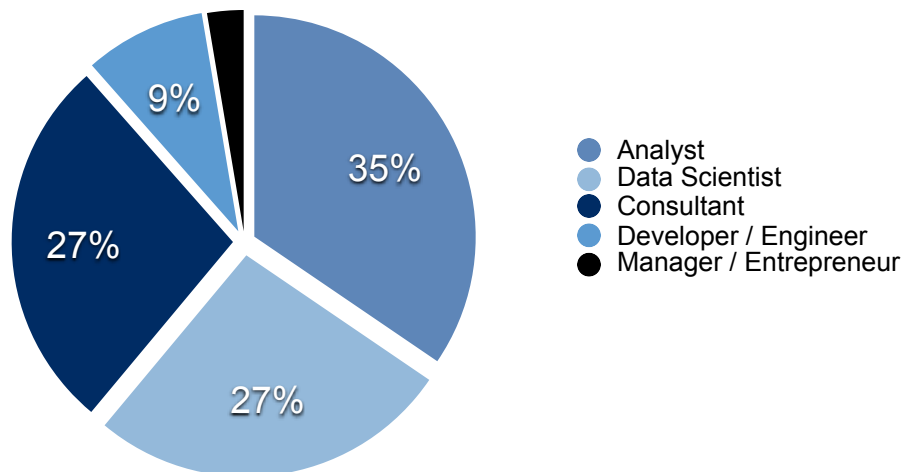
MASTER OF SCIENCE IN ANALYTICS EMPLOYMENT REPORT – CLASS OF 2016

EMPLOYMENT OUTCOMES SUMMARY	
Number of graduates:	113
Number of graduates seeking new employment:	109
Candidates with one or more offers by graduation:	99%
Candidates placed by graduation:	95%
Number of employers interviewing (on site):	166 (43)
Median number of initial job interviews per candidate:	10
Median number of offers of employment per candidate:	2
Job placements facilitated by the Institute:	90%
Estimated ROI payback period in months:	22
Total number of reported job offers:	280
Job placements based in North Carolina:	44%
Job placements based in U.S.:	100%
Candidates reporting job offer data:	99%
Placement results for Class of 2016 reported as of May 15, 2016.	

POSITIONS FILLED – MSA CLASS OF 2016

<p>Advanced Analytics Data Scientist Analyst, Product Analytics Analytic Methodologist Analytics Consultant Analytics Professional Associate Consultant Associate Data Scientist (2) Business Data Scientist (3) Clinical & Business Intelligence Developer Co-Founder Consultant (6) Data Scientist (20) Data Scientist Analyst (2) Digital Analyst Engineer (3) Experienced Associate Finance Associate Forecasting Analyst Industry Consultant Informatics Analyst (2) Integration Consultant Manager, Consumer/Guest Research Analysis Marketing Analytics Analyst Marketing Optimization Associate Model Risk Analytics Analyst Operations Research / Systems Analyst Operations Research Analyst Quality Analyst</p>	<p>Quantitative Finance Analyst (2) Quantitative Risk Analyst (4) Risk Analyst Senior Analyst Risk Consultant Senior Analyst, Direct to Consumer Senior Analyst, Supply Chain (2) Senior Analyst, Supply Chain Development Senior Analytics Consultant Senior Associate Analytical Consultant (7) Senior Associate Analytical Systems Eng. (5) Senior Associate Technical Consultant (2) Senior Associate, Marketing Optimization (2) Senior Consultant (4) Senior Data Analyst Senior Data Analyst, Supply Chain Senior Data Scientist Senior Enterprise Intelligence Analyst Senior Financial Analyst (3) Senior Informatics Analyst (2) Senior Quantitative Finance Analyst Senior Statistical Analyst Specialist, Global Advanced Analytics Solutions Specialist Staff Consultant (3) Technical Account Manager Technical Architect Technology Consultant</p>
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MAJOR TYPES OF POSITIONS MSA CLASS OF 2016



COMPENSATION – MSA CLASS OF 2016

	ANNUAL BASE SALARY				SIGNING BONUS
	Total	Prior Work Experience			
		None	1-2 Years	3+ Years	
Mean	\$93,250	\$88,600	\$91,300	\$101,200	\$10,500
Median	\$90,000	\$85,000	\$92,000	\$100,000	\$10,000
75th Percentile	\$100,000	\$92,000	\$95,000	\$105,000	\$15,000
25th Percentile	\$85,000	\$85,000	\$85,000	\$91,000	\$5,000
Maximum	\$130,000	\$120,000	\$120,000	\$130,000	\$45,000
Minimum	\$67,000	\$70,000	\$67,000	\$81,000	\$1,500
N	104	49	21	34	81
% Reporting	100%	47%	20%	33%	78%

Notes: Data with respect to salaries and bonuses are self-reported by graduates (without anonymity) and whenever possible verified by employers in cases where placement is arranged by the Institute (i.e., most candidates). Four graduates in 2016 did not seek new employment: all returned to a sponsoring employer. Student job placements are full-time paid positions without exception; the Institute does not place students in part-time, internship, or pro bono work. Data are made public here to guide prospective students and employers. Annual base salary figures do not include signing bonuses, relocation allowances or other forms of one-time compensation guaranteed upon signing. Conditional job offers (i.e., those requiring security clearance prior to employment) or other public sector employment are not included in the data. As a STEM-qualified degree, international MSA graduates are eligible for Optional Practical Training (OPT). Commencement is typically held on the first Saturday in May. **DISCLAIMER:** The Institute has a proven track record for placing graduates in the analytics profession, but it does not under any circumstance offer a guarantee of employment upon completion of the MSA degree.

**EMPLOYERS EXTENDING OFFERS
MSA CLASS OF 2016**

Abercrombie & Fitch (Columbus, OH)	InterWorks (Omaha, NE)
Accenture (Washington, DC)	JP Morgan Chase (Columbus, OH)
Advanced Auto Parts (Raleigh, NC)	Liberty Healthcare (Raleigh, NC)
Ankura Consulting (Washington, DC)	Liberty Mutual (Boston, MA)
B2W (Cambridge, MA)	Lowe's Companies (Mooresville, NC)
Bank of America (Charlotte, NC)	M&T Bank (Buffalo, NY)
BB&T (Winston-Salem, NC)	Magnify Analytics (Detroit, MI)
Blue Cross Blue Shield NC (Durham, NC)	Marriott International (Bethesda, MD)
Bain & Company (Atlanta, GA)	McKinsey (Boston, MA)
Booz Allen Hamilton (Washington, DC)	MDA Information Sys. (Gaithersburg, MD)
Boston Consulting Group (Boston, MA)	Mission Health (Asheville, NC)
Cargill (Minneapolis, MN)	Monumental Sports Entertainment / Washington Wizards (Washington DC)
Cognizant (Teaneck, NJ)	Nike (Portland, OR)
Community Care of NC (Raleigh, NC)	Northrop Grumman (Melbourne, FL)
Conclusive Analytics (Charlotte, NC)	Pitt County Government, NC
CoreCompete LLC (Durham, NC)	Premier (Charlotte, NC)
Deloitte (Atlanta, GA; Charlotte, NC; Chicago, IL; Dallas, TX)	Progressive Leasing (Salt Lake City, UT)
Disney (Orlando, FL)	Putnam Investments (Boston, MA)
Dollar Tree (Chesapeake, VA)	PwC (McLean, VA)
Elder Research (Washington, DC)	Red Hat (Raleigh, NC)
Elevate (Ft. Worth, TX; San Diego, CA)	RTI International (RTP, NC)
Elicit, LLC (Austin, TX)	SAS (Cary, NC)
EY (Charlotte, NC; New York, NY)	Teradata (San Diego, CA)
Financial Risk Group (Cary, NC)	The J.M. Smucker Company (Orrville, OH)
First Class Technology (Chicago, IL)	United Airlines (Chicago, IL)
Florida Blue (Jacksonville, FL)	Universal Resorts (Orlando, FL)
General Motors (Warren, MI)	US Bank (Charlotte, NC)
Home Depot (Atlanta, GA)	Visionist (Columbia, MD)
Humana (Chicago, IL)	Zencos (Cary, NC)
IBM (Lanham, MD; RTP, NC)	Zions Bank (Salt Lake City, UT)

Bold = employers that succeeded in hiring one or more candidates.
List does not include federal government agencies.

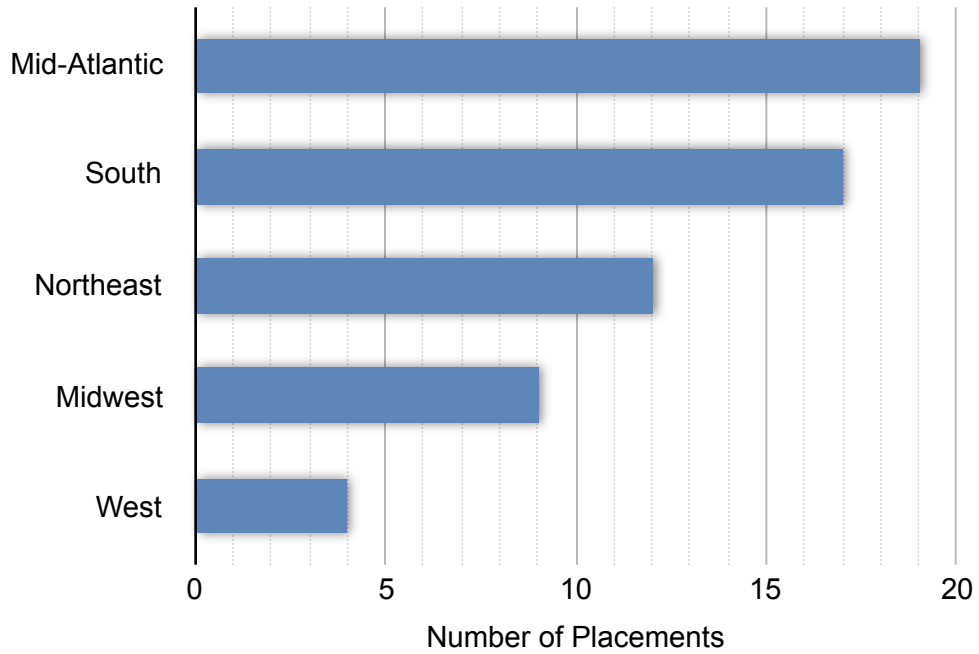
COMPENSATION BY GEOGRAPHIC REGION – MSA CLASS OF 2016

	ANNUAL BASE SALARY				
	North Carolina	Geographic Region Outside North Carolina			
		South	Northeast	Mid-Atlantic	Midwest / West
Mean	\$90,200	\$93,100	\$108,000	\$91,100	\$97,000
Median	\$85,000	\$92,000	\$105,000	\$90,000	\$93,000
75th Percentile	\$95,000	\$95,750	\$120,000	\$100,000	\$105,000
25th Percentile	\$85,000	\$85,300	\$100,500	\$85,000	\$90,000
Maximum	\$130,000	\$125,000	\$125,000	\$102,000	\$110,000
Minimum	\$70,000	\$70,000	\$85,000	\$67,000	\$85,000
N	48	16	10	17	13

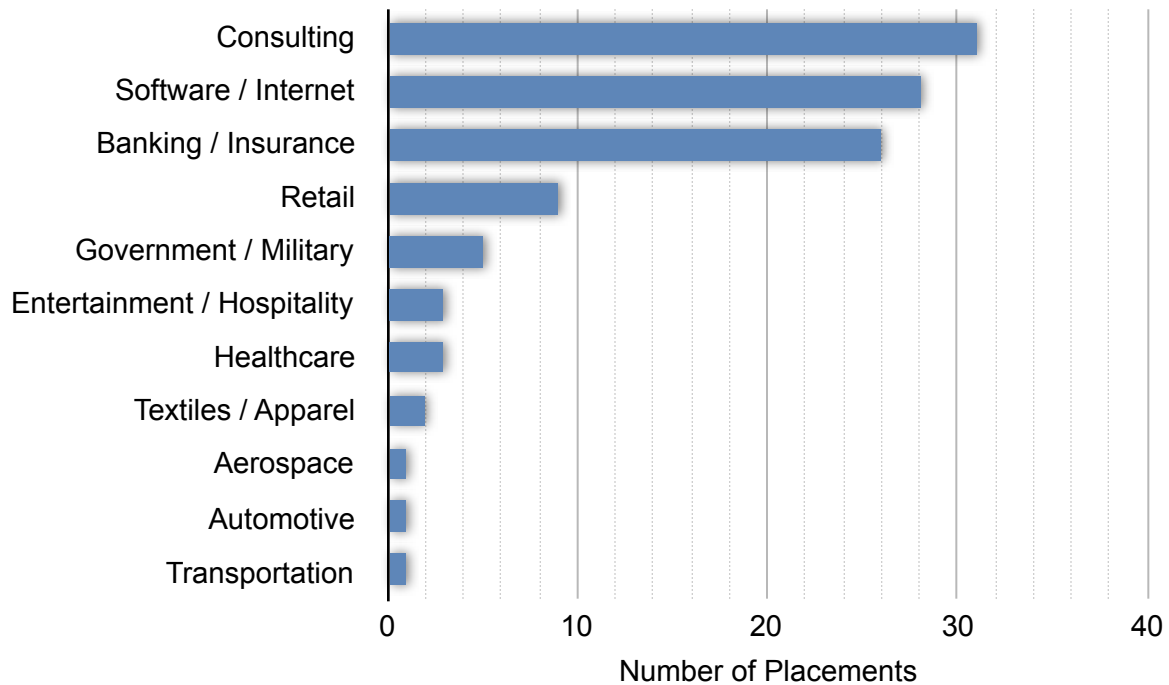
COMPENSATION BY INDUSTRY SECTOR – MSA CLASS OF 2016

	ANNUAL BASE SALARY			
	Consulting	Banking / Insurance	Retail	Software / Internet
Mean	\$89,900	\$101,400	\$93,000	\$90,900
Median	\$90,000	\$102,000	\$92,000	\$87,500
75th Percentile	\$95,500	\$115,000	\$92,000	\$95,000
25th Percentile	\$85,000	\$90,000	\$92,000	\$85,000
Maximum	\$125,000	\$130,000	\$110,000	\$105,000
Minimum	\$70,000	\$80,000	\$85,000	\$85,000
N	31	26	10	28

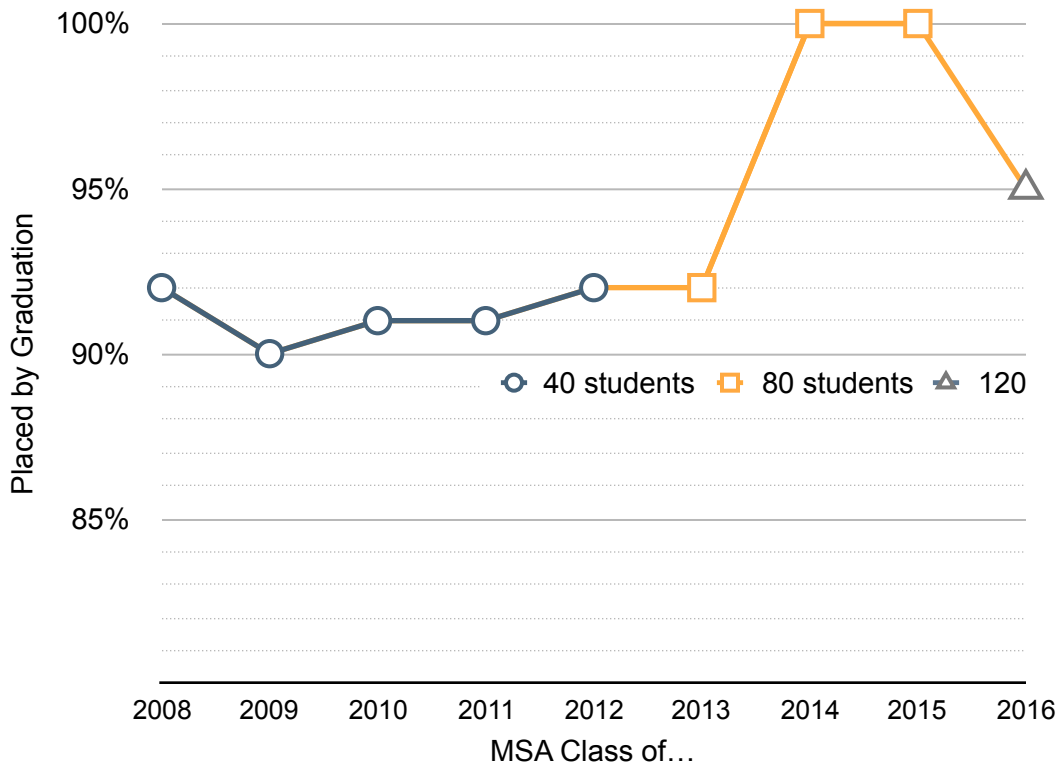
DISTRIBUTION OF EMPLOYMENT OUTSIDE NORTH CAROLINA BY REGION – CLASS OF 2016



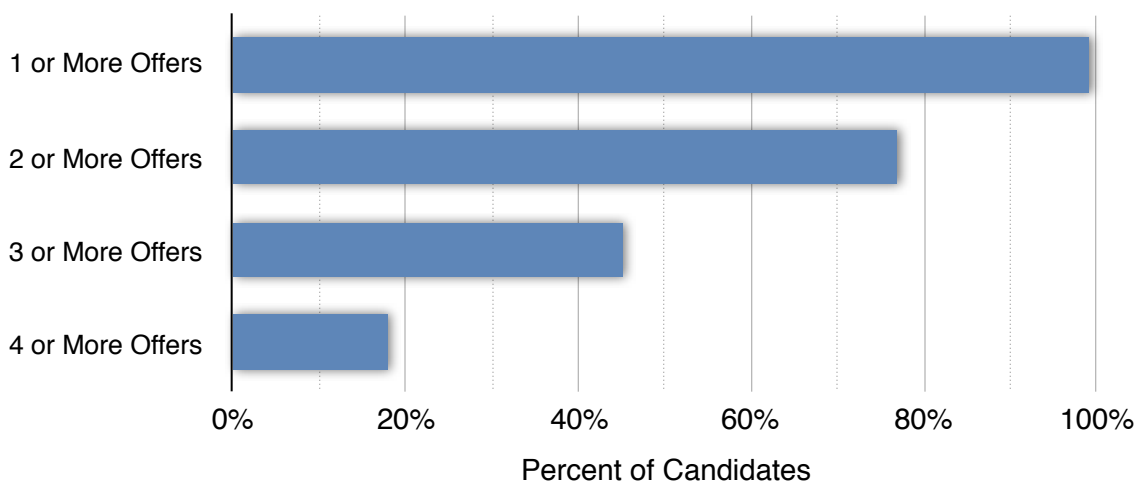
DISTRIBUTION OF EMPLOYMENT BY INDUSTRY SECTOR – CLASS OF 2016



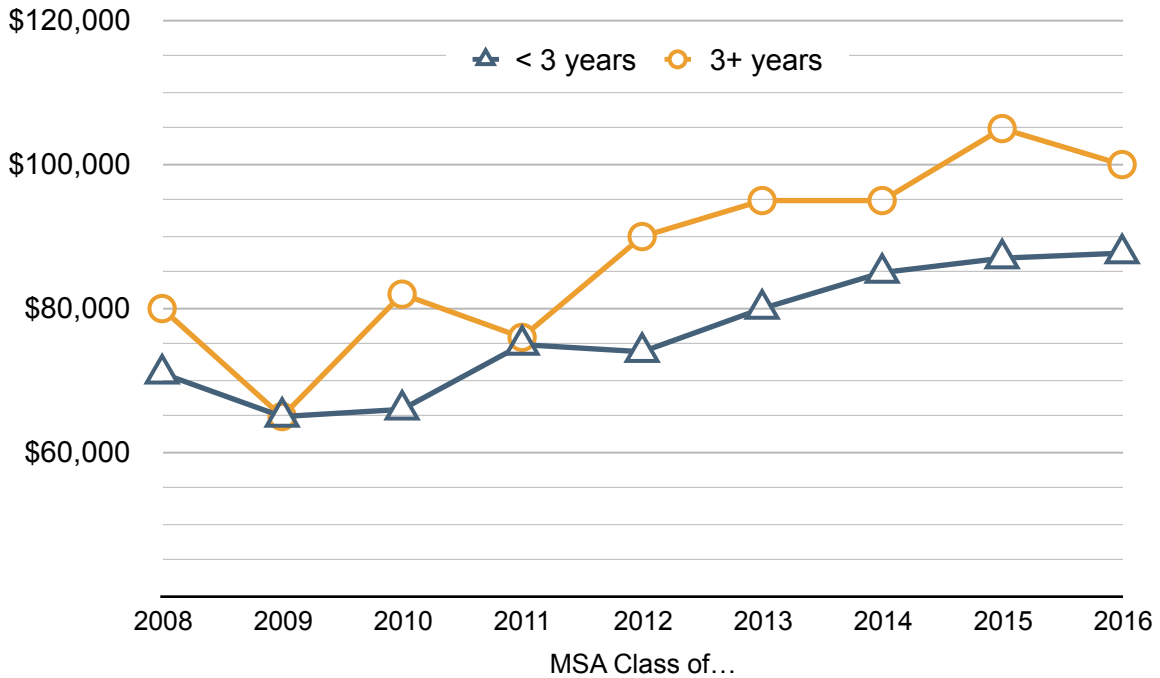
**HISTORICAL TREND IN JOB PLACEMENT RATE
MSA CLASSES OF 2008 – 2016**



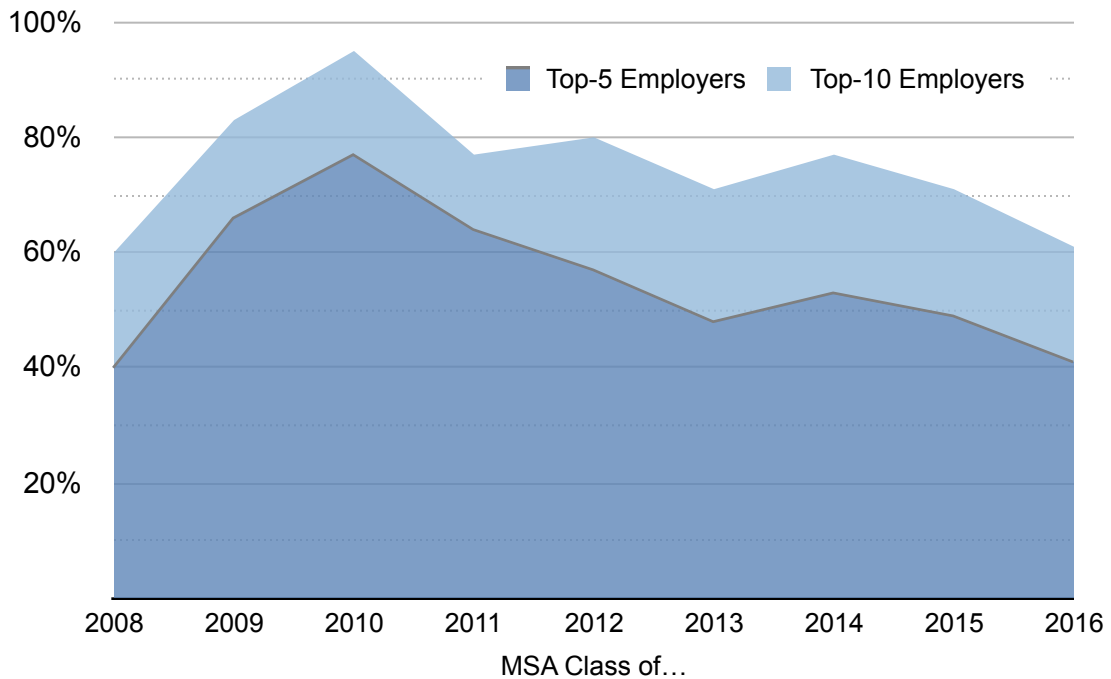
**NUMBER OF JOB OFFERS RECEIVED BY GRADUATION
MSA CLASS OF 2016**



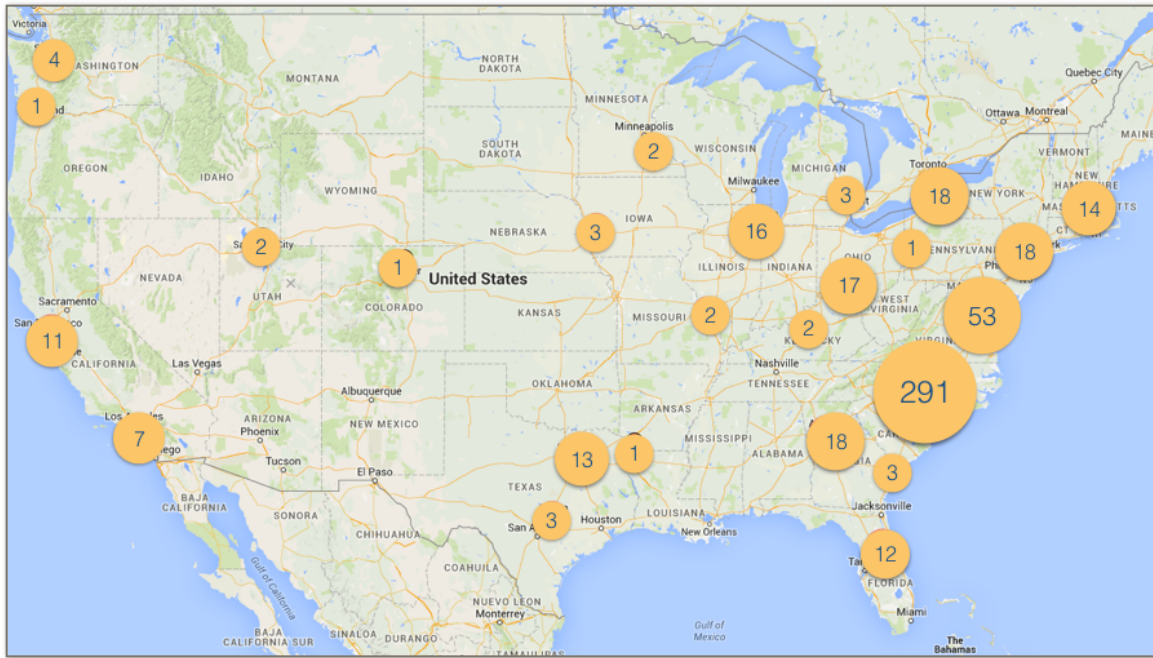
HISTORICAL TREND IN MEDIAN BASE STARTING SALARY BY LEVEL OF PRIOR WORK EXPERIENCE



HISTORICAL TREND IN PLACEMENT CONCENTRATION AMONG THE TOP-5 AND TOP-10 EMPLOYERS



GEOGRAPHIC DISTRIBUTION OF EMPLOYMENT OF U.S.-BASED MSA ALUMNI (N=521)



Note: 98% of the MSA alumni community is employed in the U.S.

EMPLOYMENT BY RESIDENCY STATUS PRIOR TO ADMISSION MSA CLASS OF 2016

	Number of Candidates Placed		Subtotal
	Inside North Carolina	Outside North Carolina	
Non-Resident	17	39	56
NC Resident	31	22	53
Subtotal	48	61	109

Includes candidates returning to a previous employer.

STUDENT RETURN ON INVESTMENT – MSA CLASS OF 2016

	NC Resident	Non-Resident
Number of Respondents	55	55
Pre-MSA Salary Median*	\$52,000	\$49,500
(+) Tuition & Fees	\$25,000	\$42,850
(–) Signing Bonus	\$9,500	\$10,000
Total Investment	\$67,500	\$82,350
Post MSA Salary Median	\$90,000	\$92,000
(–) Pre-MSA Salary	\$52,000	\$49,500
Net Salary Increase	\$38,000	\$42,500
Payback Period (months)	21	23
Net 3-Year ROI	\$123,500	\$137,500
*Based on graduates with full-time employment prior to program entry.		

PAYBACK PERIOD CALCULATION

$$\text{Payback Period (in months)} = \frac{(\text{Pre-MSA Salary} + \text{Tuition}) - \text{Signing Bonus}}{\text{Post-MSA Salary} - \text{Pre-MSA Salary}} \times 12$$

About the ROI Survey: An anonymous and voluntary survey was conducted over a 5-day period just prior to graduation. The response rate was 97-percent. Respondents provided information about their pre- and post-MSA annual base salaries, signing bonuses, and residency status (which determines tuition payments). Since the cost of attending differs by residency, the analysis is performed for both residents and non-residents separately. Fifty percent of respondents were NC residents, and 62-percent were employed full-time prior to entry. Ninety-five percent of respondents accepted full-time employment prior to graduation. All but one respondent reported an increase in salary after completing the MSA degree.

Students are assumed to forgo one-year of earning, even though the MSA program is only 10-months in duration. The average pre-MSA salary is estimated based on those candidates working full-time prior to entry in the program. Pre-MSA salaries ranged from \$20,000 to \$120,000.

The payback calculation does not take into consideration interest incurred by students who borrow to finance their education. Thirty-seven percent of students took on debt to pay tuition, borrowing a median of \$29,500 at a median interest rate of 5.8-percent. The average ratio of starting base salary to debt was 3.1.

RECRUITING TIMETABLE – MSA CLASS OF 2017	
New cohort of 120 students arrives in:	June
Basic demographic profile of new cohort published by:	July 1
New student roster available on Institute web site by:	July 15
Employer information sessions hosted beginning first week of:	September
Student Profile Book available on web site by:	October 1
Student Resume Book sent to employers by:	December 1
On-site interviews begin second week of:	January
Student placement decision date before second week of:	March
Graduation date normally in the first week of:	May
Employment Report published on web site by:	June 1
Candidates typically begin employment by the first week of:	June
Open job positions can be circulated to MSA alumni:	Upon receipt
MSA recruitment is managed entirely by the Institute as a service provided free of charge as a courtesy to employers.	

DISCLAIMER

The Institute has a proven track record for placing graduates in the analytics profession, but it does not under any circumstance offer a guarantee of employment upon completion of the MSA degree.

Source URL: <http://analytics.ncsu.edu/reports/employment/MSA2016.pdf>

<http://analytics.ncsu.edu>

NC STATE UNIVERSITY

DATE: April 14, 2017

TO: Administrative Board of the Graduate School

FROM: Howard Bondell (DGP, Statistics), Pierre Gremaud (DGP, Mathematics), George Rouskas (DGP, Computer Science)

SUBJECT: Response to “M.S. in Data Science Request to Plan – Consultation” by Michael Rappa

Although Dr. Rappa’s remarks do not address directly the degree content or structure of the proposed M.S. in Data Science, we welcome the opportunity to respond to the three concerns that he raises.

The new degree represents an “unnecessary duplication” of the MSA. The MSA spans 10 months and offers “a single, fully-integrated course of study – not a menu of core and elective courses – taught exclusively to students in the program.”¹ Both the content and structure of the proposed M.S. in Data Science are quite distinct in a way that *complements* the MSA rather than duplicating it, and strengthens NC State’s presence in Data Science. M.S. in Data Science students will take 3-credit courses taught by regular faculty across the three departments, they will have the opportunity to specialize in one of several tracks depending on their interests and career objectives, and they will have the option of completing the program either full-time (3-4 semesters) or part-time, and either on-campus or online. Entering students will also be expected to have a basic background in all of linear algebra, statistical methods, and computer programming.

“Analytics and Data Science are used more or less interchangeably.” We agree with Dr. Rappa, but also note that, due to the significant differences in program content and structure, prospective students and employers should be able to differentiate between the two programs despite the fact that the names have some degree of similarity. For instance, NC State currently offers Masters degrees in Chemistry, Textile Chemistry, Biochemistry, and Chemical Engineering, but the similarity in the names of these programs does not cause confusion among students or employers. Similarly, the COE offers Masters degrees in Computer Engineering, Computer Networking, and Computer Science. Importantly, the Computer Science and ECE departments manage admissions for their part of the Computer Networking program separately, but prospective students have no difficulty in determining the department most appropriate for their background and experience.

The Triangle job market will not absorb the graduates of the new degree program. In the Request to Plan, we have included a link to a McKinsey analysis which estimates that the US will face a shortage of 140-190K persons with data science skills by 2018. We also note that the MSA program tripled in size (from 40 to 120 students) between 2012 and 2016, with minimal impact on job placement rates or offered salaries, according to the Institute’s data. Furthermore, 55% of 2016 MSA graduates (61/109) were placed outside North Carolina, and graduates of the M.S. in Data Science program will similarly find opportunities outside the Triangle area. Finally, we project that the new program will reach 50 graduates in the fourth year (2022) when we expect the market for Data Scientists to be larger than it is today.

¹ http://analytics.ncsu.edu/?page_id=123