Campus Request for Authorization of Premium Tuition for the Masters in Foundations of Data Science

Date: September 25, 2018

Institution: N.C. State University

Degree Program CIPs

30.3001

Level: Masters

Degree Types:
see above

Proposed Date of Implementation:
Semester: Fall
Year: 2020

Introduction

The present request for authorization of premium tuition is for the support of our proposed Master of Science in Foundations of Data Science (MSFDS). The MSFDS is an interdisciplinary program to be 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 as well as 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, as well as 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 trained to develop data solutions across a range of industries. The Request to Plan (Letter of Intent) was approved in August 2018.

The MSFDS is proposed jointly by three N.C. State departments: Computer Science (CSC), Mathematics and Statistics and thus involves two Colleges (Sciences and Engineering). The CSC department is one of the largest departments at N.C. State University by student enrollment and by the number of graduated students. It is also one of the largest computer science departments in the nation[1]. CSC is one of the top

[1] https://www.asee.org/papers-and-publications/publications/college-profiles

departments at N.C. State by research funding[2] and among other computer science departments nationwide[1]; the department is larger in student numbers, and brings in more research funding, than several of the Colleges at N.C. State. Our university is ranked 3rd in the nation in R&D expenditures in the mathematical sciences[3], i.e., in Mathematics and Statistics; this is a testimony not only of the quality of both the Department of Mathematics and the Department of Statistics but also of the amount of resources both departments generate and bring to the university. The Department of Mathematics is a recognized pole of excellence in applied mathematics. The Department of Statistics is the largest one in the country and is currently ranked 8th among all Statistics Departments in the country[4].

All three departments are key in workforce production relevant to high-technology areas of North Carolina, and we are a top supplier of new university-graduated hires to industry leaders such as IBM, Cisco, and SAS. In fact, access to new computer savvy workforce well versed in quantitative sciences is critical for a number of high-technology companies (re)locating to North Carolina. The proposed program will increase the impact of N.C. State in this regard by developing education capabilities for data science in the sciences and engineering disciplines. The need for such capabilities was strongly emphasized in a 2017 report by the National Academies of Sciences, Engineering and Medicine.[5]

Professionals 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.

With its strong credentials in math, statistics, and computer science, NC State is well positioned to lead the nation in developing unique formal training in data science that covers the key concepts above, including domain-specific considerations.

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[2] N.C. State Report by the Task Force on Review of N.C. State Academic Programs, October 15,2012

[3] https://ncsesdata.nsf.gov/herd/2016/html/HERD2016_DST_22.html

[4] http://www.amstat.org/asa/files/pdfs/OGRP-USNews_StatisticsRankings.pdf

[5] http://www.nap.edu/24886

We request a premium tuition of $2,800 per semester for each full-time Masters student in the MSFDS degree, an amount that is equal to the premium tuition for Masters students in Computer Science. The premium will be prorated for part-time students, including Distance Track degree students.

A. The anticipated impact of the proposed tuition premium on program quality and capacity

Our top priorities will be (i) to provide our students with an educational experience that is of the highest caliber and nationally competitive and (ii) to equip our graduates with advanced skills in the components, methods and tools of data science and their application to a variety of tasks related to knowledge discovery as well as computational and statistical data analysis.

The proposed degree is organized around 7 core courses (out of a total of 10 courses) that all students in the program have to pass; these include two courses in each of Computer Science, Mathematics and Statistics (and a seventh in machine learning that may be taken either within Computer Science or in Statistics).

The requested premium tuition is necessary to enable our three departments to serve a larger student population in the face of a mostly stagnant number of faculty. To make this possible, the proposed degree will be available both as a regular on-campus degree and as an online degree. Specifically, the availability of tuition premium will improve both accessibility and quality of instruction and scholarship by:

1. Providing needed support for the program director (course buyout and summer salary);
2. Hiring graduate program staff members to improve advising and support services;
3. Providing three Teaching Assistantships (one in each of CSC, Math and Stat) to facilitate teaching and advising;
4. Providing need-based financial assistance and recruiting incentives, especially for under-represented groups;
5. Providing buyouts for faculty to ensure the continuous and sustained development of the courses associated to the proposed program.

Our proposed program will not be able to remain on a path towards higher quality and rankings without an independent source of funding that is not tied to the constituent departments. Premium tuition funds will be used to cover the program costs, with any remaining funds distributed equally to each of the three departments.

B. The projected impact of increased tuition on access for North Carolina residents

We expect the percentage of students in the proposed Masters degree program who will be residents of North Carolina to be between 10 and 20%. Further, based on our experience with current MS programs, we estimate that about half of the students who complete the Master degree will do so in three semesters and half will do so in four semesters. The proposed premium tuition of $5,600 per academic year will thus increase the cost of a Masters degree education for full-time students by $9,100 on average. Predictions on the affordability of the proposed programs are complicated by the fact that we expect our students to come with different undergraduate degrees each with its distinct earning potential. Let us conservatively assume that the expected starting salary of a prospective student is $70,000 if he/she does not join a graduate program versus an expected salary of $100,000 after he/she graduates with the proposed MSFDS. Then, the time it takes that student to fully recover the cost of the premium tuition is only slightly more than one month, both for NC residents and non-resident students.

This represents a fast "return on investment" for students. This analysis does not include the additional positive impacts, such as higher placement rates and quality of career paths, made possible by a high quality graduate program.

We will set aside part of the proposed premium tuition increase for financial aid for underrepresented groups, and for U.S. students with documented financial hardships.

C. The availability of student financial aid for students with economic need and of tuition remission

Students in all degree programs are eligible to apply for need-based subsidized and unsubsidized federal loans (Perkins and Stafford), and the federal PLUS program. As already mentioned, part of the proposed tuition increase will be set aside for the recruitment of, and financial aid for, underrepresented groups, and for U.S. students with documented financial hardships; therefore, affordability will actually improve for those populations.

D. The extent to which current and prospective students can afford increases in tuition

The U.S. Bureau of Labor Statistics projections for the period 2016-2026 shows that the number of positions for computer and information research scientists (M.S. degree) will increase by 19.2%. These occupations had median annual wages of $114,520 in 2017. Likewise, the number of positions for mathematicians and statisticians will increase by 29.7% and 33.8% respectively. In 2017, these

occupations had median annual wages of S103,010 (Math M.S. degree) and $84,060 (Stat. M.S. degree).

Major employers who have established or are establishing substantial operations in North Carolina do so because of the readily available supply of a highly-skilled workforce in science, engineering, and computing. Recent examples include Fidelity Investments, Credit Suisse, Deutsche Bank, MetLife, LexisNexis, and others. The N.C. State Engineering Career Fair each year attracts several hundred employers.

E. The relationship between projected tuition revenue to institutional and/or program costs

We project that the proposed program will reach a steady state of around 50 students by year 4. By that time and with premium tuition, the program will be fully self-supported.

F. Tuition and fees, net of remissions and waivers, charged by peer institutions or programs as compared to tuition and fees, net of remissions, for the program

Although there exists a growing number of Data Science and/or Analytics programs, both within the UNC system and nationwide, the proposed program fills a 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 in Statistics: Data Science program at Stanford University is the only other program whose curriculum aligns with our proposed training. The annual graduate tuition there is over $50,000.

Tuition and fees for other premium tuition programs at N.C. State in 2018-2019 are shown in Table 4:

Program	Resident	Nonresident
Master of Business Administration (MBA), Global Luxury and Management (GLAM), Supply Chain Engineering & Management (MSCEM)	$12,809	$21,296
Master of Accounting	$12,278	$20,491
Master of Science in Analytics	$10,747	$18,991
Master of Financial Mathematics	$10,747	$18,991
Computer Science	$9,297	$17,541
ECE and Computer Networking	$8,897	$17,141
MSFDS - Proposed	**$8,547**	**$16,791**

Table 4. Tuition and fees for premium tuition programs at N.C. State in 2018-19

Even with the proposed premium tuition, the new MSFDS degree will have the lowest total tuition among NC State programs with premium tuition. Note that the above figures for MSFDS do not include the COE enhancement fee. Even if the COE fee were to apply, the total cost would be the same as for Computer Science. We believe that the tuition for the proposed program represents an excellent value considering the expected outcomes.

G. A plan for the intended use of additional tuition receipts

The proposed premium tuition increase will be allocated approximately as follows:

- 15% - Fellowships
- 85% - Program support (including, but not limited to: faculty and teaching assistants; graduate program staff; software, equipment, and technical support needed, above and beyond ETF funding; online education initiatives; professional development; employer relations; and career services)

These expenditures will improve the quality, scholarship, and experience of our students as described in Section A above.

H. Assistantships or grant support for graduate students

For graduate students appointed on the premium tuition account (see Section A), the 25% GSSP tuition remission match (for non-residents), in-state tuition award (ISTA), and health insurance (GSHI) required for students supported from non-state sources will be paid from the premium tuition receipts. Therefore, the premium tuition will allow the new degree program to support graduate students without affecting the GSSP costs to the university.

I. Analysis of student indebtedness levels within the university

Not applicable to this proposal (new degree).