University of Nebraska

UNK N O

August 19, 2019

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Coordinating Commission for Postsecondary Ed.

Dr. Michael Baumgartner
Executive Director
Coordinating Commission for
Postsecondary Education
140 N. 8th Street, Suite 300
Lincoln, NE 68509

Dear Michael:

Enclosed is a copy of the proposal to create an interdisciplinary Master of Science in Data Science offered jointly by the Colleges of Arts and Sciences, Business Administration, and Information Science and Technology at UNO. The proposal was approved by the Board of Regents at the August 16, 2019 meeting. Also enclosed is the Proposal for New Instructional Program Form 92-40.

Please do not hesitate to contact me if you have any questions.

Sincerely,

David S. Jackson, Ph.D.
Interim Executive Vice President and Provost

Enclosures

c: Chancellor Jeffrey Gold
Senior Vice Chancellor Sacha Kopp
Dean David Boocker, College of Arts and Sciences
Interim Dean Lynn Harland, College of Business Administration
Dean Hesham Ali, College of Information Science and Technology

Office of the Executive Vice President and Provost
Varner Hall | 3835 Holdrege Street | Lincoln, NE 68583-0743 | 402.472.5242 | FAX: 402.472.4240 | nebraska.edu

COORDINATING COMMISSION FOR POSTSECONDARY EDUCATION

140 N. 8th Street, Suite 300
Lincoln, NE 68508

Telephone: (402) 471-2847
FAX: (402) 471-2886

PROPOSAL FOR NEW INSTRUCTIONAL PROGRAM

Form 92-40

SECTION I

Institution Submitting Proposal: University of Nebraska at Omaha

Title of Program: Data Science

CIP Code: 30.0801

Organizational Unit in which program will be located:

College of Arts and Sciences
College of Business Administration
College of Information Science and Technology

Name of contact person in the event additional information is needed: Dr. David S. Jackson

Telephone: 402-472-5242

Degree, Diploma, or Certificate to be offered (use separate submittal for each level):

Master of Science in Data Science

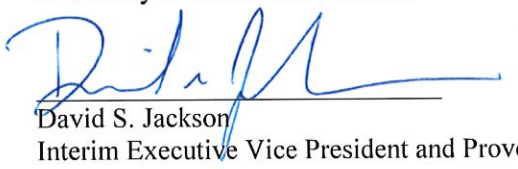
Proposed date to initiate program: When approved by the Coordinating Commission

List the location(s) where this program will be offered: UNO

If the program has a projected ending date, please so indicate:

Date approved by Governing Board: August 16, 2019
(Attach all documents related to this proposal upon which the Governing Board made its decision to approve the proposal.)

Chief Executive Officer's or other Authorized Officer's signature: _____
David S. Jackson

TO:	The Board of Regents	Addendum IX-A-3
	Academic Affairs	
MEETING DATE:	August 16, 2019	
SUBJECT:	Creation of an interdisciplinary Master of Science (MS) in Data Science offered jointly by the Colleges of Arts and Sciences, Business Administration, and Information Science and Technology at the University of Nebraska at Omaha (UNO)	
RECOMMENDED ACTION:	Approval is requested to create an interdisciplinary Master of Science in Data Science offered jointly by the Colleges of Arts and Sciences, Business Administration, and Information Science and Technology at UNO	
PREVIOUS ACTION:	None	
EXPLANATION:	UNO proposes to establish an interdisciplinary Master of Science in Data Science degree program. The program is designed to provide flexible, innovative, and technologically-current education to data professionals who want to prepare for corporate leadership positions through their functional expertise. This proposed graduate program is designed to be completed in 24 months. The curriculum includes course modules on topics that address the following major themes: data organization, manipulation, cleaning, and visualization; data analytics; data quantity; missing and messy data; data value analyses; and data product creation. This proposal has been approved by the Council of Academic Officers and the Executive Graduate Council. This proposal also has been reviewed by the Academic Affairs Committee.	
PROGRAM COST:	$0 for Year 1; $60,000 over five years	
SOURCE OF FUNDS:	Tuition and fees	
SPONSORS:	Sacha E. Kopp Senior Vice Chancellor for Academic Affairs Jeffrey P. Gold, Chancellor University of Nebraska at Omaha	
RECOMMENDED:	 David S. Jackson Interim Executive Vice President and Provost	
DATE:	July 22, 2019	

University of Nebraska Omaha

MS in Data Science Proposal

Descriptive Information

- Name of institution proposing the program: The University of Nebraska at Omaha
- Name of the program proposed: Data Science
- Degrees/credentials to be awarded graduates of the program: M.S.
- Other programs offered in this field by this institution: Mathematics, Computer Science, IT Innovation, Biomedical Informatics, Executive Master's in Information Technology, Information Systems and Quantitative Analysis, Economics
- CIP code: 30.0801
- List the administrative units for the program:
  - Graduate College
  - College of Business Administration
  - College of Information Science and Technology
  - College of Arts and Science, Mathematics Department
- Proposed delivery site(s), and type(s) of delivery, if applicable: Traditional and hybrid
- Proposed date (term/year) the program will be initiated: Upon approval

1. Description and Purpose of the Proposed Program

The University of Nebraska at Omaha proposes to establish an interdisciplinary Master of Science in Data Science degree program. The vision of this program is to provide flexible, innovative, and technologically current education to rising data professionals who want to prepare for corporate leadership positions through their functional expertise. The interdisciplinary data science program brings together thought leaders in the fields of IT, business and arts and science and other units at UNO, international university partners and local businesses. This interdisciplinary graduate program is designed to be completed in 24 months. The curriculum includes course modules on topics that address the following major themes: Data organization, manipulation, cleaning, and visualization; data analytics; working with massive amounts of data; dealing with missing and messy data; understanding the value of data and creating data products. Students will take the coursework from three colleges based on their preference. The colleges of Arts and Sciences, Business, and Information Science and Technology will offer classes as per degree concentration. There will be six core courses, with each of the three colleges offering two of these courses.

Currently, each college offers concentrations in the data science field. This proposal will allow UNO to take an interdisciplinary approach to data science. This proposed program will break down traditional silos as is recommended by the Business-Higher Education Forum in a 2017 report.[1]

[1] Business-Higher Education Forum, PwC. (2017). Investing in America's data science and analytics talent: The case for action. Retrieved from http://www.bhef.com/sites/default/files/bhef_2017_investing_in_dsa.pdf

The Role of Big Data

In classical statistical inference and experimental studies, the role of data is primarily to prove or disprove a hypothesis. In these studies, the distribution of a test statistic is typically derived theoretically. Data is used to obtain an empirical distribution when theory is not possible, or in order to confirm the predictions of a theory. In any case, the role of data is passive and has a very specific purpose. We can illustrate this by an example: in a situation where researchers want to test the population mean being equal to a certain value, they do not need the data in order to infer the distribution of test statistic, as long as established assumptions are met. Data is used only to find the evidence for or against the hypothesis. The formation of a hypothesis and the derivation of test statistics, do not require data. Data is only needed to finally make the decision.

The advent of big data has changed the classical way of thinking. A researcher with a great amount of data does not necessarily have a well-defined hypothesis in mind, or even clear preferences for testing a given hypothesis. The challenge is to explore data and discover hidden value in the data which, later, may lead to more formal hypotheses and enable the use of classical methods to test them. Big data changes the role of data by making it more active. This workflow mandates unique skills, such as those listed above, for individuals involved in data analysis on large data. The rise of big data fundamentally changes data processing and analyses, causing a need for academic programming to train students accordingly.

2. Program of Study

Admissions Requirements

- Application: a complete electronic application with an application processing fee.
- Educational and testing requirements: a bachelor's degree from an accredited college or university, minimum 3.00/4.00 GPA required.
- In accordance with Graduate College requirements, international students need a satisfactory IELTS or TOEFL score or need a waiver.
- Foundation courses: students must have completed basic courses in the following areas, either as an undergraduate student or prior to enrolling in the first Data Science course:
  - Introductory Programming: one semester of Java, Python, C++, or other approved programming course.
  - Statistics: one semester of undergraduate statistics.

  Foundation courses do not count towards the program of study/degree requirements.
- Resume: An up-to-date resume with details about all relevant IT experience and skills.
- Letters of Recommendation: Three recommendation letters from an employer, mentor, or other relevant person.
- Interview: A personal or telephone or Skype interview is encouraged, but is optional.
- A GRE or GMAT score will not be required.

At the beginning of the program, admission will be restricted to the fall semester. In instances where the applicant clearly meets or clearly does not meet the admission requirement, the decision for admission will be made by the Graduate Program Chair on behalf of the Graduate Program Committee. In all other instances, the Graduate Program Chair will discuss the application with the full Graduate Program Committee for a final decision.

While certain elective courses may require additional prerequisites than what is required for the program, there are pathways for students to complete their degree without additional prerequisites.

Curriculum:

The proposed program consists of 36 credit hours, and is designed to be completed in two years with students taking 18 credit hours per year. The program will be taught with substantive hands-on orientation using realistic case studies, projects, group discussion, and an integrated project experience as the fundamental pedagogical approach. The proposed program mostly consists of existing courses in a variety of topical areas of interest to data science students from the three colleges involved. These courses will be delivered in a standard classroom face-to-face mode, although some virtual or online work could be a requirement of individual courses.

A maximum of half the coursework can be cross-listed as graduate and undergraduate courses.

A: Core Courses (18 hours)

- Intro to Data Science (STAT 8416)
- Data Visualization (STAT 8426)
- Data & Information Quality (ISQA 8206)
- Tools for Data Analysis (ECON 8320)
- Research Methods (TBD IS&T)
- Business Forecasting (BSAD 8080)[2]

B: Concentrations (12 hours)[3]

Concentration: Business

- Marketing Research (BSAD 8910) this is a special topics course, but a graduate level course will be created upon approval of the program
- Business Demographics (BSAD 8426)
- Econometrics from Scratch (ECON 8330)
- Econometrics (ECON 8300)

[2] The Business Forecasting course will cover fundamental business concepts.
[3] With permission of the graduate program committee, other courses could be included.

Concentration: Information Technology

- Advanced Statistical Methods for IS&T (or comparable) (ISQA 8156)
- Applied regression analysis (ISQA 8340)
- Business Intelligence (ISQA 8016)
- Data Warehousing and Data Mining (ISQA 8700 or CSCI 8350)
- Decision support systems (ISQA 8736)
- Pattern Recognition (CSCI 8476)
- Applied Experimental Design & Analysis (ISQA 9120)
- Multivariate Data Analysis (ISQA 9130)
- NoSQL and Big Data Technologies (ISQA 8450)
- IoT, Big Data, and the Cloud (ISQA 8460)
- Interactive Data Visualization (ISQA 8750)
- Special Topics related to decision science

Concentration: Mathematics

- Time Series Analysis (STAT 8446)
- Linear Models (STAT 8436)
- Deterministic Operations Research Models (MATH 8306)
- Probabilistic Operations Research Models (MATH 8316)
- Introduction to Probability Models (MATH 8650)
- Topics in Probability and Statistics (MATH 8670)
- Network Programming (MATH 8440)
- Integer Programming (MATH 8460)
- Machine Learning and Data Mining (STAT 8456)
- Design and Analysis of Experiments (STAT 8710)

Concentration: Data Science for Health Sciences

- BMI 8100: Introduction to Biomedical Informatics
- Electives (choose 3):
  - BIOI 8850: Special Topics in Bioinformatics (Health Informatics Research Methods)
  - BMI 8020 Advanced Course in Bioinformatics
  - BMI 8866: Bioinformatics Algorithms
  - CSCI 8156: Graph Theory and Applications
  - BMI 8896: Genetic Sequence Analysis
  - CSCI 8XXX: Machine Learning

Concentration: Interdisciplinary

- Any 12 hours from above elective courses with approval from adviser.

C: Capstone

- Project (3 hours)[4] or Thesis (6 hours)

[4] If a student chooses a Project as his/her capstone, (s)he will be required to choose one of the courses in section B as an additional elective. With permission of the graduate program committee, internships will be allowed to count as a final project.

3. Faculty, Staff, and other Resources

Existing faculty and staff resources in the three colleges are sufficient to start and operate the program. Mathematics, Information Science and Technology, and Business Administration faculty will be teaching of the proposed program. All instructional faculty will deliver the classes in-load. There will be no need for additional resources, including space, equipment, or library resources.

The graduate program committee will consists of two graduate faculty of each participating college/department. Members serving the committee will be recommended by the chairs of the participating departments, and approved by the Dean of Graduate Studies (delegated by the Graduate College, University of Nebraska). The chair would change on a rotating basis every three years.

If enrollments increase, the hiring of a part-time advisor might be required in year 4. In addition, to meet the increased demand, one or two adjunct instructors may be hired. Based on the projected enrollments (see section 4), only a part-time advisor will be needed to operate the program.

4. Evidence of Need and Demand

The rise of big data has fundamentally changed the way data professionals analyze data. Big data is now a fundamental component of businesses, nonprofit organizations, and governmental agencies. A study by the AIM Institute and the Greater Omaha Chamber illustrates the strong need for professionals trained in big data and data analytics. Nationally, a study commissioned by IBM found that the number of job listings in the data science and analytics market was 2.35 million in 2015, and projected to grow by 364,000 (15%) to 2.72 million by 2020.[5] A subset of this category (Data Scientists and Advanced Analysts) is projected to grow by 28%. Another report, commissioned by the U.S. Chamber of Commerce Foundation, found that the number of job listings specifically for "Data Scientists" jumped 14-fold between 2012 and 2016.[6] In 2018, the Bureau of Labor Statistics introduced Data Science as a new occupation in the Standard Occupational Classification.[7] While the Data Science classification is relatively new, closely related professions, such as Mathematicians (15-2021) Operations Research Analysts (15.2031) and Statisticians (15-2041) are classified as high wage jobs with a strong projected increase in job openings between 2016 and 2026 in Nebraska[8]. Indeed, the proposed program will allow UNO to train professionals that meet this important workforce demand.

[5] Markow, W., Braganza, S., & Taska, B. (2017). The Quant Crunch: How the demand for data science skills is disrupting the job market. Boston, MA: Burning Glass Technologies. Retrieved from http://www.burning-glass.com/wp-content/uploads/The_Quant_Crunch.pdf

[6] Restuccia, D. (2018). Different Skills, Different Gaps: Measuring & closing the skills gap. Boston, MA: Burning Glass Technologies. Retrieved from https://www.uschamberfoundation.org/sites/default/files/Skills_Gap_Different_Skills_Different_Gaps_FINAL.pdf

[7] Standard Occupational Classification Manual. (2018). Office of Management and Budget. Retrieved from https://www.bls.gov/soc/2018/soc_2018_manual.pdf

[8] https://neworks.nebraska.gov/admin/gsipub/htmlarea/uploads/Statewide%20H3.xlsx

While data science and data analytics build on a well-established foundation of quantitative methods, rapid changes in tools, technologies, analysis techniques, and the nature of data available to organizations amplify the skills gap as organizations in all sectors struggle to develop or acquire the necessary capacity. Continuous professional development is a constant for established professionals as well as those entering the workforce.

The Business-Higher Education Forum examined the workforce demands for data science skills. Its report states that "employers will need data-driven, multidisciplinary teams to tackle their biggest problems." In critiquing traditional educational programs, the report continues: "but this runs counter to an educational culture where both faculty and students devote little time outside of their own specialties."[9] As evidenced by the submitted letters of support from local employers, the workforce in Nebraska is in strong need for graduates trained in interdisciplinary data science. The proposed program is designed to meet this need.

In an attempt to meet this demand, an increased number of institutions have started to offer data science concentrations since 2010. In recent years, myriad institutions started offering stand-alone data science programs[10]. Unlike the proposed program, the data science programs offered elsewhere, are programs offered out of one college alone; in some institutions the initiative is taken by Information Science and Technology, while in other schools it is by Business or Arts and Sciences.

The skills required for data analysis are so specific and technical that with skills in only one of the fields (such as mathematics, computing or business) it is difficult, if not impossible, to solve the problems facing firms and society as a whole. The proposed interdisciplinary program takes an innovative approach by combining the three fields into one program. This will allow students to graduate with a more comprehensive understanding of big data and allow for the training of professionals that are better equipped to solve more sophisticated data challenges.

The creation of the proposed program is bolstered by the feedback received from local industries that deal with data and use data in their decision-making processes. People who work in data science without formal training often have an IS&T, Arts and Sciences, or Business background. However, the skills which are unique to data science, are commonly learnt through their practical experiences. This informal learning does not provide complete training, and industries need a workforce that is formally trained in data science skills.

Once the interdisciplinary program starts operation, companies will be able to recruit a workforce trained in the unique (and highly demanded) skills of data science, thereby reducing their training costs. Formally trained data scientists will enable companies to achieve their goals by overcoming data-related challenges faced by nearly all firms.

[9] Business-Higher Education Forum, PwC. (2017). Investing in America's data science and analytics talent: The case for action. Retrieved from http://www.bhef.com/sites/default/files/bhef_2017_investing_in_dsa.pdf , page 3.
[10] A list of institutions that have started data science initiatives can be found in the following link: http://analytics.ncsu.edu/?page_id=4184

UNO has strong indication that the proposed program will be highly desirable for students. In recent years, UNO has created several curriculum options relating to data science and data analytics that are in high demand.

For example, although the concentration in Data Science within the MS in Mathematics has not been in operation for long, in Spring 2017 this concentration enrolled 20 students. Similarly, enrollments in the concentrations in Data Analytics and Data Management in Management Information Systems have increased in recent terms.

Concentration	Spring 2016	Fall 2016	Spring 2017
Data Analytics	37	44	43
Data Management	18	22	25

UNO offers a graduate certificate in Data Analytics. This certificate has also experienced a substantial enrollment growth: 12 enrollments in Spring 2016, 18 in Fall 2016, and 24 enrollments in Spring 2017[11].

In addition, individual Statistics courses, such as STAT 8416 (Introduction to Data Science), STAT 8426 (Exploratory Data Visualization and Quantification), have increased enrollments considerably. An increasing number of students realizes that data science skills are not only useful for data scientists, but have a broader impact on academic research. The data above demonstrates the strong demand for data science education, and the value it has to students – and provides a strong indication of that the proposed program will be in demand.

5. Partnerships with Business

The organizations we have collaborated with in regard to analysis of large data sets include:

- Union Pacific Railway
- ConAgra Foods
- Hudl
- OPPD
- TDAmeritrade
- Catch Intelligence
- West Corporation

Additionally, other companies such as Oriental Trading Company have hired UNO students as interns to work on data analysis projects, resulting in significant savings to the company as well as the company hiring a number of the interns permanently.

The proposed program will strengthen UNO's partnerships with businesses.

6. Collaborations within the University of Nebraska

The proposed program is appropriately titled 'Data Science.' The program is a joint effort by the colleges of Arts and Sciences, Business Administration, and Information Science and

[11] Transactional delivery site data.

Technology. Faculty from all three colleges will be teaching the proposed program. In addition, the proposed Data Science program will collaborate with other colleges, schools, and departments, including the School of Public Administration in the College of Public Affairs and Community Service. Public Administration and the Center for Public Affairs Research will be integral in providing service learning and community engagement opportunities, as well as access to data for government and nonprofit organizations.

The interdisciplinary nature of Data Science lends itself to collaboration. With the approval of the advisor, students will be able to take relevant and approved coursework at other NU institutions, including UNMC, UNL and UNK.

7. Collaborations with Higher Education Institutions and Agencies External to the University

Although no specific higher education institutions or agencies have been identified for collaboration, the capstone component of the proposed curriculum lends itself for collaboration. Current capstones are often carried out in partnership with external agencies, including higher education institutions, nonprofit organizations, governmental organizations, and businesses.

8. Centrality to Role and Mission of the Institution

The University of Nebraska at Omaha exists to provide appropriate educational opportunities to citizens of the state and particularly the residents of the Omaha metropolitan area. The proposed program builds on expertise and curricula in three colleges to offer stakeholders advanced, experiential learning in a field that has a high workforce demand. The proposed program addresses the UNO mission, specifically:

- *Expand the educational achievement, intellectual aspirations and horizons of our students with local, state, national, and global communities.*
- *Offer comprehensive educational programs and services of the highest quality.*

The proposed program is also aligned with the UNO strategic plan.

The program also reflects ongoing efforts to provide a strong academic foundation (Goal 1, Sub-Goal A, Objective 1) and prepare student for careers and professional responsibilities in an increasingly complex world (Goal 1, Sub-Goal B).

In being student-centered (Goal 2), the curriculum of the proposed program allows students to focus their program of study to their main interest (namely mathematics, IS, or business).

In addition, the capstones are often done in collaboration with external agencies or businesses, thus reinforcing the Community Engagement commitment (Goal 3) of the UNO Strategic Plan.

9. Consistency with the University of Nebraska Strategic Framework

The proposed degree strongly addresses the overarching goals of the University of Nebraska Strategic Planning Framework, especially those emphasizing quality academic programs, workforce and economic development, and engagement with the state.

The University of Nebraska will build and sustain undergraduate, graduate, and professional programs of high quality with an emphasis on excellent teaching. [The University of Nebraska will] pursue excellence through focus on targeted programs in the areas of important to Nebraska where the University can be a regional, national, and/or international leader (e.g. agriculture and natural resources, life sciences, information technology, and architectural engineering.)

By combining the strengths of three of the colleges at UNO, this master's degree program will mark UNO as a leader in curricular innovation in data science and will provide its students with an educational opportunity that is without a counterpart in the Midwest and is comparable to very few programs nationally. While the program builds on UNO's leadership role in information technology education within the state, it extends this leadership into interdisciplinary, applied domains through its integration of business administration and statistics.

The University of Nebraska will play a critical role in building talented, competitive workforce and knowledge-based economy in Nebraska in partnership with the state, private sector and other educational institutions.

A study[12] sponsored by the AIM Institute and the Greater Omaha Chamber of Commerce indicated strong demand in the marketplace in engineering and information technology. Big data/data analytics, which constitute a part of the broader data science discipline, was the third most frequently mentioned need in the study. The distinctive nature of the tri-college collaboration is likely to attract international and out-of-state students.

10. Avoidance of Unnecessary Duplication

As mentioned, in recent years, myriad institutions started offering stand-alone data science programs.[13] Unlike the proposed program, the data science programs offered elsewhere, are often programs offered out of one college alone; in some institutions the initiative is taken by Information Science and Technology, while in other schools it is by Business or Arts and Sciences. The interdisciplinary nature makes the proposed program unique, attractive to incoming students, and responsive to workforce needs.

There are very few alternatives to the proposed program in Nebraska. Bellevue University offers an online MS in Data Science. There are substantial differences between the proposed program and the one offered at Bellevue, including the online delivery mode and the cost of attendance associated with a private university. Further, the UNO proposed program offers significantly more varied options, which truly exemplifies its interdisciplinary nature. Creighton University offers both a certificate in Business Analytics and a Master's Degree in Business Intelligence and

[12] Vaslow, J. "Omaha Area IT and Engineering Talent Study", The MSR Group, 2013.
[13] A list of institutions that have started data science initiatives can be found in the following link: http://analytics.ncsu.edu/?page_id=4184

Analytics (see https://www.creighton.edu/program/business-intelligence-and-analytics-msbia and https://www.creighton.edu/program/business-intelligence-and-analytics-business-administration-mba-msbia). There are substantial differences in the curricular (emphasis on business with no interdisciplinary focus) and financial components between the Creighton program and the UNO proposed interdisciplinary Data Science program.

In addition, the University of Nebraska - Lincoln has recently created an online MS in Business Analytics. The UNL Business Analytics program has a strong emphasis on business fundamentals (12 out of 30 student credit hours, including coursework in marketing, financial accounting, and supply chain management).

Further, a primary reason for UNO proposing this interdisciplinary Data Science program is to be responsive to the Omaha workforce needs. As indicated by the letters of support, Omaha businesses (including First National Bank, Methodist Health, and West Corporation, believe there is a gap in current higher education offerings and their workforce need. A large component of this gap is the lack of interdisciplinary program offerings. UNO relies heavily on advisory boards with strong business and community representation to guide its curricular efforts, including the development of this proposed interdisciplinary data science program. Based on this input, UNO believes that an in-person interdisciplinary program in the Omaha region will be the most beneficial to respond to the business community's requests.

A review of program offerings in the region demonstrates similar differences between currently existing programs and the proposed Data Science program. Most programs are focused on a specific field (e.g. heath care, business, journalism, etc.) and lack the interdisciplinary focus, which makes the proposed program unique and highly desired.

- Iowa State University offers a blended Master's Degree in Business Analytics.
- Emporia State University offers an MS in Informatics which concentrations in health care related fields
- Colorado State University – Fort Collins offers an online Master of Applied Statistics
- Colorado University Denver offers in online MS in Information System-Business Intelligence
- Dakota State University offers an online MS in Analytics
- Capella offers an online MS in Analytics focused on Business Intelligence/data visualization tools and an online MBA in Business Intelligence.
- Mizzou offers a MS in Data Science and Analytics which allows students to focus on data journalism, strategic communications, etc.

Aside from the curricular differences mentioned, it is important to understand that working professionals employed by Omaha businesses will be interested in pursuing the proposed program – and an educational opportunity offered in the Omaha area will be especially important for these non-traditional students.

While these existing programs are related to the proposed program, they are fundamentally different, and do not offer the unique opportunities of the proposed interdisciplinary Data Science program. In order to excel in Data Science, it is critical to have an understanding of the

underlying mathematical concepts of analysis, the computer algorithms required to implement analysis, and the understanding of business practices to put knowledge to use. No other program offers students training across all of the fields that are essential to Data Science, leaving our proposed program as the only program that is capable of delivering the education and training necessary for an individual to have a successful career as a Data Scientist. Further, UNO is uniquely positioned to offer a Data Science program because of its highly collaborative partnerships with local businesses. This will ensure that students will be taught coursework that is strongly aligned with workforce needs.

Further, it is important to realize that the three UNO colleges proposing the Data Science program are already offering concentrations in the field of data science and data analytics. UNO is not duplicating the curriculum to offer the proposed Data Science program. The same courses that allow students, enrolled in the MIS, Mathematics, or Economics graduate degrees, to specialize in data science will be part of the proposed interdisciplinary Data Science program. In addition, the concentrations make data science available to MIS, Mathematics, and Economics students and that do not want the choice between getting a full Data Science degree or not gaining any data science skills at all. UNO believes that by offering a broader set of options for students with varying degrees of interest in data science, we will be able to attract more students. Further, this proposal would allow the colleges to collaborate in offering an interdisciplinary curriculum thus responding to national and local workforce needs.

11. Consistency with the Comprehensive Statewide Plan for Postsecondary Education

The proposed program is consistent with the Comprehensive Statewide Plan for Postsecondary Education.

- **Meeting the educational needs of students:** As demonstrated in this proposal, there is a significant student demand for Data Science curriculum. Further, the structure of the proposed program, specifically the flexibility in concentrations, allows students to tailor the program to their specific professional interests. This proposal is responsive to the statewide goal of providing "graduates with the skills and knowledge needed to succeed as capable employees and responsible citizens" (p. 35). In fact, this program is proposed because changes in the workforce landscape demand students to receive additional training interdisciplinary data science skills.

- **Meeting the needs of the state:** Big data has become a significant part of the operations of businesses, nonprofits, and governmental organizations. Meeting the needs of the workforce, the proposed program will graduate professionals who understand and process big data. As the Statewide Plan for Postsecondary Education states: "Each day technology transforms how, when, and where business is conducted, creating an ongoing need for employee training (...)" (p. 38). This workforce development argument is an essential component for the proposal to create this program. The changes in technology and data science have changed drastically over the last twenty years, demanding new training for prospective employees in order to meet workforce needs and remain competitive.

- **Meeting educational needs through exemplary institutions:** The proposed program will help UNO fulfill its metropolitan mission. Omaha is an entrepreneurial city. Omaha headquarters four fortune 500 companies and is a prime destination for start-ups. These businesses are desperately in need of employees with interdisciplinary data science skills. Furthermore, the proposed program relies predominately on existing faculty and staff resources across three colleges – exemplifying "effective and efficient use of resources (...) for the benefit of students and the citizens of the state." (p. 54).

First National Bank

1620 Dodge Street
Omaha, NE 68197

Subject: An interdisciplinary MS degree in data science at UNO

To Whom It May Concern,

I am writing this letter in strong support of a new interdisciplinary Master of Science in Data Science being proposed by the University of Nebraska at Omaha.

I am Dr. Jianqiang Hao, a Vice President at First National Bank of Omaha. My team, Decision Sciences, is responsible for leveraging data and analytics to predict customer behavior and make data-driven decisions. In 2018, I worked with Dr. Majumder to develop customized training for the First National Bank Decision Sciences team. This course, "Doing Data Science using Machine Learning Models", included 10 2-hour sessions held at UNO College of Business to train the Decision Sciences analysts about the best practices, tools and cutting-edge techniques in the field of data science and machine learning. The training was a great success, as we not only learned these techniques, but also had the chance to apply them to real problems from our bank.

There is a tremendous demand for data scientists across various industries. Many universities have started to offer data science degrees, and I am excited to hear about the new interdisciplinary MS degree at UNO. This program is important for UNO's ability to continue to draw in talented students, and ultimately bring in new talent to companies like us. The new interdisciplinary MS in Data Science will develop students with the machine learning, operational research, data engineering, and problem-solving skills that are highly sought after.

Over the years, we have built a good partnership with the UNO data science program, and we currently employ several graduates from this program as interns or full time employees. I am aware of the high quality of the programs that UNO offers and I look forward to a continued relationship with UNO's data science program. I hope that this program will be approved soon, so that we can benefit from the expertise of its students.

Sincerely,

Jianqiang Hao

Jianqiang Hao, Ph.D.
Vice President - Decision Sciences
First National Bank of Omaha

METHODIST
HEALTH SYSTEM

November 13, 2017

Dr. Jim Rogers, Chair
Department of Mathematics
University of Nebraska at Omaha
6001 Dodge Street
Omaha, NE 68182-0243

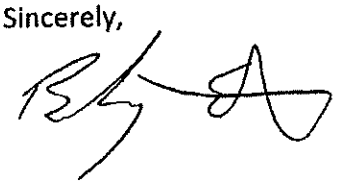
Dear Dr. Rogers:

I am writing you with this letter of support for the University of Nebraska at Omaha Data Science program. This year I began to build an analytics team at Methodist and Dr. Majumder has been instrumental in helping me to develop these resources. Dr. Majumder and Dr. Konvalina explained the data science philosophy of UNO Mathematics department and have given me a great start to better understand current technology and the Omaha market for this type of resource.

I started building my team by hiring students from UNO's undergraduate and graduate data science program as interns. These students were very prepared to work in a corporate environment and 'hit the ground running'. The program's combination of mathematics, computer science, and business provided these students with the ability to get data, conduct analysis, and present to business audiences.

When building past teams, I've had to hire experienced staff in order to produce these types of results this quickly. The data science students were very prepared and are able to present and defend their analysis to a variety of clinical and business audiences. I look forward to continuing Methodist's relationship with the UNO Data Science program.

Sincerely,



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cc: Mahbubul Majumder

TABLE 1: PROJECTED EXPENSES - NEW INSTRUCTIONAL PROGRAM
MS in Data Science at UNO

	(FY 2019-20 Year 1		(FY 2020-21) Year 2		(FY 2021-22) Year 3		(FY 2022-23) Year 4		(FY 2023-24) Year 5		**Total**
Personnel	**FTE**	Cost	FTE	Cost	FTE	Cost	FTE	Cost	FTE	Cost	**Cost**
Faculty											$0
Non-teaching staff: Professional [1]		$0		$0		$0	0.5	$30,000	0.5	$30,000	$60,000
Graduate assistants											$0
Non-teaching staff: Support Staff											$0
Subtotal	0	$0	0	$0	0.0	$0	0.0	$30,000	0.0	$30,000	$60,000
Operating											
General Operating											$0
Equipment											$0
New or renovated space											$0
Library/Information Resources											$0
Other											$0
Subtotal		$0		$0		$0		$0		$0	$0
Total Expenses		$0		$0		$0		$30,000		$30,000	**$60,000**

[1] Based on anticipated increased enrollments, a part-time advisor will be hired in Year 4.

TABLE 2: REVENUE SOURCES FOR PROJECTED EXPENSES - NEW INSTRUCTIONAL PROGRAM
MS in Data Science at UNO

	(FY 2019-20) Year 1	(FY 2020-21) Year 2	(FY 2021-22) Year 3	(FY 2022-23) Year 4	(FY 2023-24) Year 5	**Total**
Reallocation of Existing Funds						$0
Required New Public Funds						$0
1. State Funds						$0
2. Local Tax Funds (community colleges)						$0
Tuition and Fees [1]	$26,316	$32,292	$52,632	$78,948	$131,580	$321,768
Other Funding						$0
1						$0
2						$0
3						$0
Total Revenue	$26,316	$32,292	$52,632	$78,948	$131,580	$321,768

[1] Estimate of students: 3 students Year 1; 4 students Year 2; 6 students Year 3; 9 students Year 4; and 15 students Year 5. Each student is expected to enroll in 18 SCH per year. Estimations are based on resident tuition of $332 per SCH and non-resident tuition of $798 per SCH (proposed 2019-20 tuition rates).

	Resident Enrollment	Non-resident Enrollment	Resident Yearly cost of attendance	Non-resident Yearly cost of attendance	Total
Year 1	2	1	$ 11,952.00	$ 14,364.00	$ 26,316.00
Year 2	3	1	$ 17,928.00	$ 14,364.00	$ 32,292.00
Year 3	4	2	$ 23,904.00	$ 28,728.00	$ 52,632.00
Year 4	6	3	$ 35,856.00	$ 43,092.00	$ 78,948.00
Year 5	10	5	$ 59,760.00	$ 71,820.00	$ 131,580.00