SOUTH DAKOTA BOARD OF REGENTS
ACADEMIC AFFAIRS FORMS

New Specialization

UNIVERSITY:	SDSU
TITLE OF PROPOSED SPECIALIZATION:	**Data Science**
NAME OF DEGREE PROGRAM IN WHICH SPECIALIZATION IS OFFERED:	**Mathematics (B.S.)**
INTENDED DATE OF IMPLEMENTATION:	**2018-2019 Academic Year**
PROPOSED CIP CODE:	**27.0501**
UNIVERSITY DEPARTMENT:	**Mathematics & Statistics**
UNIVERSITY DIVISION:	**Jerome J. Lohr College of Engineering**

University Approval

To the Board of Regents and the Executive Director: I certify that I have read this proposal, that I believe it to be accurate, and that it has been evaluated and approved as provided by university policy.

Institutional Approval Signature *President or Chief Academic Officer of the University*	10/17/2017 Date

1. **Level of the Specialization:**

   Baccalaureate ☒   Master's ☐   Doctoral ☐

2. **What is the nature/purpose of the proposed specialization?**

SDSU requests authorization to offer a Data Science Specialization in the B.S. in Mathematics. The proposed Data Science Specialization will draw upon the wide range of data-science-centered mathematics, statistics, and statistical computation courses created over the past several years by the Department of Mathematics and Statistics as it has developed a strong regional and national presence in the field of data science. The specialization will offer students an exceptionally strong undergraduate preparation in the field of data science that will prepare them either for direct entry into the workforce or for entry into competitive graduate programs in data science or related disciplines. In particular, it will allow students to transition seamlessly into SDSU's M.S. in Data Science program, which is now in its fourth successful year of operation.

Graduates of the M.S. in Data Science program are in high demand, as are graduates of the B.S. in Mathematics. The Department has advised undergraduate students interested in data science careers to complete elective coursework within the Mathematics major focused on this pathway. This pathway has been offered for several years. The Department is now certain that student and employer demand for this area is high, and that it is possible to offer a high quality data science education at the undergraduate level. Consequently, this proposal will convert this existing pathway to a Data Science Specialization within the B.S. in Mathematics program.

The University does not request new state resources. No new courses are being requested as part of this proposal.

3. **Provide a justification for the specialization, including the potential benefits to students and potential workforce demand for those who graduate with the credential.[1]**

The Bureau of Labor Statistics does not record employment projections under the job title of "Data Scientist." However, data scientists and data science skills are in high demand within many occupations. Evidence of the substantial, wide-spread demand for data science skills is abundant.

- The first major report to this effect came from McKinsey in 2011 when it published its study *Big data: The next frontier for innovation, competition, and productivity* which predicted that by 2018 "140,000-190,000 more deep analytical talent positions, and 1.5 million more data-savvy managers are needed to take full advantage of big data in the United States."[2]
- Since then, a steady flow of reports and articles from the likes of the Harvard Business Review, Forbes, Glassdoor, CareerCast, and InfoWorld continued to confirm the substantial, ongoing shortage of skilled data scientists. For example, Glassdoor rated Data Scientist the best job in the nation in both 2016 and 2017 based on the number of job openings, the job satisfaction rating, and the median annual base salary, while a new study by CareerCast.com found that Data Science jobs have the best growth potential over the next seven years.[3]
- Most recently (2017), IBM's *The Quant Crunch: How the Demand for Data Science Skills is Disrupting the Job Market* projected that by 2020 the number of annual job openings for all data savvy professionals in the U.S. will increase by 364,000 openings to 2,720,000.[4]
- Finally, placing this extraordinary demand for data scientists in a broader context of demand in the Mathematical Sciences Occupations is the most recent available (2016) Conference Board/Wall Street Journal Labor Shortages Index, in which the Mathematical Sciences Occupations trail only Occupational/Physical Therapy Assistants in terms of demand for qualified employees outstripping supply.[5] Much of this demand comes in the form of demand for data scientists.

Employers of recent graduates who have emphasized data science in their program of study include Allianz, Amazon, Bancorp, Bluestem Brands, Cabela's, CAPITAL Card Services, Cargill, Citibank, Clickrain, Cornerstone Bank, Cortrust Bank, Dacotah Bank, Daktronics, Deloitte, Experian, First Bank and Trust, First National Bank of Omaha, First Premier Bank, Great West Casualty, Impact Radius, MARTA, Meta Payment Systems, Microsoft, Midland National Life, Mutual of Omaha, Optum, Plains Commerce Bank, POET, Premier Bankcard, Premier, Inc., Raven Industries, Reliamax, Sanford Health, Sanford Research, SD PUC, Target Corporation, The World Bank, US Census Bureau, Weather Analytics, and Wells Fargo.

Job titles of these students are extremely varied, including Actuary, Advanced Analytics Consultant, Analyst, Analytics Leader, Analytics Manager, BP&A Lead Analyst, Business Analyst, Business Intelligence Analyst, Business Risk Analyst, Chief Data Scientist, Contract Analyst, Credit Analyst, Credit Risk Analyst, Credit Risk Manager, Data Analyst, Data Engineer, Data Science Director, Data Scientist, Decision Support Developer, Director of Decision Analytics, Financial Analyst, Portfolio Analyst, Risk Analyst, Statistician, and Vice President of Analytics.

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[1] For workforce related information, please provide data and examples; data sources may include but are not limited to the South Dakota Department of Labor, the US Bureau of Labor Statistics, Regental system dashboards, etc.
[2] http://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/big-data-the-next-frontier-for-innovation
[3] https://www.glassdoor.com/List/Best-Jobs-in-America-LST_KQ0,20.htm
[4] https://www.ibm.com/analytics/us/en/technology/data-science/quant-crunch.html
[5] http://graphics.wsj.com/table/LABORSHORTAGEINDEX_0419

Many others have gone on to graduate programs in data science, statistics, mathematics, or closely related areas. Particularly popular choices of these graduates have been the M.S. in Data Science, M.S. in Statistics, M.S. in Mathematics, and Ph.D. in Computational Science and Statistics.

4. **List the proposed curriculum for the specialization (including the requirements for completing the major – <mark>*highlight courses in the specialization*</mark>):**

Mathematics (B.S.) – Data Science Specialization	Credit Hours	Credit Hours	Percent
System General Education Requirements	32		
Subtotal, Degree Requirements		32	27%
Major Requirements	31		
Mathematics – Data Science Specialization Requirements	30		
Required Support Courses	3		
Subtotal, Program Requirements		64	53%
General Electives		24	20%
Degree Total[6]		120	100%

System General Education Requirements

Prefix	Number	Course Title	Credit Hours	New (yes, no)
		Student Choice (SGR #1)	3	No
		Student Choice (SGR #1)	3	No
		Student Choice (SGR #2)	3	No
		Student Choice (SGR #3)	3	No
		Student Choice (SGR #3)	3	No
		Student Choice (SGR #4)	3	No
		Student Choice (SGR #4)	3	No
MATH	123	Calculus I (SGR #5)	4	No
INFO	101	Introduction to Informatics (SGR #6)	3	No
Select <u>one</u> of the following courses (SGR #6): PHYS 111-111L Introduction to Physics I and Lab (4) OR PHYS 211-211L University Physics I and Lab (4) OR CHEM 106-106L Chemistry Survey and Lab (4) OR CHEM 112-112L General Chemistry I and Lab (4) OR BIOL 151-151L General Biology I and Lab (4)			4	No
		Subtotal	32	

Major Requirements

Prefix	Number	Course Title	Credit Hours	New (yes, no)
MATH	198	The Mathematics Profession	1	No

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[6] Board Policy 2:29 requires each baccalaureate level degree program to require 120 credit hours and each associate degree program to require 60 credit hours. Exceptions to this policy require documentation that programs must comply with specific standards established by external accreditation, licensure, or regulatory bodies or for other compelling reasons and must receive approval by the Executive Director in consultation the President of the Board of Regents.

MATH	125	Calculus II	4	No
MATH	225	Calculus III	4	No
MATH	230	Sophomore Seminar	1	No
MATH	253	Logic, Sets, and Proof	3	No
MATH	315	Linear Algebra	4	No
MATH	321	Differential Equations	3	No
MATH	401	Senior Capstone and Advanced Writing	2	No
MATH	413	Abstract Algebra I	3	No
MATH	425	Real Analysis I	3	No
STAT	382	Probability and Statistics I	3	No
		Subtotal	31	

Mathematics - Data Science Specialization Requirements

Prefix	Number	Course Title	Credit Hours	New (yes, no)
Select 30 credits from the following courses:				
CSC	250	Computer Science II	3	No
CSC	300	Data Structures	3	No
CSC	319	Parallel Computing	3	No
MATH	475	Operations Research	3	No
STAT	383	Geospatial Data Analysis	3	No
STAT	410	SAS Programming	3	No
STAT	415	R Programming	3	No
STAT	445	Nonparametric Statistics	3	No
STAT	451	Predictive Analytics I	3	No
STAT	453	Applied Bayesian Statistics	3	No
STAT	460	Time Series Analysis	3	No
STAT	482	Probability and Statistics II	3	No
		Subtotal	30	

Supporting Coursework

Prefix	Number	Course Title	Credit Hours	New (yes, no)
CSC	150	Computer Science I	3	No
		Subtotal	3	

Total number of hours required for completion of specialization	30
Total number of hours required for completion of major	64
Total number of hours required for completion of degree	120

5. **Delivery Location[7]**

    A. Complete the following charts to indicate if the university seeks authorization to deliver the entire program on campus, at any off campus location (e.g., UC Sioux Falls, Capital University Center, Black Hills State University-Rapid City, etc.) or deliver the entire program through distance technology (e.g., as an on-line program)?

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[7] The Higher Learning Commission (HLC) and Board of Regents policy requires approval for a university to offer programs off-campus and through distance delivery.

	Yes/No	Intended Start Date	
On campus	Yes	**Summer**	**2018**

	Yes/No	If Yes, list location(s)	Intended Start Date
Off campus	No		

	Yes/No	If Yes, identify delivery methods[8]	Intended Start Date
Distance Delivery	No		

B. Complete the following chart to indicate if the university seeks authorization to deliver more than 50% but less than 100% of the certificate through distance learning (e.g., as an on-line program)? [9]

	Yes/No	If Yes, identify delivery methods	Intended Start Date
Distance Delivery	Yes	Online	2018-2019 AY

Currently, 60% (73 out of 120 credits) of the Data Science Specialization are available online. Currently online courses include all SGR's except INFO 101 (29 total credits); MATH 125, 225, and 321 (11 credits); STAT 410 and 415 (6 credits); CSC 150 (3 credits), and; General Electives (24 credits). It is possible that 11 or more additional credits of specialization courses could be delivered online in the future.

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[8] Delivery methods are defined in AAC Guideline 5.5.
[9] This question responds to HLC definitions for distance delivery.