SOUTH DAKOTA BOARD OF REGENTS

Academic and Student Affairs
Consent

AGENDA ITEM: 8 – E (1)
DATE: June 22-23, 2022

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SUBJECT

New Specialization Request – SDSMT – Specialization in Data Science – BS in Mathematics

CONTROLLING STATUTE, RULE, OR POLICY

BOR Policy 2:23 – Program and Curriculum Approval

BACKGROUND / DISCUSSION

South Dakota School of Mines & Technology (SDSMT) requests authorization to offer a specialization in Data Science within the BS in Mathematics. The proposed specialization will focus on mathematical theory and computational methods. Data science is a rapidly growing, multidisciplinary field within research and has applications in an increasing number of STEM disciplines and fields. Roughly 12% of SD Mines Mathematics graduates currently pursue careers in the data sciences and having this skill set included on the student transcript will benefit these students.

IMPACT AND RECOMMENDATION

SDSMT requests authorization to offer the specialization on campus. SDSMT is not requesting additional state resources to offer the program. No new courses will be required.

Board office staff recommends approval of the program.

ATTACHMENTS

Attachment I – New Specialization Request Form: SDSMT – Data Science – BS in Mathematics

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DRAFT MOTION 20220622_8-E(1):

I move to authorize SDSMT to offer a specialization in Data Science within the BS in Mathematics, as presented.

SOUTH DAKOTA BOARD OF REGENTS
ACADEMIC AFFAIRS FORMS

New Specialization

Use this form to propose a new specialization within an existing degree program. Specializations provide students with an alternative to the primary format of the major or it may be one of several tracks within a broad major. Specializations contain courses within the discipline(s) of the existing program. Specializations appear in the institutional catalog and on the transcript. Majors that offer specializations typically have one-third to two-thirds of the credits in common with the remaining course work fulfilling the requirements of the specialization(s) offered. The Board of Regents, Executive Director, and/or their designees may request additional information about the proposal. After the university President approves the proposal, submit a signed copy to the Executive Director through the system Chief Academic Officer. Only post the New Specialization Form to the university website for review by other universities after approval by the Executive Director and Chief Academic Officer.

UNIVERSITY:	**SDSM&T**
TITLE OF PROPOSED SPECIALIZATION:	**Data Science**
NAME OF DEGREE PROGRAM IN WHICH SPECIALIZATION IS OFFERED:	**Mathematics**
BANNER PROGRAM CODE:	**MBS.MTH**
INTENDED DATE OF IMPLEMENTATION:	**6/1/2022**
PROPOSED CIP CODE:	**27.0304**
UNIVERSITY DEPARTMENT:	**Mathematics**
BANNER DEPARTMENT CODE:	**MMTH**
UNIVERSITY DIVISION:	**4L**
BANNER DIVISION CODE:	**4L**

☒ **Please check this box to confirm that:**

- The individual preparing this request has read AAC Guideline 2.6, which pertains to new specialization requests, and that this request meets the requirements outlined in the guidelines.
- This request will not be posted to the university website for review of the Academic Affairs Committee until it is approved by the Executive Director and Chief Academic Officer.

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.

	Click here to enter a date.
Institutional Approval Signature *President or Chief Academic Officer of the University*	Date

Note: In the responses below, references to external sources, including data sources, should be documented with a footnote (including web addresses where applicable).

1. **Level of the Specialization (*place an "X" in the appropriate box*):**

Baccalaureate ☒ Master's ☐ Doctoral ☐

2. **What is the nature/purpose of the proposed specialization? Please include a brief (1-2 sentence) description of the academic field in this specialization.**

South Dakota Mines requests authorization to offer a Data Science Specialization in its B.S. in Mathematics. The proposed specialization is in the field of Data Science, with a particular focus on its mathematical theory and computational methods. Data science is a rapidly growing multidisciplinary field with research and applications in an increasing number of STEM disciplines and fields.

Between 11% and 13% of South Dakota Mines Mathematics graduates pursue careers in the data sciences, taking on positions such as data scientists and data analysts with companies including Boeing, Cyentia Institute, RARE Science, United Airlines, Xcel, and the NSWC. South Dakota Mines has an active and successful interdisciplinary Mathematics/Computer Science Data Science research group, and data science is one of the most popular areas of interest for prospective Mines mathematics majors. The proposed specialization seeks to capitalize on this success, expertise and interest, combining the Mathematics Department's robust instruction in applied and computational mathematics (including statistics, numerical methods, and data analysis) with the Department of Computer Science (including courses in programming, data structure and mining, machine learning, and artificial intelligence) to provide students a strong undergraduate preparation in the field of data science. It codifies a pathway through pre-existing elective MATH and CSC coursework that has been previously shown effective in securing Mathematics graduates careers in data science fields. Thus, this proposal requires no new courses or new state resources.

Graduates earning the specialization will be well-prepared to enter the workforce as a data scientist or data analyst, or to pursue competitive graduate education in data science or similar disciplines. In particular, this specialization will allow graduates to naturally transition to South Dakota Mine's new interdisciplinary Data Science and Engineering PhD program, which will start in Fall 2022.

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

In an age of ever-increasing connectivity, networking, and data collection, we are inundated by data. According to **Domo**, in 2017 roughly 2.5 *quintillion* bytes of data were created *every day*[1], and that by 2020 there was 40 times more bytes of data than there are stars in the observable universe[2] … and this was *before* the global pandemic that moved nearly every aspect of our working and social lives online.

[1] https://www.domo.com/learn/infographic/data-never-sleeps-5
[2] https://www.domo.com/learn/infographic/data-never-sleeps-7

Consequently, there is a critical need across disciplines and industries for trained mathematicians to effectively analyze and process this tsunami of information. A January 17, 2022, search of **Indeed.com** lists some 6500 job positions for *data scientist* or *data analyst*, with employers including Amazon, Apple, Assurant, Booz Allen Hamilton, Capital One, IBM, Intel, General Motors, Hewlett Packard, Lawrence Livermore National Lab, Lockheed Martin, Mayo Clinic, Microsoft, New York Life, Netflix, TikTok, and USAA. In South Dakota alone, data scientists and engineers are sought by employers such as Pearson, Lexmark, Change Healthcare, Sanford Health, Ryder Systems, Raven Industries, and Citi.

The demand for data science jobs continues to grow. **Forbes** reports that data science jobs have increased over 650% since 2012[3], while the **U.S. Bureau of Labor Statistics** expects demand for data scientists to increase by another nearly 28% by 2026[4]. That equates to roughly 11 million new data science jobs by 2026.

The proposed specialization will allow its graduates to capitalize on this growing professional need. Data science jobs aren't just in demand – they are the beginnings of satisfying careers. **U.S. News and World Report** ranks Data Scientist as #6 in its 2022 list of 100 Best Jobs in America, #6 in its list of Best STEM jobs, and #3 in its list of Best Technology Jobs.[5] (They similarly ranked Data Scientist #8 in 2021.) Similarly, **GlassDoor.com** ranks Data Science #2 in its 2021 list of 50 Best Jobs in America, with a median salary of $113,736, and an average of 4.1 rating out of 5 in job satisfaction[6].

Additionally, data science and analysis require significantly less physical infrastructure than that of other, more traditional STEM disciplines like engineering, science, or manufacturing. This allows data scientists the ability to work remotely more easily, having a global career while remaining a resident in South Dakota – a career option made more desirable since the COVID pandemic.

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

Prefix	Number	Course Title *(add or delete rows as needed)*	Credit Hours	New (yes, no)
Mathematics Degree Requirements				
MATH	110	Survey of Mathematics	1	No
MATH	123	Calculus I	4	No
MATH	125	Calculus II	4	No
MATH	225	Calculus III	4	No
MATH	315	Linear Algebra	3	No
MATH	321	Differential Equations	3	No
MATH	373	Numerical Methods	3	No

[3] https://www.forbes.com/sites/louiscolumbus/2017/12/11/linkedins-fastest-growing-jobs-today-are-in-data-science-machine-learning
[4] https://www.bls.gov/opub/btn/volume-7/big-data-adds-up.htm
[5] https://money.usnews.com/careers/best-jobs/data-scientist
[6] https://www.glassdoor.com/List/Best-Jobs-in-America-LST_KQ0,20.htm

MATH	381	Introduction to Probability and Statistics	3	No
MATH	413	Abstract Algebra I	3	No
MATH	423	Advanced Calculus I	3	No
MATH	498	Undergraduate Research	1	No
MATH	402	Communicating Mathematics	1	No
CSC	251	Finite Structures	3	No
MATH sequence elective			3	No
MATH upper-level elective			3	No
Department-approved upper-level electives			6	No
Computer science sequence			6-7	No
English communications requirement (ENGL 101, 278, 279)			9	No
Humanities and Social Sciences General Education requirement			12	No
Science requirement (PHYS 211, approved 2nd science course and lab)			7	No
Free electives			36	No
Data Science Specialization*				
Required courses				
MATH	382	Probability and Statistics II	3	No
MATH	415	Advanced Linear Algebra	3	No
CSC	315	Data Structures and Algorithms	4	No
CSC	484	Database Management Systems	3	No
Select one of the following:				
MATH	443	Data Analysis	3	No
CSC	454	Data Mining	3	No
Select one of the following:				
CSC	447	Artificial Intelligence	3	No
CSC	448	Machine Learning	3	No
CSC	449	Advanced Artificial Intelligence	3	No

Total number of hours required for completion of specialization	19
Total number of hours required for completion of major	69
Total number of hours required for completion of degree	120

* The required 19 credits for the completion of the specialization may be obtained from a combination of various upper-level and free electives for the Mathematics B.S.

- MATH 382 fulfills the MATH sequence elective
- MATH 415 fulfills the MATH upper-level elective
- MATH 443, CSC 315, CSC 448, and CSC 449 are upper-level electives.
- CSC 454 and CSC 484 are free electives.

5. Delivery Location

Note: The accreditation requirements of the Higher Learning Commission (HLC) require Board approval for a university to offer programs off-campus and through distance delivery.

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 specialization through distance technology (e.g., as an on-line program)?

	Yes/No	***Intended Start Date***
On campus	Yes	**Fall 2022**

	Yes/No	***If Yes, list location(s)***	***Intended Start Date***
Off campus	No		Choose an item. Choose an item.

	Yes/No	***If Yes, identify delivery methods*** *Delivery methods are defined in AAC Guideline 5.5.*	***Intended Start Date***
Distance Delivery (online/other distance delivery methods)	No		Choose an item. Choose an item.

B. Complete the following chart to indicate if the university seeks authorization to deliver more than 50% but less than 100% of the specialization through distance learning (e.g., as an on-line program)? *This question responds to HLC definitions for distance delivery.*

	Yes/No	***If Yes, identify delivery methods***	***Intended Start Date***
Distance Delivery (online/other distance delivery methods)	No		Choose an item. Choose an item.