

SOUTH DAKOTA BOARD OF REGENTS

Academic and Student Affairs
Consent

AGENDA ITEM: 5 – E (4)

DATE: May 10, 2022

SUBJECT

New Undergraduate Certificate Request – USD – Data Science

CONTROLLING STATUTE, RULE, OR POLICY

[BOR Policy 2:23](#) – Program and Curriculum Approval

BACKGROUND / DISCUSSION

The University of South Dakota (USD) requests authorization to offer an undergraduate certificate in Data Science. The certificate will provide students with focused education and training that will provide rudimentary exposure to and training in computer programming languages, data mining tools, and machine learning. The intent is to offer a certificate that non-Computer Science (CSC) majors or minors would be able to complete to provide a basic training in computing and machine learning that will make them more competitive in the job market within academia, government, and industry.

IMPACT AND RECOMMENDATION

USD plans to offer the certificate in Data Science on campus and online. USD does not request new state resources. One new course will be required.

Board office staff recommends approval.

ATTACHMENTS

Attachment I – New Certificate Request: USD – Data Science (Undergraduate)

DRAFT MOTION 20220510_5-E(4):

I move to authorize USD to offer an undergraduate certificate in Data Science, as presented.



SOUTH DAKOTA BOARD OF REGENTS ACADEMIC AFFAIRS FORMS

New Certificate

UNIVERSITY:	USD
TITLE OF PROPOSED CERTIFICATE:	Data Science
INTENDED DATE OF IMPLEMENTATION:	Fall 2022
PROPOSED CIP CODE:	11.0102
UNIVERSITY DEPARTMENT:	Computer Science
BANNER DEPARTMENT CODE:	UCSC
UNIVERSITY DIVISION:	College of Arts & Sciences
BANNER DIVISION CODE:	2A

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

- The individual preparing this request has read [AAC Guideline 2.7](#), which pertains to new certificate 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.

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. Is this a graduate-level certificate or undergraduate-level certificate (place an "X" in the appropriate box)?

Undergraduate Certificate ☒ Graduate Certificate ☐

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

The proposed Data Science certificate focuses the use of data mining tools for all possible data types regardless of their sources. It includes scientific computing, applied machine learning, data visualization, ethical issues of AI-guided tools, and data science projects. It takes hands-on real-world projects that are ranging from healthcare informatics to risk management with a primary aim to build data-driven decision-making solution(s).

3. If you do not have a major in this field, explain how the proposed certificate relates to your university mission and strategic plan, and to the current Board of Regents Strategic Plan 2014-2020.

Links to the applicable State statute, Board Policy, and the Board of Regents Strategic Plan are listed below for each campus.

BHSU:	<u>SDCL § 13-59</u>	<u>BOR Policy 1:10:4</u>
DSU:	<u>SDCL § 13-59</u>	<u>BOR Policy 1:10:5</u>
NSU:	<u>SDCL § 13-59</u>	<u>BOR Policy 1:10:6</u>
SDSMT:	<u>SDCL § 13-60</u>	<u>BOR Policy 1:10:3</u>
SDSU:	<u>SDCL § 13-58</u>	<u>BOR Policy 1:10:2</u>
USD:	<u>SDCL § 13-57</u>	<u>BOR Policy 1:10:1</u>
	<u>Board of Regents Strategic Plan 2014-2020</u>	

The offering of this undergraduate certificate is aligned to the institutional mission of educating students who are well-prepared for a global and complex world with classroom experience that is robust, experiential, and practical. This undergraduate certificate will support the College mission of producing graduates who will solve the future's most pressing challenges. As stated previously, computers are woven into the fabric of current society. In the workplace, persons who are functional in computer programming and machine learning will hold an advantage over those persons who are not functional in these aspects of computers. A certificate in Data Science will allow our graduates to not only succeed in the future world but be leaders in solving the challenges of the future, a future where computers and machine learning will continue to increase in use and function.

There are no active program offerings within the BOR system that are comparable to this undergraduate certificate. DSU has a 12 credit hour undergraduate certificate in Data Analytics, the certificate focuses on business problems. USD's 9 credit hour Data Science certificate will educate both computer science majors and non-computer science majors. Our certificate is general enough that it would allow students from all disciplines and programs to complete. Students in non-computer science majors come from diverse backgrounds such as social science, mathematics and statistics, business disciplines, fine arts, humanities, etc. The closest offerings are a minor or major in computer science at SDSU (Data Science), DSU, and USD and the artificial intelligence undergraduate certificate offered at USD. The primary difference between the proposed undergraduate certificate and those active program offerings is the target audience. The AI certificate is intended for students majoring in computer science.

The proposed certificate is intended for non-computer science majors as a 2018 Kaggle Machine Learning & Data Science survey confirmed that 67% of the data analysts in the industry¹ that participated in the survey were not currently using machine learning and data science models in their current profession.

4. Provide a justification for the certificate program, including the potential benefits to students and potential workforce demand for those who graduate with the credential. For workforce related information, please provide data and examples. Data may include, but are not limited to the South Dakota Department of Labor, the US Bureau of Labor Statistics, Regental system dashboards, etc. Please cite any sources in a footnote.

According to the Bureau of Labor Statistics (BLS), employment of computer and information technology occupations is projected to grow 12% from 2018 to 2028, much faster than the

¹ <https://www.kaggle.com/kaggle/kaggle-survey-2018>

average for all occupations², with these occupations being projected to add about 546,200 new jobs during that time frame. In contrast, employment for data analysts is projected to increase 31.4% from 2020 to 2030³, where a median salary for a typical baccalaureate degree is \$98,280.00.

Computers are woven into the fabric of current society and as a result, many future employers (across a range of professions) will expect their employees to possess some knowledge of computer programming and data analytics. In this era of big data analytics, data use is on the forefront of bigger projects. Big data allows for effective decision making and its applications range from healthcare to transportation to risk management. According to Kaggle survey data on machine learning and data science (2018), 67% of persons employed as a data scientist are non-CSC majors; persons working as data scientists possess majors in social science, math, business, fine arts, and humanities, to name a few. An undergraduate certificate in Data Science will provide students with focused education and training that will provide rudimentary exposure to and training in computer programming languages, data mining tools, and machine learning. The intent is to offer a certificate that non-CSC majors or minors would be able to complete to provide a basic training in computing and machine learning that will make them more competitive in the job market: academia, government, and industry.

5. Who is the intended audience for the certificate program (including but not limited to the majors/degree programs from which students are expected)?

The proposed certificate is intended to target all majors, particularly non-CSC majors. CSC majors are welcome to complete the certificate, but the curriculum is targeted at those who do not have a background in computing.

6. Certificate Design

A. Is the certificate designed as a stand-alone education credential option for students not seeking additional credentials (i.e., a bachelor's or master's degree)? If so, what areas of high workforce demand or specialized body of knowledge will be addressed through this certificate?

The proposed certificate could potentially be useful as a stand-alone education credential option for students not seeking additional credentials (undergrad or grad). Developing data scientists/analysts majoring in programs other than computer science (e.g., social science, math, business, fine arts, and humanities, to name a few) brings diversity and inclusiveness into job market.

B. Is the certificate a value-added credential that supplements a student's major field of study? If so, list the majors/programs from which students would most benefit from adding the certificate.

The proposed certificate program aims to bring a value-added credential to students in undergraduate programs across all disciplines by providing them training in an area that may increase their marketability after graduation.

C. Is the certificate a stackable credential with credits that apply to a higher-level credential (i.e., associate, bachelor's, or master's degree)? If so, indicate the program(s)

² <https://www.bls.gov/ooh/computer-and-information-technology/computer-and-information-research-scientists.htm>

³ <https://www.businessinsider.com/jobs-expected-to-grow-the-most-future-employment-projections-salaries-2021-9#9-all-other-data-scientists-and-mathematical-science-occupations-employment-is-projected-to-increase-314-from-2020-to-2030-for-this-occupation-12>

to which the certificate stacks and the number of credits from the certificate that can be applied to the program.

For CSC majors, these courses contribute to the student's undergraduate degree as elective courses.

7. List the courses required for completion of the certificate in the table below (if any new courses are proposed for the certificate, please attach the new course requests to this form).

Prefix	Number	Course Title	Prerequisites for Course <i>Include credits for prerequisites in subtotal below.</i>	Credit Hours	New (yes, no)
Category A: Foundation of programming (complete 3 cr hrs)					
CSC	405	Business Analytics Fundamentals	0	3	No
CSC	417	Programming for scientific computing	0	3	Yes
Category B: Applied Data Science (complete 6 cr hrs)					
CSC	427	Trends in information/data science	0	3	No
CSC	457	Data Analysis/Decision Making	0	3	No
CSC	472	AI and ethical issues	0	3	No
CSC	488	Pattern Recognition & Machine Learning	0	3	No
Subtotal				9	

8. Student Outcome and Demonstration of Individual Achievement.

Board Policy 2:23 requires certificate programs to "have specifically defined student learning outcomes."

A. What specific knowledge and competencies, including technology competencies, will all students demonstrate before graduation? *The knowledge and competencies should be specific to the program and not routinely expected of all university graduates.*

- Utilize scientific computing skills for design/code machine learning and data science tools
- Explore information science/data science by taking real-world projects into account
- Leverage data science tools: data analysis, decision-making, and visualization
- Explore technological basis of AI tools and key ethical issues (including risk factors)

B. Complete the table below to list specific learning outcomes – knowledge and competencies – for courses in the proposed program in each row.

Individual Student Outcome	CSC 405	CSC 417	CSC 427	CSC 457	CSC 472	CSC 488
Utilize scientific computing skills for design/code machine learning and data science tools	X	X		X		X
Explore information science/data science by taking real-world projects into account			X	X	X	X
Leverage data science tools: data analysis, decision-making, and visualization	X	X		X	X	X
Explore technological basis of AI tools and key ethical issues (including risk factors)	X	X	X		X	X

9. 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., USD Community College for Sioux Falls, Black Hills State University-Rapid City, Capital City Campus, etc.) or deliver the entire program 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		

	Yes/No	If Yes, identify delivery methods <i>Delivery methods are defined in AAC Guideline 5.5.</i>	Intended Start Date
Distance Delivery (online/other distance delivery methods)	Yes	015- Internet asynchronous 018- Internet synchronous	Fall 2022
Does another BOR institution already have authorization to offer the program online?	No	If yes, identify institutions:	

- 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)? 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		

10. Additional Information:



SOUTH DAKOTA BOARD OF REGENTS ACADEMIC AFFAIRS FORMS

New Course Request

USD	Arts & Sciences/Computer Science	
Institution	Division/Department	
<i>Elizabeth M. Freeburg</i>		<i>2/17/2022</i>
Institutional Approval Signature		Date

Section 1. Course Title and Description

Prefix & No.	Course Title	Credits
CSC 417/517	Programming for Scientific Computing	3

Course Description

Introduces computational science, object-oriented programming, data structures, and parallel computing within the scope of scientific computing. Students will investigate problems through Python/R implementation.

Pre-requisites or Co-requisites

Prefix & No.	Course Title	Pre-Req/Co-Req?
N/A		

Registration Restrictions

N/A

Section 2. Review of Course

2.1. Will this be a unique or common course? (place an "X" before course type)

X	Unique Course <i>If the request is for a unique course, institutions <u>must</u> review the common course catalog in the system course database to determine if a comparable common course already exists. List the two closest course matches in the common course catalog and provide a brief narrative explaining why the proposed course differs from those listed. If a search of the common course catalog determines an existing common course exists, complete the Authority to Offer an Existing Course Form. <u>Courses requested without an attempt to find comparable courses will not be reviewed.</u></i>
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Prefix & No.	Course Title	Credits
CSC 319	Parallel Computing	3
CSC 350	Algorithms & Data Structure	3
CSC 461	Programming Science	3
CSC 510	Parallel Computing	3
CSC 555	Algorithms	3
CSC 561	Programming Science	3

Provide explanation of differences between proposed course and existing system catalog courses below:

CSC 319 is limited parallel computing techniques; CSC 350 includes systematic study of data structures and their accompanying algorithms; and CSC 461 covers how programming languages are designed in addition to the concept of parsing and compiling. None of them consider scientific computing.

CSC 510 is limited parallel computing techniques; CSC 555 includes systematic study of data structures and their accompanying algorithms; and CSC 561 covers how programming languages are designed in addition to the concept of parsing and compiling. None of them consider scientific computing.

<input type="checkbox"/>	Common Course
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Indicate universities that are proposing this common course (place an "X" before the university):

<input type="checkbox"/>	BHSU	<input type="checkbox"/>	DSU	<input type="checkbox"/>	NSU	<input type="checkbox"/>	SDSMT	<input type="checkbox"/>	SDSU	<input type="checkbox"/>	USD
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Section 3. Other Course Information

3.1. Are there instructional staffing impacts? (place an "X" in the box before the correct response)

<input type="checkbox"/>	No. Replacement of _____ (course prefix, course number, name of course, credits) Effective date of deletion: _____
X	No. Schedule Management, explain below: The department offers one or two elective courses per semester. This course will be incorporated into the rotation of electives offered each semester.
<input type="checkbox"/>	Yes. Specify below:

3.2. Existing program(s) in which course will be offered: BA/BS in Computer Science and Data Science Certificate Programs (newly proposed).

3.3. Proposed instructional method by university (as defined by [AAC Guideline 5.4](#)):

D Discussion/Recitation

3.1. 3.4. Proposed delivery method by university (as defined by [AAC Guideline 5.5](#)):

U01: Face-to-face Term Based Instruction, U15 Internet Asynchronous, and U18 Online Synchronous

3.5. Term change will be effective: Summer 2022 (catalog year, 2022-23)

3.6. Can students repeat the course for additional credit? (YES and total credit limit or NO)

No

3.7. Will grade for this course be limited to S/U (pass/fail)? (YES or NO)

No

3.8. Will section enrollment be capped? (YES and max per section or NO)

Yes, max per section: 30

3.9. Will this course equate (i.e., be considered the same course for degree completion) with any other unique or common courses in the common course system database in Colleague and the Course Inventory Report? (YES or NO)

No

If yes, indicate the course(s) to which the course will equate (add lines as needed):

Prefix & No.	Course Title

3.10. Is this prefix approved for your university? (YES or NO)

Yes

If no, provide a brief justification:

Section 4. Department and Course Codes (Completed by University Academic Affairs)

4.1. University Department: CSC

4.2. Banner Department Code: UCSC

4.3. Proposed CIP Code: 11.0202

Is this a new CIP code for the university? (YES or NO) No