SOUTH DAKOTA BOARD OF REGENTS
ACADEMIC AFFAIRS FORMS

New Undergraduate Degree Program

UNIVERSITY:	**SDSU**
MAJOR:	**Data Science**
EXISTING OR NEW MAJOR(S):	**New**
DEGREE:	**Associate of Science (A.S.)** **Bachelor of Science (B.S.)**
EXISTING OR NEW DEGREE(S):	**Existing**
INTENDED DATE OF IMPLEMENTATION:	**2018-2019 Academic Year**
PROPOSED CIP CODE:	**27.0501**
SPECIALIZATIONS:[1]	**None**
IS A SPECIALIZATION REQUIRED (Y/N):	**No**
DATE OF INTENT TO PLAN APPROVAL:	**5/9/2018**
UNIVERSITY DEPARTMENT:	**Mathematics & Statistics (SMATH)**
UNIVERSITY DIVISION:	**Jerome J. Lohr College of Engineering (SENGR)**

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.

Barry H. Dunn

President of the University — Date: 5/16/2018

1. What is the nature/purpose of the proposed program?

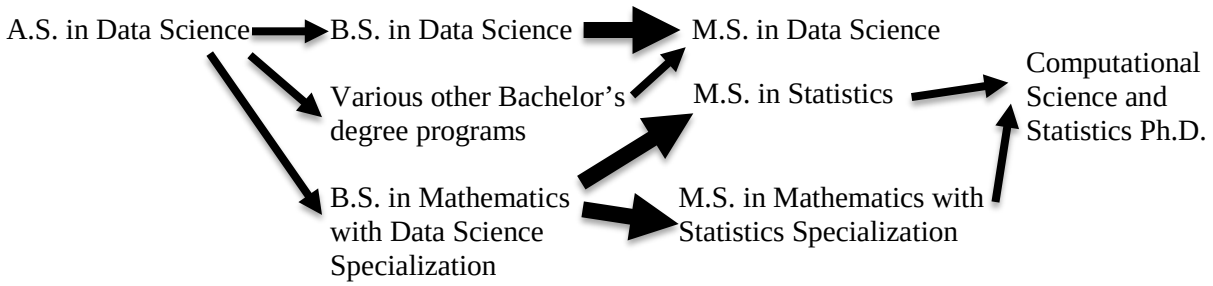
South Dakota State University (SDSU) requests authorization to offer both an Associate of Science and a Bachelor of Science in Data Science. The proposed programs will draw upon the wide range of data-science-centered mathematics, statistics, and statistical computation courses created over the past 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 A.S. in Data Science would stack naturally into the B.S. in Data Science, the B.S. in Mathematics with Data Science Specialization, or many other degree programs in the applied, social, or natural sciences that can be enhanced by additional data science focus. It is also expected that the A.S. in Data Science will be of interest to students pursuing bachelor's

[1] If the proposed new program includes specific specializations within it, complete and submit a New Specialization Form for each proposed specialization and attach it to this form. Since specializations appear on transcripts, they require Board of Regents approval.

degrees in various applied, social, and natural sciences degrees. It would stack naturally into bachelor's degree programs into a variety of other degree programs, producing data-enabled graduates in these fields that will deliver more value in the workplace than their less data-enabled colleagues with otherwise similar credentials. The curriculum for the associate degree has been designed to allow students to fulfill the first 60 credits of coursework towards their baccalaureate degree; graduates of the A.S. in Data Science can complete the B.S. in Data Science or B.S. in Mathematics – Data Science Specialization with an additional 60 credit hours. The programs 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 data science programs. In particular, the B.S. in Data Science will allow students to transition seamlessly into SDSU's M.S. in Data Science program.

The chart below depicts the potential paths through the SDSU Department of Mathematics and Statistics' existing and proposed data science, statistics, mathematics, and computational science programs that would exist if the two proposed programs are approved. Thicker arrows indicate situations in which it currently is or will be possible to follow an accelerated path to completion of a combined bachelor's plus master's degree. The result is a comprehensive set of programs that will prepare students for entry into the workforce of many sectors of the economy, with many different levels of data proficiency.



The University does not request new state resources for either program.

2. How does the proposed program relate to the university's mission and strategic plan, and to the current Board of Regents Strategic Plan 2014-2020?[2]

As a land grant university, SDSU is charged with serving the state and its citizens through education, research, and service. Given the professional value of data science education to individuals, and the capacity of a data-enabled workforce to drive economic growth and enhance quality of life, it is clear that the proposed program's goals align directly with SDSU's mission.

The proposed major in Data Science supports the statutory mission of SDSU as provided in SDCL 13-58-1: *Designated as South Dakota's land grant university, South Dakota State University, formerly the state college of agriculture and mechanical arts, shall be under the control of the Board of Regents and shall provide undergraduate and graduate programs of instruction in the liberal arts and sciences and professional education in agriculture, education, engineering, home economics, nursing and pharmacy, and other courses or programs as the Board of Regents may determine.*

[2] South Dakota statutes regarding university mission are located in SDCL 13-57 through 13-60; Board of Regents policies regarding university mission are located in Board Policies 1:10:1 through 1:10:6. The Strategic Plan 2014-2020 is available from https://www.sdbor.edu/the-board/agendaitems/Documents/2014/October/16_BOR1014.pdf.

Board Policy 1:10:2 South Dakota State University Mission Statement provides: *The legislature established South Dakota State University as the Comprehensive Land Grant University to meet the needs of the State and region by providing undergraduate and graduate programs of instruction in the liberal arts and sciences and professional education in agriculture, education, engineering, human sciences, nursing, pharmacy, and other courses or programs as the Board of Regents may determine (SDCL 13-58-1).*

The proposed programs build on SDSU's existing faculty expertise, research programs, and portfolio of existing academic programs in data science, statistics, mathematics, and computational science as depicted in the diagram on the bottom of page 1 of this document.

Both the proposed A.S. and B.S. in Data Science also align well with the current South Dakota Board of Regents Strategic Plan 2014-2020. The SDBOR's strategic plan calls out the five target sectors identified in the South Dakota Science and Innovation Strategy as expressed in SD EPSCoR's 2020 Vision report: Value Added, Agriculture and Agribusiness, Energy and Environment, Materials and Advanced Manufacturing, Human Health and Nutrition, Information Technology/Cyber-Security/ Information Assurance. The availability of data-enabled workforce members such as those who will graduate from the proposed A.S. and B.S. in Data Science programs and the existing M.S. in Data Science program to which they can lead is a key ingredient to progress in each of these sectors. Additionally, the proposed programs are STEM degrees, another area of emphasis in SDBOR's plan.

3. **Describe the workforce demand for graduates of the program, including national demand and demand within South Dakota.** *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.*

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."[3]
- 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.[4]
- More 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.[5]

[3] http://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/big-data-the-next-frontier-for-innovation
[4] https://www.glassdoor.com/List/Best-Jobs-in-America-LST_KQ0,20.htm
[5] https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=IML14576USEN

- 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.[6] Much of this demand comes in the form of demand for data scientists.
- The most recent evidence indicates that the demand for data science will continue to grow.
  - In October 2017, the U.S. Bureau of Labor Statistics released its 2016-26 employment projections, which separately placed both statisticians and mathematicians in the top ten fastest growing occupations[7] (these are the BLS categories that include data science).
  - In December, LinkedIn named the top 20 emerging jobs of 2017, with four distinct data science jobs in the top ten. Specifically, they are (with rankings) Machine Learning Engineer (1), Data Scientist (2), Big Data Developer (5), and Director of Data Science (8).[8]

At the state and regional level, demand in this area is already strong and is predicted to grow. For example, the South Dakota Department of Labor and Regulation's July 2016 e-Labor Bulletin[9] puts the "Professional, Scientific, and Technical Services" industry fourth on the list of highest projected employment growth from 2014 through 2024, with growth projected at 13.2%.

Similarly, *Growth and Change in South Dakota Labor Markets*[10] states that with respect to new jobs created between 2001 and 2013,

> "Especially rapid growth occurred in the health professions, computer/mathematical and engineering occupations…",

noting that,

> "The strongest job growth was concentrated in the professional fields including scientific, engineering and math-related fields".

It goes on to state that when looking to the future,

> "The South Dakota professional, scientific and technical services industry is a major employer of a large variety of workers in various business and management professions as well as scientific, engineering and computer science and mathematical technology occupations. Strong job growth and very low unemployment rates in this industry and among the major professional occupations that make up this industry also suggest growing labor scarcity",

and finally that,

> "With extraordinarily low unemployment in the PST (professional, scientific and technical) industry, a strong long-term record of job growth with only modest cyclical swings in employment and very bright national outlook, we believe that the prospects for growth in this industry are quite bright in South Dakota. The basic constraint on this growth will be access to qualified professionals."

[6] http://graphics.wsj.com/table/LABORSHORTAGEINDEX_0419
[7] https://www.bls.gov/news.release/pdf/ecopro.pdf
[8] https://economicgraph.linkedin.com/research/LinkedIns-2017-US-Emerging-Jobs-Report
[9] https://dlr.sd.gov/lmic/lb/2016/lbart_july2016_industry_employment_trends_to_2024.pdf
[10] https://dlr.sd.gov/publications/documents/sdwins_sd_labor_markets_may2014.pdf

Both proposed programs will provide direct responses to this ongoing, extraordinary demand for data science expertise in the workforce.

Traditionally, careers such as data scientist have been thought of as being open to those with Bachelor's, Master's, or Doctoral degrees. However, national and regional interest in alternative credentials has grown substantially in recent years, and is having an impact in tech fields similar in nature to data science such as coding, where certificates, boot camps, and other credentialing mechanisms have become very popular and effective.[11] Major employers such as IBM want to and do hire substantial numbers of employees who don't have four-year degrees in hard to hire areas.[12]

Employers would be expected to be as at least as receptive to hiring employees with a high-quality A.S. in Data Science as they are to hiring those with various alternative coding credentials.

In South Dakota more data-enabled people are needed in workforce at every level and across many disciplines. The proposed A.S. program will help the state meet this need by:

- preparing graduates who have the valuable set of data management and basic data analysis skills that can be delivered in a program at the Associate degree level.
- serving as an accessible entry point into the important discipline of data science for students at all levels including high school, traditional college, and non-traditional.
- giving students in a wide variety of majors and disciplines the opportunity to enhance their professional capabilities by enhancing their ability to manage and analyze data.
- leading naturally into more advanced study in data science for interested students.

It is also expected that the A.S. in Data Science will be of interest to students pursuing bachelor's degrees in various applied, social, and natural sciences degrees. It would stack naturally into bachelor's degree programs including but not limited to Biology, Biotechnology, Business Economics, Computer Science, Economics, Exercise Science, Food Science, Geographic Information Sciences, Microbiology, Psychology, Precision Agriculture, and Sociology. Stacking the A.S. in Data Science into these bachelor's degree programs will produce data-enabled graduates in these fields that will deliver more value in the workplace than their less data-enabled colleagues with otherwise similar credentials. The A.S. in Data Science will also stack naturally into the B.S. in Data Science and the B.S. in Mathematics with Data Science Specialization.

Employers of recent graduates of the SDSU Department of Mathematics and Statistics who have emphasized data science in their program of study are diverse, cutting across many sectors of the economy. They 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, US Census Bureau, Weather Analytics, and Wells Fargo.

[11] https://www.wsj.com/articles/coding-boot-camps-attract-tech-companies-1470945503
[12] https://www.cnbc.com/2017/11/07/why-ibm-wants-to-hire-employees-who-dont-have-a-4-year-college-degree.html

Job titles of these recent graduates are also quite diverse, 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.

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

4. How will the proposed program benefit students?

As discussed in the response to question 3, demand for data-enabled graduates is substantial and cuts across many economic sectors. The proposed programs will produce data-enabled graduates capable of direct entry into the workforce in any of these sectors. They will also provide a means for students to either develop deep data science expertise through further study in graduate programs such as the M.S. in Data Science, or to incorporate enhanced data science skills into careers, undergraduate programs of study, or graduate programs of study in the applied, social, or natural sciences. Any of these paths lead to enhanced professional value in the students' chosen disciplines. In addition, any student who is pursuing a bachelor's degree and has fulfilled the requirements of the associate's degree will be awarded the associate's degree.

5. Program Proposal Rationale:

A. If a new degree is proposed, what is the rationale?[13]

SDSU is authorized to deliver the A.S. and B.S. degrees.

B. What is the rationale for the curriculum?

This curriculum derives primarily from other related departmental programs successfully created and delivered over the past ten years, particularly the M.S. in Data Science and the B.S. in Mathematics with Specialization in Data Science. The curricula for these programs were derived in turn from years of interaction with the industry advisory board and other regional and national stakeholders, as well as study of other successful programs such Montana Tech's B.S. in Data Science program. SDSU's Department of Mathematics and Statistics faculty have substantial regionally and nationally recognized expertise in this area as well, and after gathering input from the aforementioned sources discussed and developed the curricula for the proposed programs.

The curricula of the proposed programs have a strong applied, professional focus, in

[13] This question refers to the type of degree, not the program. For example, if your university has authorization to offer the Bachelor of Science and the program requested is a Bachelor of Science, then the request is not for a new degree.

keeping with that of the very successful M.S. in Data Science program to which they might naturally lead. As with the M.S. in Data Science, the proposed programs will prepare students for employment opportunities across broad swaths of both the public and private sectors.

C. Demonstrate/provide evidence that the curriculum is consistent with current national standards. *Complete the tables below and explain any unusual aspects of the proposed curriculum?*

There are no well-defined national standards in the sense of curriculum specified by an accrediting agency, given that no such accreditation is available. However, the curriculum addresses all major areas of the statistical, mathematical, and computational practice of data science that are accessible to undergraduates, is consistent with that of similar programs such as Montana Tech's B.S. in Data Science, and perhaps most importantly is modeled on the curricula of the department's other very successful data science programs. Learning outcomes for the proposed programs will similarly be modeled on those of the department's other data science programs. Students graduating from these programs have been very well prepared for regional and national professional opportunities.

D. Summary of the degree program:

The A.S. in Data Science would offer two options for some courses. The first set of options produces a program well suited for stacking into majors other than data science programs. [14] The second set of options produces a program well suited for stacking in data science programs.[15]

A.S. in Data Science	Credit Hours	Credit Hours	Percent
System General Education Requirements**	26 OR 25		
Subtotal, Degree Requirements		26 OR 25	43.3 OR 41.7%
Required Support Courses	3		
Major Requirements	21 OR 22		
Subtotal, Program Requirements		24 OR 25	40 OR 41.6%
General Electives		10	16.7%
Degree Total[16]		60	100%

**Board Policy 2:26 requires all associate degree programs to include 24 credits of coursework. At least three credit hours shall be earned from each of six goals (total of 18 credits). The additional six credits designated by SDSU will include Goal #1 and Goal # 3. Students would select between MATH 121-121L (5 credits) and MATH 123 (3 credits) for SGR #5. This has increased the System General Education Requirement from 25 to 26 credits.

[14] Courses selected for option 1 will stack into non-data science programs. Courses will include MATH 121-121L (SGR #5), STAT 281 or STAT 381 (Major Requirement), STAT 441 (Major Requirement), and STAT 442 (Major Requirement).
[15] Courses selected for option 2 will stack into data science programs. Courses will include MATH 123 (SGR #5), MATH 125 (Major Requirement), STAT 382 (Major Requirement), and STAT 482 (Major Requirement).
[16] 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.

System General Education Requirements

Prefix	Number	Course Title	Credit Hours	New (yes, no)
		SGR #1 Written Communication	3	No
		SGR #1 Written Communication	3	No
		SGR #2 Oral Communication	3	No
		SGR #3 Social Sciences/Diversity	3	No
		SGR #3 Social Sciences/Diversity	3	No
		SGR #4 Humanities and Arts/Diversity	3	No
MATH OR MATH	121-121L (Option 1) 123 (Option 2)	Survey of Calculus and Lab (5) Calculus I (4) (SGR #5 Mathematics)	4-5	No
INFO	101	Introduction to Informatics (SGR #6 Natural Sciences)	3	No
		Subtotal	26 (Option 1) OR 25 (Option 2)	

Required Support Courses Outside the Major

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

Major Requirements

Prefix	Number	Course Title	Credit Hours	New (yes, no)
STAT	101	Introduction to Data Science	3	No
STAT	410	SAS Programming	3	No
STAT	415	R Programming	3	No
STAT OR STAT OR STAT	281 (Option 1) 381 (Option 1) 382 (Option 2)	Introduction to Statistics (3) Introduction to Probability and Statistics (3) Probability and Statistics I (3)	3	No
STAT OR STAT	441 (Option 1) 482 (Option 2)	Statistical Methods II (3) Probability and Statistics II (3)	3	No
STAT OR MATH	442 (Option 1) 125 (Option 2)	Exploratory Data Analysis (3) Calculus II (4)	3-4	No
MATH OR MATH	250 253	Mathematics for Computer Science (3) Logic, Sets, and Proof (3)	3	No
		Subtotal	24 (Option 1) OR 25 (Option 2)	

B.S. in Data Science	Credit Hours	Credit Hours	Percent
System General Education Requirements**	32		
Subtotal, Degree Requirements		32	26.7%
Required Support Courses	3		
Major Requirements	23		
Major Electives	24		
Subtotal, Program Requirements		50	41.7%
General Electives		38	31.6%
Degree Total[17]		120	100%

**Board Policy 2:7 requires all baccalaureate degree programs to include 30 credits of coursework. PHYS 111-111L, PHYS 211-211L, CHEM 106-106L, CHEM 112-112L and BIOL 151-151L each require four credits. This has increased the System General Education Requirement from 30 to 32 credits.

System General Education Requirements

Prefix	Number	Course Title	Credit Hours	New (yes, no)
		SGR #1 Written Communication	3	No
		SGR #1 Written Communication	3	No
		SGR #2 Oral Communication	3	No
		SGR #3 Social Sciences/Diversity	3	No
		SGR #3 Social Sciences/Diversity	3	No
		SGR #4 Humanities and Arts/Diversity	3	No
		SGR #4 Humanities and Arts/Diversity	3	No
MATH	123	Calculus I (SGR #5 Mathematics)	4	No
INFO	101	Introduction to Informatics (SGR #6 Natural Sciences)	3	No
Select one of the following courses (SGR #6 Natural Sciences): 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	

Required Support Courses Outside the Major

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

[17] 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.

Major Requirements

Prefix	Number	Course Title	Credit Hours	New (yes, no)
MATH	125	Calculus II	4	No
MATH	198	The Mathematics Profession	1	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	401	Senior Capstone	2	No
STAT	382	Probability and Statistics I	3	No
STAT	482	Probability and Statistics II	3	No
		Subtotal	23	

Major Electives: List courses available as electives in the program. Indicate any proposed new courses added specifically for the major.

Select 24 credits from the following list.

Prefix	Number	Course Title	Credit Hours	New (yes, no)
CSC	250	Computer Science II	3	No
CSC	300	Data Structures	3	No
CSC	319	Parallel Computing	3	No
MATH	316	Discrete Math	3	No
MATH	374	Scientific Computation	3	No
MATH	475	Operations Research	3	No
STAT	101	Introduction to Data Science	3	No
STAT	383	Geospatial Data Analysis	3	No
STAT	410	SAS Programming	3	No
STAT	415	R Programming	3	No
STAT	441	Statistical Methods II	3	No
STAT	442	Exploratory Data Analysis	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

6. Student Outcomes and Demonstration of Individual Achievement

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.* **Complete Appendix A – Outcomes using the system form.** *Outcomes discussed below should be the same as those in Appendix A. The knowledge and competencies specific to the program must relate to the proposed assessments in B and C below.*

The knowledge and competencies for both proposed programs are the same. The level of sophistication at which each competency can be implemented will be higher for the B.S. program than the A.S. program.

Upon graduation, graduates of the A.S. and B.S. in Data Science will be able to:

- gather requirements from professional contexts and translate them into a clearly articulated data analysis problem.
- identify and gather the data necessary for the analysis and prepare the data for analysis.
- select the optimal combination of mathematical and statistical techniques necessary to solve this problem.
- select those software tools and computing environments that are optimal for implementing these mathematical and statistical techniques.
- conduct the analysis in a manner that produces well-understood and reproducible results, and avoids common analytical and ethical problems associated with data analysis.
- interpret the results of the analysis to generate actionable intelligence, and;
- communicate the results of the analysis to stakeholders in the optimal combination of written, graphical/visual, and verbal means.

See Appendix A for specific courses which meet these outcomes.

B. Are national instruments (i.e., examinations) available to measure individual student achievement in this field? If so, list them.

No national instruments are available to measure individual student achievement.

C. How will individual students demonstrate mastery? Describe the specific examinations and/or processes used, including any external measures.[18] What are the consequences for students who do not demonstrate mastery?

Students in the both programs will be assessed continuously throughout their two or four year degree program in accordance to the assessment plan for all departmental programs.

The proposed programs build on existing, successful departmental programs with strong, proven assessment processes in place. The existing framework of courses and faculty expertise will provide a strong foundation for student learning. In particular, capstone experiences in both programs will provide a final, cumulative opportunity to assess students level of mastery of all program learning outcomes.

Students failing to develop mastery of learning outcomes are unlikely to pass critical key core courses within the major and would then be forced to retake those courses. In addition, departmental assessment tools are designed to provide feedback to the curriculum process and instructional approaches taken by faculty teaching assessment courses. While the department cannot guarantee that all students will be successful, mechanisms are in place to ensure quality control and feedback loops which will engage continual review and revision of programs and courses.

[18] What national examination, externally evaluated portfolio or student activity, etc., will verify that individuals have attained a high level of competence and identify those who need additional work?

7. What instructional approaches and technologies will instructors use to teach courses in the program? *This refers to the instructional technologies and approaches used to teach courses and NOT the technology applications and approaches expected of students.*

The following approaches and technologies will be utilized:

- Lecture/Lab/Discussion
- Active learning infused throughout the curriculum
- Case Studies
- Desire 2 Learn classroom management software
- Remote conferencing technologies

8. Did the University engage any developmental consultants to assist with the development of the curriculum?[19] Did the University consult any professional or accrediting associations during the development of the curriculum? What were the contributions of the consultants and associations to the development of curriculum?

No consultants were utilized.

9. Are students enrolling in the program expected to be new to the university or redirected from other existing programs at the university? Complete the table below and explain the methodology used in developing the estimates (*replace "XX" in the table with the appropriate year*). *If question 12 includes a request for authorization for off-campus or distance delivery, add lines to the table for off-campus/distance students, credit hours, and graduate*

It is expected that students will be both new to the University and redirected from other programs.

Enrollment estimates for the B.S. in Data Science below are based on:

- Known interest among current B.S. in Mathematics students.
- Known interest in double majors among current students in other SDSU programs.
- Enrollment trends observed when the Department started the M.S. in Data Science program alongside the existing M.S. in Mathematics and M.S. in Statistics programs.

	Fiscal Years*			
	1st	2nd	3rd	4th
Estimates	FY 19	FY 20	FY 21	FY 22
Students new to the university	0	15	30	20
Students from other university programs	10	10	20	20
Continuing students	0	5	15	30
=Total students in the program (fall)	10	30	60	70
Program credit hours (major courses)**	130	390	780	910
Graduates	5	10	20	25

*Do not include current fiscal year.

[19] Developmental consultants are experts in the discipline hired by the university to assist with the development of a new program (content, courses, experiences, etc.). Universities are encouraged to discuss the selection of developmental consultants with Board staff.

**This is the total number of credit hours generated by students in the program in the required or elective program courses. Use the same numbers in Appendix B – Budget.

Enrollment estimates for the A.S. in Data Science below are based on:

- Interest in the M.S. in Data Science program and graduate certificate in Data Science expressed by students in other graduate programs.
- The heavy emphasis being placed on alternative, non-four-year degree credentials by the IT industry and multiple levels of government.

These estimates are necessarily less precise than those for the proposed B.S. in Data Science program. It is important to note that no new classes will be required for either of these degrees, so no courses offered in the A.S. of Data Science program will be depending on large enrollment in this program in order to be financially viable.

	Fiscal Years*			
	1st	2nd	3rd	4th
Estimates	FY 19	FY 20	FY 21	FY 22
Students new to the university	5	5	5	5
Students from other university programs	0	0	5	5
Continuing students	0	5	5	5
=Total students in the program (fall)	5	10	15	15
Program credit hours (major courses)**	70	140	210	210
Graduates	0	4	8	8

10. Is program accreditation available? If so, identify the accrediting organization and explain whether accreditation is required or optional, the resources required, and the University's plans concerning the accreditation of this program.

Accreditation is not available.

11. Does the University request any exceptions to any Board policy for this program? Explain any requests for exceptions to Board Policy. *If not requesting any exceptions, enter "None."*

None.

12. Delivery Location[20]

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 online program)?

A.S. and B.S. in Data Science

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

	Yes/No	*Intended Start Date*
On campus	Yes	2018-2019 Academic Year

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

A.S. in Data Science

	Yes/No	*If Yes, identify delivery methods*[21]	*Intended Start Date*
Distance Delivery (online/other distance delivery methods)	Yes	015 Internet Asynchronous – Term Based Instruction	2018-2019 Academic Year

B.S. in Data Science

Distance Delivery (online/other distance delivery methods)	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 online program)? [22]

B.S. in Data Science

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

45% of the B.S. in Data Science is available online.

13. Cost, Budget, and Resources: Explain the amount and source(s) of any one-time and continuing investments in personnel, professional development, release time, time redirected from other assignments, instructional technology & software, other operations and maintenance, facilities, etc., needed to implement the proposed major. Address off-campus or distance delivery separately.

A program budget is provided in Appendix B. All courses and faculty necessary to offer this program are already in place as part of existing programs. The A.S. and B.S. in Data Science programs would be supported by the applying the same MATH and STAT program fees applied to the B.S. in Mathematics. New enrollment generated by this program will be managed by adding GTA support as needed in existing courses to keep faculty workload unchanged. Faculty FTE stated in the budget represent the portion of an FTE that will be devoted to teaching students in this program, who will represent part but not all of the enrollment in any given course.

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

14. Is the university requesting or intending to request permission for a new fee or to attach an existing fee to the program)? *If yes, explain.*

☐ Yes ☒ No

Explanation (if applicable):

15. New Course Approval: New courses required to implement the new undergraduate degree program may receive approval in conjunction with program approval or receive approval separately. Please check the appropriate statement:

☐ YES,
the university is seeking approval of new courses related to the proposed program in conjunction with program approval. All New Course Request forms are included as Appendix C and match those described in section 5D.

☒ NO,
the university is not seeking approval of all new courses related to the proposed program in conjunction with program approval; the institution will submit new course approval requests separately or at a later date in accordance with Academic Affairs Guidelines.

Appendix A
A.S. and B.S. in Data Science – Student Learning Outcomes

A.S. in Data Science

	Program Courses that Address the Outcomes														
	Required Coursework														
Individual Student Outcome	CSC 150	INFO 101	MATH 121/L	MATH 123	MATH 125	MATH 250	MATH 253	STAT 101	STAT 281	STAT 381	STAT 382	STAT 410	STAT 441	STAT 442	STAT 482
Gather requirements from professional contexts and translate them into a clearly articulated data analysis problem.								X	X	X	X		X	X	X
Identify and gather the data necessary for the analysis and prepare the data for analysis.								X	X	X	X		X	X	X
Select the optimal combination of mathematical and statistical techniques necessary to solve this problem.	X	X										X		X	X
Select those software tools and computing environments that are optimal for implementing these mathematical and statistical techniques.								X	X	X	X		X	X	
Conduct the analysis in a manner that produces well-understood and reproducible results, and avoids common analytical and ethical problems associated with data analysis.								X	X	X	X		X	X	X
Interpret the results of the analysis to generate actionable intelligence.								X	X	X	X		X	X	X
Communicate the results of the analysis to stakeholders in the optimal combination of written, graphical/visual, and verbal means.								X	X	X	X		X	X	X

MATH 121/L, MATH 123, MATH 125, MATH 250, AND MATH 253 are prerequisites for other required courses included in this table.

B.S. in Data Science

	Program Courses that Address the Outcomes																											
	Required Coursework												Electives															
Individual Student Outcome	CSC 150	INFO 101	MATH 123	MATH 125	MATH 198	MATH 225	MATH 230	MATH 253	MATH 315	MATH 401	STAT 382	STAT 482	CSC 250	CSC 300	CSC 319	MATH 316	MATH 374	MATH 475	STAT 101	STAT 383	STAT 410	STAT 415	STAT 441	STAT 442	STAT 445	STAT 451	STAT 453	STAT 460
Gather requirements from professional contexts and translate them into a clearly articulated data analysis problem.											X	X						X	X	X			X	X	X	X	X	X
Identify and gather the data necessary for the analysis and prepare the data for analysis.											X	X							X	X			X	X	X	X	X	X
Select the optimal combination of mathematical and statistical techniques necessary to solve this problem.											X	X				X		X	X	X			X	X	X	X	X	X
Select those software tools and computing environments that are optimal for implementing these mathematical and statistical techniques.	X	X											X	X	X		X				X	X	X						
Conduct the analysis in a manner that produces well-understood and reproducible results, and avoids common analytical and ethical problems associated with data analysis.											X	X				X		X	X	X		X	X	X	X	X	X	X
Interpret the results of the analysis to generate actionable intelligence.											X	X							X	X		X	X	X	X	X	X	X
Communicate the results of the analysis to stakeholders in the optimal combination of written, graphical/visual, and verbal means.										X									X	X			X	X	X	X	X	X

MATH 123, 125, 198, 225, 230, 253, and 315 are prerequisites for other required courses included in this table.

Appendix B
Budget and Resources

SDSU A.S. in Data Science

1. Assumptions		1st	2nd	3rd	4th
Headcount & hours from proposal		FY19	FY20	FY21	FY22
Fall headcount (see table in proposal)		5	10	15	15
Program FY cr hrs, On-Campus		70	140	210	210
Program FY cr hrs, Off-Campus		0	0	0	0
Faculty, Regular FTE	See p. 3	*0.06*	*0.12*	*0.18*	*0.18*
Faculty Salary & Benefits, average	See p. 3	$89,123	$89,123	$89,123	$89,123
Faculty, Adjunct - number of courses	See p. 3	0	0	0	0
Faculty, Adjunct - per course	See p. 3	$1,000	$1,000	$1,000	$1,000
Other FTE (see next page)	See p. 3	*0.00*	*0.00*	*1.00*	*1.00*
Other Salary & Benefits, average	See p. 3	$16,968	$16,968	$16,968	$16,968

2. Budget				
Salary & Benefits				
Faculty, Regular	$5,199	$10,398	$15,597	$15,597
Faculty, Adjunct (rate x number of courses)	$0	$0	$0	$0
Other FTE	$0	$0	$16,968	$16,968
S&B Subtotal	$5,199	$10,398	$32,565	$32,565
Operating Expenses				
Travel	$0	$0	$0	$0
Contractual Services	$0	$0	$0	$0
Supplies & materials	$0	$0	$0	$0
Capital equipment	$0	$0	$0	$0
OE Subtotal	$0	$0	$0	$0
Total	**$5,199**	**$10,398**	**$32,565**	**$32,565**

3. Program Resources					
Off-campus support tuition/hr, HEFF net	UG	$296.48	$296.48	$296.48	$296.48
Off-campus tuition revenue	hrs x amt	$0	$0	$0	$0
On-campus support tuition/hr, HEFF net	UG	$296.48	$296.48	$296.48	$296.48
On-campus tuition revenue	hrs x amt	$20,753	$41,507	$62,260	$62,260
Program fee, per cr hr (if any)	$40.25	$2,818	$5,635	$8,453	$8,453
Delivery fee, per cr hr (if any)	$0.00	$0	$0	$0	$0
University redirections		$0	$0	$0	$0

Community/Employers	$0	$0	$0	$0
Grants/Donations/Other	$0	$0	$0	$0
Total Resources	**$23,571**	**$47,142**	**$70,712**	**$70,712**
Resources Over (Under) Budget	**$18,372**	**$36,744**	**$38,147**	**$38,147**

Provide a summary of the program costs and resources in the new program proposal.

Estimated Salary & Benefits per FTE		Faculty	Other
Estimated salary (average) - explain below		$70,513	$16,800
University's variable benefits rate	(see below)	0.1438	0.0100
Variable benefits		$10,140	$168
Health insurance/FTE, FY18		$8,470	
Average S&B		$89,123	$16,968

Explain faculty used to develop the average salary & fiscal year salaries used. Enter amount above.

The FY18 salaries of 9 people in the Mathematics and Statistics Department were averaged.

Explain adjunct faculty costs used in table:

NA

Explain other [for example, CSA or exempt] salary & benefits. Enter amount above.

"Other" salary and benefit information contained in column E is for Graduate Teaching Assistants.

Summarize the operating expenses shown in the table:

Routine expenses are included with those for the B.S. in Data Science program specified on the other tab of this document.

Summarize resources available to support the new program (redirection, donations, grants, etc).

No specific redirection will occur, but it's worth noting that no new courses will be developed to support this program, and no new faculty will be hired to support this program. New enrollment generated by this program will be managed by adding GTA support as needed in existing courses to keep faculty workload unchanged. Faculty FTE stated in section one represent the portion of an FTE that will be devoted to teaching students in this program, who will represent part but not all of the enrollment in any given course.

SDSU B.S. in Data Science

1. Assumptions		1st FY19	2nd FY20	3rd FY21	4th FY22
Headcount & hours from proposal					
Fall headcount (see table in proposal)		10	30	60	70
Program FY cr hrs, On-Campus		130	390	780	910
Program FY cr hrs, Off-Campus		0	0	0	0
Faculty, Regular FTE	See p. 3	*0.11*	*0.33*	*0.65*	*0.76*
Faculty Salary & Benefits, average	See p. 3	$89,123	$89,123	$89,123	$89,123
Faculty, Adjunct - number of courses	See p. 3	0	0	0	0
Faculty, Adjunct - per course	See p. 3	$1,000	$1,000	$1,000	$1,000
Other FTE (see next page)	See p. 3	*0.00*	*2.00*	*4.00*	*5.00*
Other Salary & Benefits, average	See p. 3	$16,968	$16,968	$16,968	$16,968

2. Budget				
Salary & Benefits				
Faculty, Regular	$9,655	$28,965	$57,930	$67,585
Faculty, Adjunct (rate x number of courses)	$0	$0	$0	$0
Other FTE	$0	$33,936	$67,872	$84,840
S&B Subtotal	$9,655	$62,901	$125,802	$152,425
Operating Expenses				
Travel	$0	$0	$0	$0
Contractual Services	$0	$0	$0	$0
Supplies & materials	$1,000	$1,000	$2,000	$2,000
Capital equipment	$1,000	$1,000	$2,000	$2,000
OE Subtotal	$2,000	$2,000	$4,000	$4,000
Total	**$11,655**	**$64,901**	**$129,802**	**$156,425**

3. Program Resources					
Off-campus support tuition/hr, HEFF net	UG	$296.48	$296.48	$296.48	$296.48
Off-campus tuition revenue	hrs x amt	$0	$0	$0	$0
On-campus support tuition/hr, HEFF net	UG	$296.48	$296.48	$296.48	$296.48
On-campus tuition revenue	hrs x amt	$38,542	$115,625	$231,251	$269,792
Program fee, per cr hr (if any)	$40.25	$5,233	$15,698	$31,395	$36,628
Delivery fee, per cr hr (if any)	$0.00	$0	$0	$0	$0
University redirections		$0	$0	$0	$0
Community/Employers		$0	$0	$0	$0
Grants/Donations/Other		$0	$0	$0	$0

Total Resources	**$43,774**	**$131,323**	**$262,646**	**$306,420**
Resources Over (Under) Budget	**$32,119**	**$66,422**	**$132,844**	**$149,995**

Provide a summary of the program costs and resources in the new program proposal.

Estimated Salary & Benefits per FTE		Faculty	Other
Estimated salary (average) - explain below		$70,513	$16,800
University's variable benefits rate	(see below)	0.1438	0.0100
Variable benefits		$10,140	$168
Health insurance/FTE, FY18		$8,470	$0
Average S&B		$89,123	$16,968

Explain faculty used to develop the average salary & fiscal year salaries used. Enter amount above.

The FY18 salaries of 9 people in the Mathematics and Statistics Department were averaged.

Explain adjunct faculty costs used in table:

NA

Explain other [for example, CSA or exempt] salary & benefits. Enter amount above.

"Other" salary and benefit information contained in column E is for Graduate Teaching Assistants.

Summarize the operating expenses shown in the table:

Routine expenses such as materiala, copying, and printing are included, as are periodic upgrades for items used in online teaching such as webcams, headsets, and video processing systems.

Summarize resources available to support the new program (redirection, donations, grants, etc).

No specific redirection will occur, but it's worth noting that no new courses will be developed to support this program, and no new faculty will be hired to support this program. New enrollment generated by this program will be managed by adding GTA support as needed in existing courses to keep faculty workload unchanged. Faculty FTE stated in section one represent the portion of an FTE that will be devoted to teaching students in this program, who will represent part but not all of the enrollment in any given course.

State-support: Change cell on page 1 to use the UG or GR net amount.

Off-Campus Tuition, HEFF & Net	FY18 Rate	HEFF	Net	
Undergraduate	$335.00	$38.53	**$296.48**	*Change cell on page 1*
Graduate	$444.25	$51.09	**$393.16**	*to point to your net*
Externally Supported	$40.00			

State-support: Change cell on page 1 to use the UG or GR net amount for your university.

On-Campus Tuition, HEFF & Net	FY18 Rate	HEFF	Net	
UG Resident - DSU, NSU, SDSU, USD	$239.70	$27.57	**$212.13**	*Change cell on page 1*
UG Resident - BHSU	$250.45	$28.80	**$221.65**	*to point to your net*
UG Resident - SDSMT	$246.00	$28.29	**$217.71**	
GR Resident - DSU,NSU,SDSU,USD	$314.70	$36.19	**$278.51**	*Change cell on page 1*
GR Resident - BHSU	$323.35	$37.19	**$286.16**	*to point to your net*
GR Resident - SDSMT	$320.05	$36.81	**$283.24**	
UG Nonresident - DSU,NSU	$337.35	$38.80	**$298.55**	*Change cell on page 1*
UG Nonresident - BHSU	$350.45	$40.30	**$310.15**	*to point to your net*
UG Nonresident - SDSU, USD	$347.95	$40.01	**$307.94**	
UG Nonresident - SDSMT	$385.30	$44.31	**$340.99**	
GR Nonresident - DSU,NSU	$585.50	$67.33	**$518.17**	*Change cell on page 1*
GR Nonresident - BHSU	$603.35	$69.39	**$533.96**	*to point to your net*
GR Nonresident - SDSU, USD	$605.05	$69.58	**$535.47**	
GR Nonresident - SDSMT	$642.35	$73.87	**$568.48**	
UG Sioux Falls Associate Degree	$271.35	$31.21	**$240.14**	*Change cell on page 1 to point to your net*

Variable Benefits Rates

University	FY18	
BHSU	14.64%	*Change the benefits rate cell in the table on page 2 to point to the rate for your university.*
DSU	14.36%	
NSU	14.31%	
SDSM&T	14.20%	
SDSU	14.38%	
USD	14.34%	