



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 (SDS-113-~~68-113~~).

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 2020. The SDBOR's strategic plan calls out the

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

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 Labor Bulletin⁹ 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 Markets¹⁰ 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 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/LinkedIn2017USEmergingJobsReport>

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

Job titles of these recent graduates are also quite diverse, including, 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 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 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?

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

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 as 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

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 program 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 programs.

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

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

** 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:

- x Interest in the M.S. in Data Science program graduate certificate in Data Science expressed by students in other graduate programs.
- x The heavy emphasis being placed on alternative 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.

Estimates	Fiscal Years*			
	1 st	2 nd	3 rd	4 th
	FY 19	FY 20	FY 21	

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 at a later date in accordance with Academic Affairs Guidelines.

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

Total Resources	\$43,774	\$131,323	\$262,646	\$306,420
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