



**SOUTH DAKOTA BOARD OF REGENTS
ACADEMIC AFFAIRS FORMS**

New Graduate Degree Program

UNIVERSITY:	DSU and SDSU
PROPOSED GRADUATE PROGRAM:	Doctor of Philosophy (Ph. D.) in Computer Science (DSU and SDSU)
EXISTING OR NEW MAJOR(S):	Existing
DEGREE:	Doctor of Philosophy
EXISTING OR NEW DEGREE(S):	Existing
INTENDED DATE OF IMPLEMENTATION:	2020-2021 Academic Year
PROPOSED CIP CODE:	11.0101
SPECIALIZATIONS:¹	None
IS A SPECIALIZATION REQUIRED (Y/N):	No
DATE OF INTENT TO PLAN APPROVAL:	6/27/2018
UNIVERSITY DEPARTMENT:	Grad Study Electrical Engineering & Computer Science (SDSU) Beacom College of Computer & Cyber Sciences (DSU)
UNIVERSITY DIVISION:	Graduate School (SDSU) Beacom College of Computer and Cyber Sciences (DSU)

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.

President of the University, Dakota State University	Click here to enter a date. <hr style="width: 100%;"/> Date
President of the University, South Dakota State University	Click here to enter a date. <hr style="width: 100%;"/> Date

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

Dakota State University (DSU) and South Dakota State University (SDSU) request authorization to offer Ph.D. programs in Computer Science. The request is in response to a national need for professionals educated in computer science. A Ph.D. in Computer Science offers the opportunity to conduct theoretical and practical research in a broad range of

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.

subfields of computer science or in the intersection of computer science and other disciplines. The field's interdisciplinary nature means that graduates will be able to work in a wide range of industries in both the private and public sector. Computer science teaches algorithmic and analytical principles that can be applied to develop optimized, and possibly intelligent solutions to various data and process centric problems. Computer science has interdisciplinary relevance to every other discipline, ranging from medical science to liberal arts.² According to the Bureau of Labor Statistics: "Computer and information research scientists invent and design new approaches to computing technology and find innovative uses for existing technology. They study and solve complex problems in computing for business, medicine, science, and other fields."³ In the absence of a Computer Science Ph.D. program, the Universities miss out on various opportunities, including many high paying jobs for graduates, and numerous interdisciplinary grants for researchers.

Collaboration between Dakota State University (DSU) and South Dakota State University (SDSU) will enable cost-savings in program delivery through sharing of courses via distance delivery and sharing of research facilities. Additionally, it will enhance program competitiveness for research funding by leveraging the resources of each institution and create a larger pool of faculty, students, facilities, and equipment.

The South Dakota system of higher education is the only state university system that does not offer a Ph.D. program in computer science. This lessens the ability to keep talented graduate students in the state as they seek opportunities for advanced studies out of state.

Both universities regularly receive inquiries about a Ph.D. program in computer science from students wishing to study in South Dakota.

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?⁴

The Legislature established Dakota State University as an institution specializing in programs in computer management, computer information systems, and other related undergraduate and graduate programs as outlined in SDCL 13-59-2.2. The Beacom College of Computer and Cyber Sciences provides complete realization of this mission in its programs related to computer science, network administration, computer game design and cybersecurity. The Board implemented SDCL 13-59-2.2 by authorizing undergraduate and graduate programs that are technology-infused and promote excellence in teaching and learning. These programs support research, scholarly and creative activities and provide service to the State of South Dakota and the region.

A STEM University

In pursuing this state mandated mission in computing and informational sciences, enrollment at DSU shows 1555 STEM students, or approximately 66.7% of student population⁵. Enrollment

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

³ https://www.bls.gov/ooh/computer-and-information-technology/computer-and-information-research-scientists.htm?view_full

⁴ 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.

⁵ US Department of Homeland Security, Fact Book SD Board of Regents, and the Consortium for Student Retention Data Exchange (2018).

at DSU in STEM fields show just how committed the institution is to its mission and encourages us to maintain a steady focus on these fields in our mission-driven decision making. Our mission specificity and U.S. workforce data suggests large increases in workforce demand for cyber security professionals. We have responded through our DSU Rising Initiatives, which include but are not limited to:

- 1) The Aug. 20, 2017 opening of the Beacom Institute (the first LEED version 4 building in South Dakota) dedicated to computing and cyber sciences instruction including a Computer game design suite, Animation lab, Network and security administration lab all in its 31,000 Sq. ft. imprint.
- 2) The Fall 2019, opening of the Madison Cyber Labs, a research and development facility with hub of cybersecurity and cyber operations expertise, education, applied research and economic development.
- 3) Collaborations with prominent STEM-related federal agencies to promote cyber science education, research and workforce development.

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). SDSU's Jerome J. Lohr College of Engineering supports a variety of engineering programs as well as undergraduate and graduate computer science programs. The proposed doctoral program is consistent with the statutory mission of South Dakota State University, as provided in SDCL 13-58-1 with its focus on applied and theoretical research. The program will add to the knowledge and increase the number of highly skilled graduates available to work in South Dakota and the surrounding area.

The purpose of the proposed Ph.D. programs is to advance the following systems strategic goals (Policy 1:21) and State initiatives:

- Expand graduate education.
- Enhance competitiveness for research funding: Doctoral students are skilled researchers who enable our universities to propose greater quantity and quality research activities.
- Encourage student engagement in research: The robust research programs that accompany Ph.D. programs create new research opportunity for our current undergraduate students.
- Support the needs of South Dakota and regional industries with the talent and technological expertise needed in today's economy.

This program supports several DSU goals found in its strategic plan⁶ Excellence through Innovation 2020; Grow to Thrive - By improving access and opportunity, DSU will enroll, retain, and graduate a larger, more diverse student body, Innovate to Transform - Continuously enhance our academic programs, university facilities, student services, and campus technologies to become a more effective and efficient university, and Collaborate to Lead - By fostering collaborative relationships with internal and external stakeholders, DSU will expand educational opportunities for students.

⁶ <https://dsu.edu/assets/uploads/resources/Strategic-Plan.pdf>

The program is consistent with SDSU’s current strategic plan Imagine 2023: Aspire. Discover. Achieve.⁷ Imagine 2023 includes the over-arching strategic goal: Foster Innovation and Increase Research, Scholarship, and Creative Activity (RSCA) along with more specific action steps [1] Strengthen the leadership and personnel infrastructure for innovation, RSCA, and economic development to serve the state, region, nation, and world. And [2] Increase, optimize, and align the physical resources and investments for innovation, RSCA, and economic development.

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.

Federal and state governments, large- and medium-size corporations, the military, including the National Guard and Reserve, need people educated with the knowledge and skills required in the doctoral level degree in computer science. The national job outlook for graduates with a terminal degree in computer science is very strong. The Bureau of Labor Statistics forecasts the need for 33,480 more computer science professionals by 2026 than the United States had in 2016 (27,900) which is an increase of 19%. The primary purpose for proposing this program is workforce development, as the United States anticipates dramatic workforce demand in computer science professionals. Computer science professionals who write, test and debug code have a median pay of \$111,840 per year.⁸

Occupational projections for computer science related professions within South Dakota indicate strong demand, as described below:

**South Dakota Department of Labor and Regulation
 Occupational Estimates and Projections, 2014-2024
 Selected Occupations Related to Computer Science⁹**

Occupation	Occupation Code	2014 Estimated Employment	2024 Projected Employment	Total 2014-2024 Employment Change	2014-2024 Annual Average Percent Change	Total Percent Change
Computer and Mathematical	150000	7,437	8,251	814	1.04%	10.95%
Computer Network Architects	151143	191	207	16	0.81%	8.38%
Computer Network Support Specialists	151152	759	831	72	0.91%	9.49%
Computer Occupations, All Other	151199	203	211	8	0.39%	3.94%
Computer Programmers	151131	609	564	-45	-0.76%	-7.39%
Computer Systems Analysts	151121	580	694	114	1.81%	19.66%

⁷ https://www.sdstate.edu/sites/default/files/2018-01/Imagine_2023_012318_online_spread.pdf

⁸ https://www.bls.gov/ooh/computer-and-information-technology/computer-and-information-research-scientists.htm?view_full

⁹ South Dakota estimates and projections from South Dakota Department of Labor <http://dlr.sd.gov/lmic/default.aspx>

Occupation	Occupation Code	2014 Estimated Employment	2024 Projected Employment	Total 2014-2024 Employment Change	2014-2024 Annual Average Percent Change	Total Percent Change
Computer User Support Specialists	151151	1,687	1,872	185	1.05%	10.97%
Information Security Analysts	151122	146	168	22	1.41%	15.07%
Network and Computer Systems Administrators	151142	1,645	1,802	157	0.92%	9.54%
Software Developers, Applications	151132	852	994	142	1.55%	16.67%
Software Developers, Systems Software	151133	238	272	34	1.34%	14.29%
Statisticians	152041	22	28	6	2.44%	27.27%
Web Developers	151134	309	383	74	2.17%	23.95%

**United States Department of Labor
 Occupational Estimates and Projections, 2016-2026
 Selected Occupations Related to Computer Science¹⁰**

Occupation Title	SOC Code	Employment 2016	Employment 2026	Employment Change 2016-2026	Employment Change Percent	Occupational Openings	2016 Median Annual Wage
Computer and information research scientists	15-1111	27.9	33.2	5.4	19.2	2.5	111,840
Computer and information systems managers	11-3021	367.6	411.4	43.8	11.9	32.5	135,800
Computer hardware engineers	17-2061	73.6	77.6	4.0	5.5	5.1	115,080
Computer network architects	15-1143	162.7	173.1	10.4	6.4	11.7	101,210
Computer network support specialists	15-1152	198.8	214.8	16.1	8.1	16.5	62,670
Computer numerically controlled machine tool programmers, metal and plastic	51-4012	25.1	29.2	4.1	16.3	3.1	50,580
Computer occupations, all other	15-1199	287.2	313.1	25.9	9.0	22.3	86,510
Computer programmers	15-1131	294.9	272.3	-22.6	-7.6	15.4	79,840

¹⁰ Estimates and projections from United States Department of Labor <https://data.bls.gov/projections/occupationProj>

Occupation Title	SOC Code	Employment 2016	Employment 2026	Employment Change 2016-2026	Employment Change Percent	Occupational Openings	2016 Median Annual Wage
Computer science teachers, postsecondary	25-1021	39.7	42.8	3.2	8.0	3.4	77,570
Computer systems analysts	15-1121	600.5	653.5	53.0	8.8	44.8	87,220

4. How will the proposed program benefit students?

The 44th annual Computing Research Association (CRA) Taulbee Survey (2014) reports that among all new 2013-14 Ph.D. graduates in computer science seeking jobs in North America, 57.5% were hired by industries, 27.3% were hired by academia, 3% were hired by the government, 1.2% were self-employed, and only 0.7% were unemployed at the time of the survey.² The Bureau of Labor Statistics projects that the number of jobs requiring a doctorate degree in Computer Science will increase by 15.3% by the year 2022 (Table 2).¹¹

Computer and Mathematical Occupations Employment by Educational Requirement, 2012 and projected 2022 (employment in thousands)

Education Level	Employment		Projected change, 2012–2022	
	2012	2022	Number	Percent
Bachelor's degree	2,893.1	3,415.2	522.1	18.0
Some college, no degree	547.7	658.5	110.8	20.2
Associate's degree	316.1	356.6	40.6	12.8
Master's degree	31.1	39.2	8.2	26.3
Doctoral or professional degree	26.7	30.8	4.1	15.3

South Dakota currently does not produce doctoral candidates in this area. Doctorate degrees are necessary to fill jobs and help with research at the federal, state, local and corporate levels. Offering a Ph.D. in Computer Science will help students in filling those jobs. Computer science provides graduates with the tools, knowledge, and vision to build systems and applications and these students will be the beneficiaries of good, relatively high paying career-predictive jobs. This program will further strengthen current programs in cyber operations and cyber defense by creating expertise among the faculty in the area of artificial intelligence and software development, the emerging tools of cyber infrastructure.

According to FederalPay.org, computer scientist was the 146th most popular job in the U.S. Government in 2016, with 1,306 employed. The most common payscale was the general schedule payscale.¹² In 2016, the Federal Aviation Administration hired the most employees titled Computer Science, with an average salary of \$123,922.¹³ According to US News, Computer Science is number four on the list of fields in which doctorates lead to jobs.¹⁴ And

¹¹ <https://www.bls.gov/opub/mlr/2013/article/occupational-employment-projections-to-2022.htm>

¹² <https://www.federalpay.org/gs>

¹³ <https://www.federalpay.org/employees/federal-aviation-administration>

¹⁴ <https://www.usnews.com/education/best-graduate-schools/articles/2017-04-03/4-fields-where-doctorates-lead-to-jobs>

according to fortune.com, a Ph.D. in Computer Science is #3 on the Best 15 Graduate Degrees for Jobs (M.S. in Computer Science is #6).¹⁵

Agencies hiring Computer Scientist¹⁶	Employees Hired	Average Salary
Federal Aviation Administration	225	\$123,921.56
National Institute of Standards and Technology	194	\$131,781.84
National Institutes of Health	167	\$133,210.54
Federal Bureau of Investigation	118	\$101,699.68
Ames Research Center	64	\$153,990.83
Geological Survey	60	\$98,055.23
Centers for Disease Control and Prevention	58	\$113,983.22
National Science Foundation	50	\$167,286.82
Food and Drug Administration	49	\$109,529.96
Internal Revenue Service	39	\$130,484.03

The program offers a growing number of students an opportunity for specialized training in computer science. The number of students graduating from DSU, SDSU, and other regional schools in computer science-related majors has grown exponentially. This trend is mirrored regionally and nationally. This program offers an opportunity for highly specialized skills sets in a field requiring more specialized training and an opportunity for students to stay in the state to obtain them.

SD Public University Graduates in Computer Science and Information Systems

Baccalaureate Degrees Conferred	DSU	NSU	SDSMT	SDSU	USD	System
2012 Graduates	92	3	20	12	7	134
2013 Graduates	95	5	19	22	5	146
2014 Graduates	112	3	13	24	9	161
2015 Graduates	110	1	21	24	8	164
2016 Graduates	124	5	30	17	11	187
2017 Graduates	151	2	18	31	10	212
2018 Graduates	183	3	27	30	16	259
Total Graduates	867	22	148	160	66	1263

From the 2013-2019 SDBOR Fact Books

Opportunities for funded and disciplinary research. The proposed program will help to attract and retain high-quality faculty members with active research agendas in computer science and related fields. Students enrolled in this proposed program will have opportunities to participate in that research which will shape their own emerging research agenda.

5. Program Proposal Rationale:

A. If a new degree is proposed, what is the rationale?¹⁷

¹⁵ <http://fortune.com/2016/03/21/best-worst-graduate-degrees-jobs-2016/>

¹⁶ <https://www.federalpay.org/employees/occupations/computer-science>

¹⁷ “New Degree” means new to the university. Thus if a campus has degree granting authority for a Ph.D. program and the request is for a new Ph.D. program, a new degree is not proposed.

Both institutions are authorized to offer the Ph.D.

B. What is the rationale for the curriculum?

DSU and SDSU are both proposing to offer a Ph.D. in Computer Science. Both programs will share a common core that will provide an essential body of knowledge for undertaking research in the area. Each program will offer distinct specializations and/or electives in order to allow students to specialize and tailor their program of study to meet their career goals as professionals in the field. Although both programs are designed to support areas of theoretical/applied research in computer science, DSU will leverage its expertise with applying machine learning, analytics, and information management in areas such as cyber security, while the SDSU program will emphasize expertise in areas such as precision agriculture solutions employing machine learning and data analytics.

The two programs will benefit by being able to use faculty strengths available at both schools to strengthen students' course and research options. Jointly, the DSU and SDSU faculty will offer a program that will fully prepare students to meet the needs of South Dakota and the region.

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?

National standards do not exist for a Ph.D. in Computer Science.

D. Summary of the degree program (complete the following tables):

Ph. D. in Computer Science @ DSU & SDSU	Credit Hours	Percent
Required courses, all students	18	25%
Electives	24-30	33-42%
Dissertation	24-30	33-42%
Total Required for the Degree Total	72	100%

Required Courses

Prefix	Number	Course Title	Locations	Credit Hours	New (yes, no)
CSC	705	Design and Analysis of Computer Algorithms	DSU & SDSU	3	No
CSC	710	Structure and Design of Programming Languages	DSU & SDSU	3	No
CSC	718	Operating Systems & Parallel Programming	DSU	3	No
CSC	720	Theory of Computation	DSU & SDSU	3	No
CSC	722	Machine Learning Fundamentals	DSU	3	No
CSC	770	Software Engineering Management	SDSU	3	No
Subtotal				18	

Elective Courses: List courses available as electives in the program. Indicate any proposed new courses added specifically for the program.

Complete 18 credits with two courses from each of the 3 areas listed below. Theory, Systems, Application.

Choose remaining elective courses (6 - 12 credits) with advisor approval from graduate level CSC, INFA, INFS, MATH, STATS, or other approved areas (supporting dissertation research).

A maximum of 9 credits at the 500 (or equivalent) level can be applied as Elective in the program.

Prefix	Number	Course Title	Locations	Credit Hours	New (yes, no)
Theory Courses (must select minimum of two)					
CSC	533	Computer Graphics	DSU & SDSU	3	No
CSC	547	Artificial Intelligence	DSU & SDSU	3	No
CSC	574	Computer Networks	SDSU	3	No
CSC	748	Software Exploitation	DSU	3	No
INFA	723	Cryptography	DSU	3	No
INFS	766	Advanced Database	DSU	3	No
INFS	768	Predictive Analytics for Decision Making	DSU	3	No
MATH	575	Operations Research	DSU & SDSU	3	No
MATH	675	Operations Research II	SDSU	3	No
STAT	601	Modern Applied Statistics I	SDSU	3	No
STAT	602	Modern Applied Statistics II	SDSU	3	No
Systems Courses (must select minimum of two)					
CSC or CSC	574 750	Computer Networks IT Infrastructure, Technology and Network Management	SDSU DSU	3 3	No No
CSC	592	Topics: Advanced High Performance Computing	DSU & SDSU	3	No
CSC	600	Accelerated Computer Science Fundamentals	SDSU	3	No
CSC	716	Secure Software Engineering	DSU	3	No
INFS	760	Enterprise Modeling and Data Management	DSU	3	No
Application Courses (must select minimum of two)					
CSC	592	Topics: Mobile Applications	SDSU	3	No
CSC	592	Topics: Internet Programming	SDSU	3	No
CSC	630	Principles of Data Base Systems Design	SDSU	3	No
CSC	750	Recent Advances in Parallel Processing	SDSU	3	No
INFA	701	Principles of Information Assurance	DSU	3	No
INFA	735	Offensive Security	DSU	3	No

Prefix	Number	Course Title	Locations	Credit Hours	New (yes, no)
INFS	730	Web Application Development	DSU	3	No
INFS	736	Technology for Mobile Devices	DSU	3	No
INFS	764	Information Retrieval	DSU	3	No
INFS	766	Advanced Databased	DSU	3	No
MATH	773	Numerical Optimization	SDSU	3	No
MATH	774	Advanced Scientific Computation	SDSU	3	No

Dissertation:

With advisor approval, credits will be applied for work related to students’ dissertation research.

- DSU students will be required to take the following as part of Dissertation work:
 CSC 804 – Research Methodologies (3 cr.)
 CSC 809 – Dissertation Preparation (3 cr.)

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 student learning outcomes were developed to ensure that all graduates are prepared to enter employment in industry, as post-doctoral researchers, or faculty in higher education. Upon graduation, graduates of either school will:

- Be able to demonstrate a broad and comprehensive understanding of core knowledge and fundamental principles in computer science.
- Be able to demonstrate conceptual knowledge and ability to demonstrate prevalent technologies of computer science.
- Be able to demonstrate a highly developed knowledge of literature in their area of computer science or closely related research.
- Be able to effectively formulate, execute, communicate, present, and defend the result and conclusions of original research.

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

None

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?

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?

Mastery will be demonstrated through assessment of the student learning outcomes. Specifically, upon completion of courses students will have demonstrated mastery through the following assessment measures:

- In individual classes, mastery will be demonstrated by written tests, written papers, oral presentations, and programming projects.
- All students will be required to take a written comprehensive examination of the 6 course courses required of all students.
- All students will be required to hold an oral defense of their dissertation work which can include questions on all courses taken by the student.

DSU and SDSU graduate policies require that the program submit an annual assessment report on achievement of student learning outcomes. Once the program is approved, program faculty will meet to ensure a common set of policies, guidelines, and expectations are in place.

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 proposed Ph.D. in Computer Science will be offered in both face-to-face and online classes between schools. A number of instructional strategies which capitalize on the use of classroom-based and distributed technologies will be used. Those approaches include seminar, labs, guided research and other interaction heavy components between instructor and doctoral students that encourage the participation of the students. Courses will be supported with D2L courseware for virtual networking, assignment submission, and class discussion. Other applications and tools will encourage small group collaborations, virtual information sessions. Point-to-point and multi-user video platforms will support synchronous dissertation committee work.

DSU has invested heavily in a virtualized infrastructure to allow for technical, hands-on experiences for students on campus and at a distance. This VMware environment has been instrumental in the online delivery of the undergraduate computer science and computer and network security majors as well as the graduate degrees in Cyber Operations and Cyber Defense. Educational experiences for students are greatly enhanced through these applied, hands-one technology-based activities.

The DSU Office of Graduate Studies and the Office of Online Education will support the Beacom College of Computing and Cyber Sciences in delivery of the Ph.D. Computer Science program, courses, and student services. We will also comply with ADA Accessibility standards to offer students with special needs the best in barrier free learning.

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?

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.

None.

- 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? 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 graduates.**

Estimates (DSU)	Fiscal Years*			
	1 st FY 21	2 nd FY 22	3 rd FY 23	4 th FY 24
Students new to the university	2	4	6	8
Students from other university programs	2	2	2	2
Continuing students	0	4	10	18
=Total students in the program (fall)	4	10	18	28
Program credit hours (major courses)**	72	180	324	504
Graduates	0	0	0	4

Estimates (SDSU)	Fiscal Years*			
	1 st FY 21	2 nd FY 22	3 rd FY 23	4 th FY 24
Students new to the university	2	4	6	8
Students from other university programs	2	2	2	2
Continuing students	0	4	10	18
=Total students in the program (fall)	4	10	18	28
Program credit hours (major courses)**	72	180	324	504
Graduates	0	0	0	4

*Do not include current fiscal year.

**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.

The estimated number of students enrolling into the program is based on information from recent graduates with an M.S. in Computer Science that indicated they wish to pursue a Ph.D. It is expected that students currently in similar Ph.D. programs at SDSU (Computational Science and Statistics, Geospatial Science and Engineering, and Electrical Engineering) may decide to pursue the computer science option instead.

Over the last five years, eleven graduates of SDSU’s M.S. in Computer Science program have completed a Ph.D. in Computer Science at another institution or are in the process of working towards that degree. All have stated that they would have continued their studies at SDSU if the degree was offered. Currently, three SDSU M.S. students are applying at other universities and would stay here if the Ph.D. program is offered.

Year	Number of Students entering a Ph. D. program
2019	3 – currently applying
2018	1 – University of Lincoln Nebraska
2017	0

Year	Number of Students entering a Ph. D. program
2016	1 – Univ. of King Saudi
2015	1 – Washington State University
2014	3- Texas Tech, University of Iowa, & Washington University in St. Louis

In addition to current M.S. students, SDSU receives approximately 2-4 emails monthly with inquiries about a Computer Science Ph.D. Even if only 10% chose to come to SDSU this would amount 3-5 students yearly.

The M.S. in Computer Science at DSU currently acts as a feeder to the Doctor of Cyber Security or Doctor of Information Systems programs. A M.S. in Computer Science is required for the Cyber Ph.D. Several MSCS graduates have gone on to these other programs as a substitution for a Ph.D. in Computer Science and have indicated that they would have preferred a Computer Science Ph.D. program. DSU’s MSCS program also receives several inquiries a semester about the availability of a Ph.D. program directly or regarding the ability to continue into a Computer Science Ph.D. program at DSU. DSU currently has Computer Science instructors with aspirations to go beyond their M.S. in Computer Science and attain a Ph.D. and would prefer not to have to go out of state. The program being offered at both SDSU and DSU will also allow similar faculty at other SD schools the opportunity to stay in state for their Ph.D. as well. DSU has also had inquiries from outside entities on the possibility of them supporting targeted research efforts at DSU with doctoral level students in Computer Science.

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.

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 Location²⁰

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)?

	Yes/No	Intended Start Date
On campus	Yes	2020-2021 Academic Year

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

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	If Yes, identify delivery methods ²¹	Intended Start Date
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

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

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. Complete Appendix B – Budget and briefly summarize to support Board staff analysis.

The Universities are not requesting any new state resources or any new or increased student fees to implement this program. The courses in the proposed degree program would qualify for existing CSC and INFS course fees.

The Jerome J. Lohr College of Engineering will support two Graduate Research Assistants for the start-up support of the program. Additional GRAs will be supported by individual researchers’ funds. Overall, budget summary shows expenses of \$66,621 in year one increasing to \$162,301 in year four. This is balanced by projected revenues of \$67,166 in year one and increasing to \$230,159 in year four. Positive cash flow of \$545 is projected in the first year and will increase each year (and remain positive) to \$67,858 in year four.

DSU - As we begin to offer the PhD in computer science, we will need additional faculty resources as the enrollment grows as we offer more sections of courses and provide adequate mentoring for students and supervision of dissertation work. We are phasing in the necessary faculty resources adding .50 FTE each year after the first year through the fourth year. Due to the increased faculty needs, the program net revenue is marginal in years two through four but also the university’s re-direction of funds is also marginal. Once the program enrollment stabilizes at 30 students after the fourth year, we are confident that the program will be self-sustaining and will not require continued university re-direction funds.

14. Board Policy 2:1 states: “Independent external consultants retained by the Board shall evaluate proposals for new graduate programs unless waived by the Executive Director.” Identify five potential consultants (including contact information and short 1-2 page CVs) and provide to the System Chief Academic Officer (the list of potential consultants may be provided as an appendix). In addition, provide names and contact

²¹ Delivery methods are defined in [AAC Guideline 5.5](#).

²² This question responds to HLC definitions for distance delivery.

information (phone numbers, e-mail addresses, URLs, etc.) for accrediting bodies and/or journal editors who may be able to assist the Board staff with the identification of consultants.

Barrett Bryant, Ph.D.
Professor and Chair of Computer Science and Engineering
University of North Texas
1155 Union Circle, #311366
Denton, Texas 76203-5017
P: 940-565-2803, F: 940-565 2799
Email: Barrett.Bryant@cse.unt.edu
Website: <http://www.cse.unt.edu/~bryant>

Sherri Harms Ph.D., Computer Engineering and Computer Science (Columbia)
Professor, Cyber Systems
Former Chair – Dept. of Computer Science and Information Technology
College of Business & Technology
University of Nebraska at Kearney
Kearney, NE 68849
P: 308-865-8123
Email: harmssk@unk.edu
Website: <http://www.unk.edu/academics/csit/about-us/harmssk.php>

Kendall E. Nygard
Professor and Chair of Computer Science
North Dakota State University
Fargo, ND 58108
P: 701-231-8203
Email: kendall.nygard@ndsu.edu
Website: <http://cs.ndsu.edu/~nygard/>

Golden Richard III, Ph.D., Computer Science
Professors of Computer Science and Engineering
Center for Computation and Technology
Louisiana State University
Baton Rouge, LA 70803
P: 504-957-5814
Email: golden@cct.lsu.edu
Website: <https://www.cct.lsu.edu/~golden/index.html>

Il-Yeol Song, Ph.D.
Professor of Computer Science
College of Computing and Informatics
Drexel University
Philadelphia, PA 19104
P: 215-895-2489, F: 215-895-2494
Email: song@drexel.edu
Website: <https://drexel.edu/cci/about/directory/S/Song-II-Yeol/>

15. 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.

<input checked="" type="checkbox"/>	<input type="checkbox"/>
Yes	No

Explanation (if applicable):

The Ph.D. in Computer Science program will be supported from the same CSC and INFS program fees applied to existing programs.

16. New Course Approval: New courses required to implement the new graduate 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.

17. Additional Information:

Admission Requirements:

South Dakota State University Graduate School requires:

- A minimum GPA of 3.0 to receive unconditional admission.
- A professional academic transcript evaluation for degrees earned outside the United States (*This requirement cannot be waived unless your highest degree was earned or will be earned in the U.S. prior to enrollment at SDSU.*)
 - If you are completing your bachelor's degree at the time of application, you may submit an incomplete evaluation. If you are accepted, a complete transcript and/or evaluation with completed degree will be required by the end of your first semester of coursework.
- Official U.S. transcripts where a degree is earned (or will be earned), and official U.S. transcripts where graduate level coursework has been taken.
- A minimum TOEFL score of 525 paper-based, 197 computer-based, or 71 Internet based, or IELTS score of 5.5.

Dakota State University Graduate School Requirements: (Ph.D. CSC)

- For unconditional admission:
 1. A baccalaureate degree in computer science (or closely related field) from an institution of higher education with full regional accreditation for that degree.

- International students must have an undergraduate (bachelor's) degree that is the equivalent to a four-year undergraduate degree in the U.S.
2. Students who are accepted into the program but do not hold a B.S. in Computer Science may be required to show competency areas such as Data Structures, Assembly Language, Operating Systems, Language Processing, Programming Languages, Discrete Mathematics. These competencies may be met with transcribed coursework or less-formal means such as experiences which demonstrate to the Admissions Committee gained competence in a knowledge area. Any remaining knowledge deficiency requirements will be included as part of the student's formal Plan of Study (POS) as additional required credits.
 3. A minimum grade point average of 3.0
 4. Students who have not earned a baccalaureate degree in computer science (or closely related field) from an institution of higher education with full regional accreditation for that degree are required to take the GRE (see Standardized Graduate Admission Tests (GRE/GMAT) under Admissions to Graduate school.
 5. Demonstration of sufficient proficiency in written and oral English as noted below (applies to international applicants only)
- International/Foreign Students

The Department of State and SEVP (the Student and Exchange Visitor Program) requires all international applicants to demonstrate sufficient English proficiency. Applicants whose native language is not English, and who have not obtained an undergraduate or graduate degree from an accredited American college or university must demonstrate English proficiency by one of the following:

1. TOEFL iBT: 76
2. TOEFL PBT: 550
3. IELTS: 6.0
4. PTE Academic: 53
5. Completion of ELS Level 112
6. GTEC CBT: 1200

International students, except for those entitled to establish a legal domicile in South Dakota, are required to purchase the South Dakota Board of Regents' endorsed student health insurance plan for themselves. (See BOR Policy 3:14). F-1 visa holders are required to have health insurance during their entire state in the United States, as well.

Upon admission, the Certificate of Financial Responsibility and official proof of financial ability (official bank statements and notarized letters of support) must be received before the University can issue Form I-20. It is strongly suggested that applicants submit these documents along with the rest of their application materials to reduce any delay in arranging their F-1 visa appointment.

International students, except for those entitled to establish a legal domicile in South Dakota, are required to purchase the South Dakota Board of Regents' endorsed student health insurance plan for themselves, their spouses and their dependents. (See BOR Policy 3:14).

Appendix A
Individual Student Outcomes and Program Courses

Individual Student Outcome	Program Courses/Credits that Address the Outcomes		
	Required Courses	Support Courses	Dissertation
Be able to demonstrate a broad and comprehensive understanding of core knowledge and fundamental principles in computer science	*	*	*
Be able to demonstrate conceptual knowledge and ability to demonstrate prevalent technologies of computer science	*	*	*
Be able to demonstrate a highly developed knowledge of literature in their area of computer science or closely related research	*	*	*
Be able to effectively formulate, execute, communicate, present, and defend the result and conclusions of original research		*	*

Appendix B
Budget

Dakota State University, Ph.D. in Computer Science

1. Assumptions

		1st FY20	2nd FY21	3rd FY22	4th FY22
<i>Headcount & hours from proposal</i>					
Fall headcount (see table in proposal)		4	10	18	28
Program FY cr hrs, On-Campus		72	180	324	504
Program FY cr hrs, Off-Campus		0	0	0	0
Faculty, Regular FTE	See p. 3	0.00	0.50	1.00	1.50
Faculty Salary & Benefits, average	See p. 3	\$118,731	\$118,731	\$118,731	\$118,731
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	0.00	0.00
Other Salary & Benefits, average	See p. 3	\$10,070	\$10,070	\$10,070	\$10,070

2. Budget

Salary & Benefits

Faculty, Regular		\$0	\$59,366	\$118,731	\$178,097
Faculty, Adjunct (rate x number of courses)		\$0	\$0	\$0	\$0
Other FTE		\$0	\$0	\$0	\$0
S&B Subtotal		\$0	\$59,366	\$118,731	\$178,097

Operating Expenses

Travel		\$1,000	\$2,000	\$2,500	\$3,000
Contractual Services		\$0	\$0	\$0	\$0
Supplies & materials		\$1,000	\$1,000	\$1,500	\$2,000
Capital equipment		\$0	\$0	\$0	\$0
OE Subtotal		\$2,000	\$3,000	\$4,000	\$5,000
Total		\$2,000	\$62,366	\$122,731	\$183,097

3. Program Resources

Off-campus support tuition/hr, HEFF net	GR	\$403.23	\$403.23	\$403.23	\$403.23
Off-campus tuition revenue	hrs x amt	\$0	\$0	\$0	\$0
On-campus support tuition/hr, HEFF net	GR	\$292.01	\$292.01	\$292.01	\$292.01
On-campus tuition revenue	hrs x amt	\$21,024	\$52,561	\$94,610	\$147,171
Program fee, per cr hr (if any)	\$70.20	\$5,054	\$12,636	\$22,745	\$35,381
Delivery fee, per cr hr (if any)	\$0.00	\$0	\$0	\$0	\$0
University redirections		\$0	\$0	\$6,000	\$1,000
Community/Employers		\$0	\$0	\$0	\$0
Grants/Donations/Other		\$0	\$0	\$0	\$0

Total Resources	\$26,079	\$65,197	\$123,355	\$183,552
Resources Over (Under) Budget	\$24,079	\$2,831	\$624	\$455

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	\$95,000	\$0
University's variable benefits rate (see below)	0.1438	0.1438
Variable benefits	\$13,661	\$0
Health insurance/FTE, FY20	\$10,070	\$10,070
<i>Average S&B</i>	\$118,731	\$10,070

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

Used average Computer Science faculty for this salary.

Explain adjunct faculty costs used in table:

0 courses per year to be taught by adjuncts at \$0,000 per course.

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

Summarize the operating expenses shown in the table:

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

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

Off-Campus Tuition, HEFF & Net	FY20	HEFF & EUC	Net	
Undergraduate	\$351.25	\$49.39	\$301.86	<i>Change cell on page 1 to point to your net</i>
Graduate	\$465.80	\$62.57	\$403.23	
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	FY20	HEFF	Net	
UG Resident - DSU, NSU, SDSU, USD	\$251.35	\$28.91	\$222.44	<i>Change cell on page 1 to point to your net</i>
UG Resident - BHSU	\$250.45	\$28.80	\$221.65	
UG Resident - SDSMT	\$246.00	\$28.29	\$217.71	
GR Resident - DSU, NSU, SDSU, USD	\$329.95	\$37.94	\$292.01	<i>Change cell on page 1 to point to your net</i>
GR Resident - BHSU	\$323.35	\$37.19	\$286.16	
GR Resident - SDSMT	\$320.05	\$36.81	\$283.24	
UG Nonresident - DSU, NSU	\$353.70	\$40.68	\$313.02	<i>Change cell on page 1 to point to your net</i>
UG Nonresident - BHSU	\$350.45	\$40.30	\$310.15	
UG Nonresident - SDSU, USD	\$347.95	\$40.01	\$307.94	
UG Nonresident - SDSMT	\$385.30	\$44.31	\$340.99	
GR Nonresident - DSU, NSU	\$616.00	\$70.84	\$545.16	<i>Change cell on page 1 to point to your net</i>
GR Nonresident - BHSU	\$603.35	\$69.39	\$533.96	
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	<i>Change cell on page 1 to point to your net</i>

Variable Benefits Rates

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

South Dakota State University, Ph.D. in Computer Science

1. Assumptions

		1st	2nd	3rd	4th
		FY21	FY22	FY23	FY24
<i>Headcount & hours from proposal</i>					
Fall headcount (see table in proposal)		4	10	18	28
Program FY cr hrs, On-Campus		36	90	162	252
Program FY cr hrs, Off-Campus		36	90	162	252
Faculty, Regular FTE	See p. 3	0.50	0.75	1.00	1.25
Faculty Salary & Benefits, average	See p. 3	\$124,241	\$124,241	\$124,241	\$124,241
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	0.00	0.00
Other Salary & Benefits, average	See p. 3	\$8,470	\$8,470	\$8,470	\$8,470

2. Budget

<i>Salary & Benefits</i>					
Faculty, Regular		\$62,121	\$93,181	\$124,241	\$155,301
Faculty, Adjunct (rate x number of courses)		\$0	\$0	\$0	\$0
Other FTE		\$0	\$0	\$0	\$0
S&B Subtotal		\$62,121	\$93,181	\$124,241	\$155,301
<i>Operating Expenses</i>					
Travel		\$1,500	\$2,500	\$3,000	\$4,000
Contractual Services		\$0	\$0	\$0	\$0
Supplies & materials		\$3,000	\$3,000	\$3,000	\$3,000
Capital equipment		\$0	\$0	\$0	\$0
OE Subtotal		\$4,500	\$5,500	\$6,000	\$7,000
Total		\$66,621	\$98,681	\$130,241	\$162,301

3. Program Resources

Off-campus support tuition/hr, HEFF net	GR	\$399.05	\$399.05	\$399.05	\$399.05
Off-campus tuition revenue	hrs x amt	\$14,366	\$35,914	\$64,646	\$100,560
On-campus support tuition/hr, HEFF net	GR	\$288.55	\$288.55	\$288.55	\$288.55
On-campus tuition revenue	hrs x amt	\$10,388	\$25,970	\$46,746	\$72,716
Program fee, per cr hr (if any)	\$67.00	\$2,412	\$6,030	\$10,854	\$16,884
Delivery fee, per cr hr (if any)	\$0.00	\$0	\$0	\$0	\$0
University redirections		\$40,000	\$40,000	\$40,000	\$40,000
Community/Employers		\$0	\$0	\$0	\$0
Grants/Donations/Other		\$0	\$0	\$0	\$0
Total Resources		\$67,166	\$107,914	\$162,245	\$230,159

Resources Over (Under) Budget

\$545 \$9,233 \$32,004 \$67,858

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	\$101,216	\$0
University's variable benefits rate (see below)	0.1438	0.1438
Variable benefits	\$14,555	\$0
Health insurance/FTE, FY18	\$8,470	\$8,470
<i>Average S&B</i>	\$124,241	\$8,470

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

The FY19 salaries of 6 people in the Electrical Engineering and Computer Science department were averaged.

Explain adjunct faculty costs used in table:

0 courses per year to be taught by adjuncts at \$0,000 per course.

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

Summarize the operating expenses shown in the table:

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

The Jerome J. Lohr College of Engineering will allocate two GRA positions from EE to CS for the start of the PhD in Computer Science. Additional external funding will be available through research.

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

Off-Campus Tuition, HEFF & Net	FY19			
	Rate	HEFF	Net	
Undergraduate	\$340.05	\$39.11	\$300.94	<i>Change cell on page 1 to point to your net</i>
Graduate	\$450.90	\$51.85	\$399.05	
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	FY19			
	Rate	HEFF	Net	
UG Resident - DSU, NSU	\$243.30	\$27.98	\$215.32	<i>Change cell on page 1 to point to your net</i>
UG Resident - SDSU, USD	\$248.35	\$28.56	\$219.79	
UG Resident - BHSU	\$254.20	\$29.23	\$224.97	
UG Resident - SDSMT	\$249.70	\$28.72	\$220.98	
GR Resident - DSU, NSU	\$319.40	\$36.73	\$282.67	<i>Change cell on page 1 to point to your net</i>
GR Resident - SDSU, USD	\$326.05	\$37.50	\$288.55	
GR Resident - BHSU	\$328.20	\$37.74	\$290.46	
GR Resident - SDSMT	\$324.85	\$37.36	\$287.49	
UG Nonresident - DSU, NSU	\$342.40	\$39.38	\$303.02	<i>Change cell on page 1 to point to your net</i>
UG Nonresident - BHSU	\$355.70	\$40.91	\$314.79	
UG Nonresident - SDSU, USD	\$360.50	\$41.46	\$319.04	
UG Nonresident - SDSMT	\$391.10	\$44.98	\$346.12	
GR Nonresident - DSU, NSU	\$596.30	\$68.57	\$527.73	<i>Change cell on page 1 to point to your net</i>
GR Nonresident - BHSU	\$612.40	\$70.43	\$541.97	
GR Nonresident - SDSU, USD	\$626.85	\$72.09	\$554.76	
GR Nonresident - SDSMT	\$652.00	\$74.98	\$577.02	
UG Sioux Falls Associate Degree	\$275.40	\$31.67	\$243.73	<i>Change cell on page 1 to point to your net</i>

Variable Benefits Rates

University	FY19	
BHSU	14.64%	<i>Change the benefits rate cell in the table on page 2 to point to the rate for your university.</i>
DSU	14.36%	
NSU	14.31%	
SDSM&T	14.20%	
SDSU	14.38%	
USD	14.34%	