DAKOTA STATE UNIVERSITY®

Beacom College of Computer and Cyber Sciences

# Network & Security Administration Program Review

## Self-Study Document

Fall 2021

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# Part I: Institutional History

## Heritage: 1881-1982

Dakota State University was established in 1881 as the first teacher education institution in Dakota Territory. Teacher education remained the primary mission of the institution through the 1950s. However, in response to the changing needs of South Dakota in the 1960s, the university began to expand its role to include degree programs in the liberal arts and business.

In 1980, South Dakota welcomed a major new industry into the state: the banking and credit card industry. The success and growth of this new industry, as well as the success of other information- oriented, computer-based industries in the state, prompted the state's leadership to carefully examine the degree programs being offered at the public institutions of higher education within the state. After lengthy discussions, leaders in state government, the banking and information services industries, and the Board of Regents agreed to develop new degree programs at one institution and then to use the experience and knowledge from this development to expand programs throughout the state's public higher education system.

## Mission Change: 1983-1984

In 1984, the Legislature of the State of South Dakota (South Dakota Codified Law 13-59-2.2) assigned Dakota State University the role and mission of developing technology-based degree programs in information systems, business, teacher education, and allied health care services at both the undergraduate and graduate levels. The Legislature provided $2.6 million in additional operating funds to support a three-year mission change at DSU. During the initial phase of the transition, the academic programs of the institution were reviewed. Degree programs were phased out if they were duplicated at the other five Regental institutions or if graduates would enter an over-supplied marketplace. New information systems programs, computer equipment, and facilities were approved for DSU. During the transition, special attention was given to ensure that all students in programs slated for phase-out received a full opportunity to complete those programs. To ensure the continuation of education quality, when the number of students continuing in a program became very small, a special faculty-mentoring program was developed.

The second phase of the transition began in August 1984, with the development of degree programs that integrated computers and information technologies into traditional academic subjects and added coursework specific to the computer and information systems areas. Existing

faculty were retrained, and new faculty were hired. Programs to implement the research and service aspects of the new role and mission were started. This was a period of stress for the campus, but it was also a period of great exhilaration with faculty and staff invigorated and renewed by the need for innovation, adaptation, and change. Some faculty and staff were unable to adapt to the changing conditions and left the university, but those who stayed on for the ride were justly proud of their accomplishments.

Realizing that the innovative programs being developed at DSU were expensive, private industry and state government provided the university with additional financial resources. Consultants from state agencies and from national corporations also provided assistance and guidance that contributed greatly to the success of the mission change.

## Since the Mission Change: 1984- Present

In 2015, as part of the launch of DSU's 2020 Strategic Plan, "Excellence through Innovation", DSU leadership and employees reaffirmed the Institutional Mission, Vision, and Values.

*Mission*

*DSU provides learning that integrates technology and innovation to develop graduates ready to contribute to local, national, and global prosperity.*

*Vision*

- Building upon its distinctive mission, DSU will become:
- The university of choice for those seeking a student-centered institution that offers innovative programs grounded in teaching, research, technology, scholarship, and service excellence.
- An academic community that serves as an economic engine in local, national, and global markets.
- A campus recognized for its achievements in continuous quality improvement.

*Values*

- Student success.
- University-wide Excellence.
- Distinction in Teaching, Scholarship, and Service.
- Academic Freedom and Integrity.
- Diversity, Respect, and Inclusion.

- Continuous Improvement.
- Community, Collaboration, and Communication.
- Technology and Innovation inside and outside the classroom.

As the institution endeavors to articulate its mission in the fullest way, our degree programs are scrutinized each year to ensure they remain on the cutting edge relative to technology to enhance and support instruction and address work force demands. When new degree programs are proposed by the colleges, they must clearly satisfy the "Is it compatible with our mission?" question before any additional planning is done.

To date, those curriculum development efforts have resulted in 27 bachelor's degrees, 6 associate's degrees, and 24 certificate programs. These programs range from Cyber Security to Elementary Education to Respiratory Care to Business Administration.

In the delivery of graduate education, the institution also offers seven master's degrees, certificates, and four doctoral degrees.

## DSU Rising Initiative

In 2017, Dakota State University began a transformational five-year capital investment initiative called DSU Rising.

The initiative is the result of a $30M donation from philanthropists Miles and Lisa Beacom and Denny Sanford. The donation will allow for the construction of an $18M, 40,000-square-foot research and development building for the Madison Cyber Labs (MadLabs). The funds also provide for additional scholarships, new program development, hiring of more faculty and staff, and support the university's intent to bring 5G network capabilities to Madison, the region, state, and eventually the nation. In addition, South Dakota Governor Dennis Daugaard pledged $10M to Dakota State, monies from the research and development Future Fund. U.S. Senator Mike Rounds(R-SD) has pledged to help Dakota State earn $20M in federal funds to advance DSU's cyber mission.

## Madison Cyber Labs

On Jan. 31, 2018 Governor Dennis Daugaard signed House Bill 1057 into legislation which permitted the demolition of DSU's Lowry Hall and construction of the Madison Cyber Labs, or MadLabs. The Madison Cyber Labs will build on DSU's expanding capabilities and strengths to establish a hub of cybersecurity and cyber operations expertise, research, and economic development in South Dakota.

The MadLabs will include resources (labs, networking, hardware, software), partners (government, business and industry, nonprofits), people (undergraduate, graduate, professional, teachers, researchers, interns and collaborators), programs (certificates, A.S., B.S., M.S. and Ph.D.) and innovation (interdisciplinary and multidisciplinary groups and projects, forensics and security). Construction of the MadLabs building began in 2018, with full occupancy expected in Fall 2019.

Already known as a national leader for cyber security and having a mission focusing on technology and information technology, DSU earned a 2012 National Security Agency designation as a Center for Academic Excellence in Cyber Operations. The NSA designation comes with levels of responsibility to the Agency regarding Knowledge Units and student success. DSU's We Are Rising initiative intends to put South Dakota on the leading edge of cybersecurity with new economic development clusters creating high paying jobs and giving former students the ability to 'come home' to cutting-edge companies and a growing regional economy.

## Student Demographics

Prior to the mission change in 1984, the majority of DSU students lived within a 50-mile radius of the campus. Most were traditional students coming to the institution directly from high school. Since the mission change, the DSU audience and student population has changed markedly. Immediately after the mission change, enrollment plunged a frightening 27.6 percent the first year, followed by another 12.6 percent decline the second year. But the new curriculum changes, combined with new institutional vigor, provided the institution with unprecedented enrollment growth and stability.

## Accreditation History

Dakota State University was granted accreditation by the Higher Learning Commission for a period of ten years in 1961 and accreditation has been continued after each comprehensive visit. The institution's most recent comprehensive visit, in October 2018, resulted in a positive review without any requirement for monitoring reports. Currently, DSU is participating in the Higher Learning Commissions' Academic Quality Improvement Program (AQIP). Six AQIP Categories provide a framework for examination. The AQIP Categories are:

- Helping Students Learn
- Meeting Student and Other Key Stakeholder Needs

- Valuing Employees
- Knowledge Management and Resource Stewardship
- Planning and Leading
- Quality Overview

Each AQIP Category deals with a related group of key processes and encourages an organization to analyze, understand, and explore opportunities for improving these processes and the interrelationships among them.

The AQIP process works in tandem with our existing strategic planning and project review processes. It provides a framework that focuses on data analysis and the achievement of its published goals and objectives. The alternate accreditation review process is every ten years. With AQIP, our accreditation is reviewed yearly in cycles and culminates in a Reaffirmation of Accreditation at the end of a seven-year cycle.

## About DSU's Network & Security Administration Program

DSU's Network and Security Administration program, NetSec, is offered as an associates, bachelors, and is additionally available as a minor. Students majoring in Cyber Operations, one of DSU's degree programs, are able to declare the NetSec minor to fulfill their Cyber Operations electives. In addition, many NetSec students take advantage of the close relation to the Cyber Ops bachelor's degree by dual majoring.

# Part 2: Trends in the Discipline

## Statewide and Nationwide Trends

The South Dakota Department of Labor and Regulation lists careers in networking, cybersecurity, and system administration with an anticipated 8.3% increase in demand annually since 2018. Nationwide, the workforce gap is estimated to exceed 1.8 million jobs in the cybersecurity and related fields[1]. Specifically within the Sioux Falls region, many IT related career opportunities have evolved over the past 15 years, and continue to grow.

## Curricular Implications

Technical trends continue to evolve at an ever-quickening pace. This includes the Network and Security Administration, Cyber Operations, and Computer Science degree programs. Keeping program content relevant is essential to the successful employment of students after graduation. The NetSec program has found specific curriculum changes that have focused on introductory cybersecurity concepts, networking technologies that continually improve, basic scripting trends, VoIP, wireless, network security, intrusion detection, and system administration. Each passing year brings new technologies that are continually integrated into the program's already established curriculum.

## Limitations

The recruitment and retention of faculty is a major limitation to the growth of the NetSec program. Faculty workloads continue to be consistently high, with many faculty teaching over their required 4/4 course load for professorial ranks, and many teaching over a 5/5 course load for instructor ranks. Aside from faculty within the college, the university's facilities, lab environments, and financial resources have been adequate per the mission of the program and commensurate with the mission of the university.

[1] T. Leithauser, "House Panel Urged to Find Ways to Fill Cyber Workforce Gap," *Cybersecurity Policy Report,* 11 February 2020.

# Part 3: Academic Program and Curriculum

## BS Network & Security Administration

### Mission Statement

The Bachelor of Science in Network and Security Administration, or NetSec, will provide graduates a strong background in computer networking theory, security, Microsoft Windows-based networks, computer forensics, UNIX/Linux network operating systems, and mission-critical applications. Graduates will have the skills necessary to manage the information technology infrastructure required to operate a modern business, with job titles that include as system administrator, network system engineer, systems analyst, network analyst, incident responder, network application developer and technical consultants. Graduates will have a solid business management background, which enables them to effectively communicate with and support the various operational units within a business organization.

### Curricular Options

Students may have the option to enroll directly into the BS program or may enroll in the BS program after completing the AS program. Typically students enroll directly into the BS program, however the AS program is available and is detailed later.

Many students progress from the BS program into the MS in Cyber Defense. These students typically leverage the Fast Track 4+1 Graduate Program. This program allows an undergraduate student to leverage up to 9 credits of free electives to take masters courses. These graduate courses then apply towards both undergraduate elective requirements as well as graduation requirements for the master's program.

The course catalog for the BS in NetSec can be found here:
https://catalog.dsu.edu/preview_program.php?catoid=33&poid=2424&returnto=1545

### Differences Among Programs

The programs are offered at different levels, associates, bachelors, and masters. The NetSec is very similarly related to the Cyber Operations degree program, however NetSec does not focus on reverse engineering, malware analysis, nor does it have as deep of an overall computer science focus. Instead the NetSec program focuses on routing, switching, and system administration while still integrating security fundamentals, offensive, and defensive cybersecurity curriculum.

## Comparison with Regional Programs

Few if any regional programs have similar content at the bachelor's level.

## Special Strengths and Unique Features

The NetSec program is focused on developing practical skills with students to enable them to fill the role of a network administrator in a modern business environment. Through the program, students have hands-on experience with router, switch, firewall, and server configurations, network administration and system administration, and exposure to Windows, Linux, and ESXi computing environments.

## Student Progression

Many students come into the program with college credits already completed (IE: CLEP, AP, dual credit courses, etc), so each students' progression varies slightly. However most students typically complete introductory and foundational courses first, followed by more specialized curriculum in their later years. In the first two semesters, students complete introductory programming, computer hardware, and security courses. In addition, students progress through general education requirements of writing, speech, and mathematics. In the second academic year students complete intermediate networking, web development, software security, and are exposed to various client operating system environments. In the third year students begin a more advanced track of network routing and switching, Windows and Linux system administration, database management, and cybersecurity policy. Typically, in the third summer of their progression, students will complete an internship as well. Lastly, in their fourth year students will explore computer forensics, offensive and defensive network security, threat hunting, incident response, scripting, and enterprise computing.

First Semester

| **Course** | **Prerequisites / Comments** | **Credits** | **Semester(s) Offered** |
|---|---|---|---|
| CSC 105 Intro to Computers | | 3 | |
| CSC 150 Computer Science I | | 3 | |
| ENGL 101 | | 3 | |
| MATH 114 | | 3 | |
| Natural Science | | 3 | |
| | | | |
| | **Total Credit Hours** | **15** | |

Second Semester

| Course | Prerequisites / Comments | Credits | Semester(s) Offered |
|---|---|---|---|
| CSC 134 Intro to CYOP<br>or<br>CSC 145 Info Sec Fund | | 3 | |
| CSC 163 Hardware, Virtual. & Data Comm. | | 3 | |
| CSC 250 Computer Science II | CSC 150 | 3 | |
| MATH 281 Intro to Statistics | MATH 114 | 3 | |
| SPCM 101, 215 or 222 | | 3 | |
| | | | |
| | **Total Credit Hours** | **15** | |

Third Semester

| Course | Prerequisites / Comments | Credits | Semester(s) Offered |
|---|---|---|---|
| CSC334 Web Development | CSC250 | 3 | |
| CSC 234 Software Security | CSC 250 | 3 | Fall and Summer |
| CSC 285 Networking I | | 3 | |
| Arts and Humanities | | 3 | |
| ENGL 201 | ENGL 101 | 3 | |
| | | | |
| | **Total Credit Hours** | **15** | |

Fourth Semester

| Course | Prerequisites / Comments | Credits | Semester(s) Offered |
|---|---|---|---|
| CSC 328 Operating Environments | | 3 | |
| CSC 385 Networking II | CSC 285 | 3 | Spring and Summer |
| Elective | | 3 | |
| Social Science | | 3 | |
| Arts and Humanities | | | |

| Course | Prerequisites / Comments | Credits | Semester(s) Offered |
|---|---|---|---|
| | **Total Credit Hours** | **15** | |
| | | | |

Fifth Semester

| Course | Prerequisites / Comments | Credits | Semester(s) Offered |
|---|---|---|---|
| CSC 321 Info Security Management | 30 Credits Completed | 3 | |
| CSC 387 Routing and Switching | CSC 385 | 5 | Fall and Summer |
| CSC 430 Windows Administration | CSC 285 and CSC 328 | 3 | Fall |
| Social Science | | 3 | |
| | | | |
| | **Total Credit Hours** | **14** | |

Sixth Semester

| Course | Prerequisites / Comments | Credits | Semester(s) Offered |
|---|---|---|---|
| CIS 484 Database Management Systems | | 3 | |
| CSC 431 Linux/Unix Administration | CSC 285 and CSC 328 | 3 | Spring and Summer |
| CSC 438 Defensive Network Security | CSC 385 | 3 | Spring and Summer |
| Elective | | 3 | |
| Natural Science | | 3 | |
| | | | |
| | **Total Credit Hours** | **15** | |

Third Summer

| Course | Prerequisites / Comments | Credits | Semester(s) Offered |
|---|---|---|---|
| CSC 494/498 Internship or Undergrad Research | | 3 | |

Seventh Semester

| Course | Prerequisites / Comments | Credits | Semester(s) Offered |
|---|---|---|---|
| CSC 388 Computer Forensics Fundamentals | CSC 163 | 3 | |
| CSC 436 Offensive Network Security | CSC 328 and CSC 385 | 3 | Fall |
| Elective | | 3 | |
| Elective | | 4 | |
| | | | |
| | **Total Credit Hours** | **13** | |

Eighth Semester

| Course | Prerequisites / Comments | Credits | Semester(s) Offered |
|---|---|---|---|
| CSC 407 Advanced Routing and Switching | CSC 387 | 3 | Spring |
| CSC 437 Survey Of Network Administration | CSC 163 and CSC 385 | 3 | Spring |
| CSC 443 Scripting for Network Administration | CSC 328 | 3 | Spring |
| CSC 439 Threat Hunting & IR | CSC328 and CSC385 | 3 | Spring |
| Elective | | 3 | |
| | | | |
| | **Total Credit Hours** | **15** | |

### Curriculum Management

All courses are offered on an annual basis. Some courses are only offered in a specific semester as designated in the sample schedule above. Multiple sections of each course are offered.

### Arrangements with Business and Industry

The program leverages an Industry Advisory Board which typically meets twice per year to advise on the programs curriculum, student progression, enrollment, and recruitment. The CSIAB is made up of regional employers including but not limited to: Daktronics, Fishback Financial Corporation, SDN Communications, and SBS Cyber.

### Use of Distance Technology

Distance education is essential for our students; all courses are available both on-campus as well as online. Students may choose enroll entirely online, entirely on-campus, or in a hybrid fashion. Through the use of DSU's Information Assurance lab students maintain the same hands-on learning experience regardless of the location of their enrollment. Labs and other assessment activities are the same for on-campus and online students.

### Instructional Methodologies

All courses leverage a lecture and lab format for instruction. These lectures often involve conceptual background as well as demonstrations and hands-on activities.
Online sections are asynchronous, students are provided with video recordings to replace the lecture component, but are provided with the same hands-on opportunities as on-campus students and are expected to complete the same in-class and homework activities.

## AS Network & Security Administration

### Mission Statement

The Associate of Science in Network and Security Administration degree program will provide graduates with a background in computer network and theory. It is a subset of the curriculum for the BS degree program and constitutes the first stage of a 2 + 2 program. Graduates will have the skills necessary to work with information technology infrastructure required in today's businesses, with job titles that include system administrator, network system engineer, systems analyst, network analyst, network application developer and technical consultants.

### Curricular Options

Students completing the AS in Network and Security Administration have the option to enroll directly into the BS in Network and Security Administration. The BS program builds upon all of the credits that a student could have completed in the AS program.

### Differences Among Programs

The AS in Network and Security Administration is one of only 5 degrees offered at the AS level. Other programs offered at this level include Business Management, Health Information Technology, Software Development, and Web Development. The AS NetSec program focuses on cybersecurity and network administration skills.

## Comparison with Regional Programs

Programs with some similar content exist within the regional 2-year technical institutes. These programs offer associates of arts credentials and focus primarily on system administration topics and do not have cybersecurity fundamentals, security management policy, nor programming topics.

## Special Strengths and Unique Features

The AS NetSec program is focused on developing introductory skills with students to enable them to fill the role of an introductory network administrator in a modern business environment. Through the program, students have hands-on experience with router, switch, firewall, and server configurations, and network administration.

## Student Progression

Many students come into the program with college credits already completed (IE: CLEP, AP, dual credit courses, etc), so each students' progression varies slightly. In the first two semesters, students complete introductory programming, computer hardware, and security courses. In addition, students progress through general education requirements of writing, speech, and mathematics. In the second academic year students complete intermediate networking, web development, software security, and are exposed to various client operating system environments.

Students completing the AS program are able to fully articulate into the BS program with an additional two years of coursework.

First Semester

| **Course** | **Prerequisites / Comments** | **Credits** | **Semester(s) Offered** |
|---|---|---|---|
| CSC 105 Intro to Computers | | 3 | |
| CSC 150 Computer Science I | | 3 | |
| ENGL 101 | | 3 | |
| MATH 114 | | 3 | |
| CSC 285 Networking I | | 3 | |
| | **Total Credit Hours** | **15** | |
| | | | |

Second Semester

| Course | Prerequisites / Comments | Credits | Semester(s) Offered |
|---|---|---|---|
| CSC 134 Intro to CYOP<br>or<br>CSC 145 Info Sec Fund | | 3 | |
| CSC 163 Hardware, Virtual. & Data Comm. | | 3 | |
| CSC 250 Computer Science II | CSC 150 | 3 | |
| CSC 385 Networking II | CSC 285 | 3 | Spring and Summer |
| CMST 101, 215 or 222, Speech Communications | | 3 | |
| | | | |
| | **Total Credit Hours** | **15** | |

Third Semester

| Course | Prerequisites / Comments | Credits | Semester(s) Offered |
|---|---|---|---|
| CSC 321 Info Security Management | 30 Credits Completed | 3 | |
| CSC 387 Routing and Switching | CSC 385 | 5 | Fall and Summer |
| ENGL 201 | ENGL 101 | 3 | |
| Natural Science | | 3 | |
| | | | |
| | **Total Credit Hours** | **14** | |
| | | | |

Fourth Semester

| Course | Prerequisites / Comments | Credits | Semester(s) Offered |
|---|---|---|---|
| CSC 328 Operating Environments | | 3 | |
| General Education Elective | | 3 | |
| Elective | | 4 | |
| Social Science | | 3 | |
| Arts and Humanities | | 3 | |

| Course | Prerequisites / Comments | Credits | Semester(s) Offered |
|---|---|---|---|
| | **Total Credit Hours** | **16** | |

### Curriculum Management

All courses are offered on an annual basis. Some courses are only offered in a specific semester as designated in the sample schedule above. Multiple sections of each course are offered.

### Arrangements with Business and Industry

The program leverages an Industry Advisory Board which typically meets twice per year to advise on the programs curriculum, student progression, enrollment, and recruitment. The CSIAB is made up of regional employers including but not limited to: Daktronics, Fishback Financial Corporation, SDN Communications, and SBS Cyber.

### Use of Distance Technology

Distance education is essential for our students; all courses are available both on-campus as well as online. Students may choose enroll entirely online, entirely on-campus, or in a hybrid fashion. Through the use of DSU's Information Assurance lab students maintain the same hands-on learning experience regardless of the location of their enrollment. Labs and other assessment activities are the same for on-campus and online students.

### Instructional Methodologies

All courses leverage a lecture and lab format for instruction. These lectures often involve conceptual background as well as demonstrations and hands-on activities.

Online sections are asynchronous, students are provided with video recordings to replace the lecture component, but are provided with the same hands-on opportunities as on-campus students and are expected to complete the same in-class and homework activities.

# Part 4: Program Enrollment and Student Placement

## Admission Standards

No program admission requirements exist. Students must meet the university admission standards.

## Current Enrollments

Table 1 shows enrollment in the NetSec program for each fall semester. Note that in 2014 the program was renamed from Network & System Administration to Network & Security Administration. Due to the significant overlap while the former program was phased out, the data is included in Table 1. Additionally, all programs were housed in the College of Business and Information Systems until 2016 when the computing programs and faculty were moved into the newly formed College of Computing. The College of Computing has since been renamed The Beacom College of Computer and Cyber Sciences.

| | 2014FA | 2015FA | 2016FA | 2017FA | 2018FA | 2019FA | 2020FA | 2021FA |
|---|---|---|---|---|---|---|---|---|
| **Program Description** | Number of Students | Number of Students | Number of Students | Number of Students | Number of Students | Number of Students | Number of Students | Number of Students |
| **DSU Network/Security Administration (AS)** | 0 | 19 | 25 | 33 | 31 | 26 | 34 | 26 |
| **DSU Network & System Administration (AS)** | 17 | 9 | 1 | 1 | - | - | - | - |
| **DSU Network & Security Administration (BS)** | 83 | 128 | 155 | 144 | 147 | 135 | 116 | 124 |
| **B.S. in Network & System Administration** | 24 | 10 | 3 | 2 | - | - | - | - |
| | | | | | | | | |
| **Beacom College** | | | 1,005 | 1,082 | 1,177 | 1,251 | 1,290 | 1,239 |
| **DSU Overall** | 3,047 | 3,145 | 3,190 | 3,307 | 3,382 | 3,268 | 3,186 | 3,219 |

*Table 1 Current Enrollment by Year*

## Degrees Awarded

| | SU14, FA14 & SP15 | SU15, FA15 & SP16 | SU16, FA16 & SP17 | SU17, FA17 & SP18 | SU18, FA18 & SP19 | SU19, FA19 & SP20 | SU20, FA20 & SP21 |
|---|---|---|---|---|---|---|---|
| AS in Network & System Administration | 5 | 8 | 0 | 2 | - | - | - |
| AS in Network & Security Administration | 0 | 4 | 14 | 11 | 10 | 10 | 14 |
| BS in Network & System Administration | 12 | 6 | 0 | 2 | - | - | - |
| BS in Network & Security Administration | 0 | 14 | 29 | 25 | 33 | 37 | 33 |

*Table 2 Program Completions and Degrees Awarded*

Those who graduated with one degree but multiple majors, or with more than one degree (i.e. AS and BS degree) will be counted more than once.

## Persistence

| | Fall 2015 Cohort | | Fall 2016 Cohort | | Fall 2017 Cohort | | Fall 2018 Cohort | | Fall 2019 Cohort | | Fall 2020 Cohort | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Number of Students** | **Percent Retained** | **Number of Students** | **Percent Retained** | **Number of Students** | **Percent Retained** | **Number of Students** | **Percent Retained** | **Number of Students** | **Percent Retained** | **Number of Students** | **Percent Retained** |
| **AS NetSec** | 0 | n/a | 0 | n/a | 5 | 40% | 2 | 100 % | 0 | n/a | 0 | n/a |
| **BS NetSec** | 18 | 94% | 15 | 87% | 10 | 90% | 23 | 87% | 5 | 100 % | 9 | 78% |
| | | | | | | | | | | | | |
| **College*** | 190 | 89% | 177 | 90% | 179 | 91% | 205 | 89% | 214 | 94% | 190 | 88% |
| **Overall University** | 320 | 87% | 305 | 86% | 355 | 88% | 377 | 86% | 399 | 89% | 355 | 83% |

*Table 3 Persistence Rates for First-time Full-time Students*

## Retention

| | Fall 2015 Cohort | | Fall 2016 Cohort | | Fall 2017 Cohort | | Fall 2018 Cohort | | Fall 2019 Cohort | | Fall 2020 Cohort | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | # Students | % Retained | # Students | % Retained | # Students | % Retained | # Students | % Retained | # Students | % Retained | # Students | % Retained |
| **AS NetSec** | 0 | n/a | 0 | n/a | 5 | 40% | 2 | 50% | 0 | n/a | 0 | n/a |
| **BS NetSec** | 18 | 83.3 % | 15 | 66.7 % | 10 | 80.0 % | 23 | 69.6 % | 4 | 75.0 % | 9 | 77.8 % |
| | | | | | | | | | | | | |
| **College*** | 190 | 70.0 % | 177 | 76.8 % | 178 | 75.8 % | 204 | 71.6 % | 214 | 80.8 % | 190 | 77.9 % |
| **Overall University** | 320 | 71.6 % | 305 | 71.8 % | 354 | 66.9 % | 376 | 65.7 % | 399 | 71.4 % | 355 | 72.1 % |

*Table 4 Retention Rates for First-time Full-time Students*

## Employment Potential and Placement

The Class of 2020 saw 10 graduates from the AS program and 36 graduates from the BS program. Both cohorts of students achieved 100% placement. Notably, 50% of the AS graduates indicated they were continuing further education, while 3 of the undergraduates sought graduate education. Of the students that responded to salary information, the average starting salary for a BS graduate was $56,000.

The destination employers were both regional and national and included government agencies. The destinations included, but were not limited to: federal agencies (Department of Defense, US Geological Survey, State of South Dakota), local businesses (Daktronics, First Bank & Trust, Infotech Solutions, Midco, Sanford Health) and national businesses (UPS, Etergy Nuclear).

## Program Capacity

The NetSec program as a whole has seen stable enrollment since its inception. Facilities on campus have greater capacity for additional sections of offered courses. Some courses, such as CSC387 Routing and Switching and CSC407 Advanced Routing and Switching have physical hardware limits that cap course section size, however these lab environments are reusable among sections. The primary limiting factor is CSC437 Survey of Enterprise Systems; this course assigns each student a physical server. At the time of this review, the Beacom College only has 90 physical servers available for this course, which limits enrollment to 90 per semester. However, with diverse scheduling, offering the course during both spring and summer semesters, student enrollment needs are met.

The Beacom College's virtual lab environment is a unique resource that has been specifically designed to accommodate all other courses that require the use of virtual machine platforms. While this environment does have a conceptual limit, the environment has ample capacity to continue to grow if needed.

# Part 5: Faculty Credentials

## Faculty Listing

The following faculty teach within the BS and AS Network and Security Administration program.

| Faculty | Degree | Rank |
|---|---|---|
| Andrew Kramer | MS | Instructor |
| Austin O'Brien | PhD | Associate Professor |
| Brent Tulloss | MS | Instructor |
| Chris Olson | PhD | Associate Professor |
| Cody Welu | PhD | Assistant Professor |
| Edward Dennis | DSc | Assistant Professor |
| Fransisca Opoku-Boateng | MS | Assistant Professor |
| Jason Jenkins | MS | Instructor |
| Jason Mixon | MS | Instructor |
| Josh Stroschein | DSc | Associate Professor |
| Kathy Engbrecht | MS | Instructor |
| Kyle Cronin | DSc | Associate Professor |
| Michael Ham | DSc | Assistant Professor |
| Rob Honomichl | MS | Assistant Professor |
| Robert Richardson | MS | Assistant Professor |
| Scott Graham | MS | Assistant Professor |
| Shawn Zwach | MS | Assistant Professor |
| Tom Halverson | PhD | Associate Professor |
| Tyler Flaagan | PhD | Assistant Professor |

*Table 5 Faculty teaching in the NetSec program*

## Workload

The DSU workload policy has been tentatively updated in 2021 and is in a probationary period in 2022. While in this period, the Provost's Advisory Committee is reviewing the policy and in its operations before it is fully implemented in 2023.

### Workload in the Beacom College

The Beacom College, which houses the Network and Security Administration program encounters a high level of student enrollments that are often unmet by increased teaching faculty. Support for hiring additional faculty is provided, however hiring qualified individuals at competitive wage in our region has been a significant challenge. Due to this, many faculty's teaching load goes into an overload state. This teaching issue, coupled with a high level of demand for faculty to work in sponsored programs, contracts, and grants, finds some faculty run up against the university's hard-cap of a 25% overload rate.

Details on the workload policy appear below:

### Professorial Rank Faculty

While the standard workload is 30 workload units per academic year, reasonable time is allocated to faculty members who hold professorial rank and who actively engage in research, scholarship, or creative artistic activity and who actively pursue professional service activities related to their disciplines. Ordinarily, reasonable allocated time is equivalent of six workload units of instruction per academic year and, if assigned, the faculty member must be actively engaged in productive scholarship. The typical full-time teaching load for tenured or tenure-track faculty is 24 workload units of instruction for each academic year (fall and spring). The institution may adjust this workload requirement to ensure faculty members have adequate time for research and scholarship or service or as deemed necessary by the institution and as specified below in this workload document. Faculty holding professorial rank but located off-campus are required to provide service to the university, service to the discipline, and to actively engage in research, scholarship, or creative artistic activity. Faculty who have over 30 workload units per academic year may qualify for overload pay.

Tenured faculty members, with consent of the dean, may opt out of the requirement for scholarship/creative activities and, in lieu of research, increase the workload assigned to instruction or service. Upon mutual agreement with the dean, faculty members who are unable to

perform expected service responsibilities may be assigned increased workload units in instruction.

## Instructor/Lecturer Rank Faculty

The standard two-term workload for faculty members who hold lecturer rank will be based primarily on instruction. Lecturers may be asked to assist the professorate informally in matters involving the curriculum and course delivery. Faculty members with a full teaching load of 30 workload units are typically exempt from university service obligations, although three workload units per year may be allocated as compensation for service obligations. Faculty members with lecturer rank and appropriate credentials and experience may be assigned graduate teaching responsibilities when approval is received from the college dean and the Graduate Council. See Section IIA for the equated workload credit assigned for graduate courses.

Faculty whose teaching load exceeds 30 credits per academic year (or 27 credits if they have been given 3 workload units of time allocated for service obligations) may qualify for overload pay.

## Overload Compensation

Overload occurs when a faculty member goes beyond 30 workload units in an academic year. Faculty members who accept overload assignments are compensated at the rate of 8 percent of their 9-month base salary per 3 workload units. The overload compensation will be adjusted pro rata. Release time for administrative duties is counted in the faculty member's workload but is not counted in overload. The administration reserves the right to identify which of the faculty member's courses would apply to overload assignment.

Faculty members who have a larger-than-normal workload assignment in the fall may also request or be assigned a reduction in their spring teaching load, in lieu of overload compensation. Assigned time as part of external grants is counted with the standard workload of faculty, although instructional duties may be applied to overload if there is not a readjustment of workload to address how research time will be accommodated within the standard workload. Faculty members who unilaterally agree to supervise independent study courses, directed practices and directed studies courses (those courses generally numbered (x9x) will not be compensated with overload pay for this supervision, unless the activity is specifically assigned by the dean and compensation arrangements are made at the time of the assignment.

Faculty workload for the academic year will be calculated after the census date in the spring semester. After the workload is calculated, faculty will be provided with their complete workload including any overload. Overload payments will be added the faculty member's paycheck during the February-May pay periods.

# Part 6: Academic and Financial Support

## Undergraduate Programs Support Services

The Beacom College office is a core area of support for all students within the college. The office is located in the Beacom Institute of Technology. In addition to the full-time staff below, the college is also staffed with several work-study positions to assist faculty with various tasks that come up.

| Name | Title | Location |
|---|---|---|
| **Dr. Pat Engebretson** | Dean, Beacom College of Computer & Cyber Science | Beacom College Office |
| **Open Position** | Associate Dean of Undergraduate Studies | TBD |
| **Open Position** | Associate Dean of Graduate Studies | TBD |
| **Kathy Engbrecht** | Retention Specialist | Beacom College Office |
| **Erin Kahler** | Administrative Assistant | Beacom College Office |
| **Kati Larsen** | Online Student Advisor | Online |
| **Carrie Graves-Warden** | Online Student Advisor | Online |

*Table 6 Support staff in the Beacom College*

## Library Resources and Services

The mission of the Karl E. Mundt Library is to support the curriculum of Dakota State University. Mundt Library provides a wide range of library services as well as a diverse collection of reference and informational materials for the use of the faculty and staff of Dakota State University. The Library exists to serve as an archive of accumulated knowledge, a gateway to scholarship, and a catalyst for the discovery and advancement of new ideas. In fulfilling its obligation to provide knowledge to the University and the scholarly community at large, the Library collects, organizes, and provides access to recorded knowledge in all formats. The Library faculty initiates discussions and proposes creative solutions to the information challenges facing the University and the scholarly community. The Library's faculty and staff actively participate in providing quality service, access, instruction, and management of scholarly information.

Since Dakota State University received its current focused mission in the 1980's, the Mundt Library's mission has been to expand its collection of materials on computers, technology, and information systems. To that end, the Library has subscribed to an ever-widening number of databases and eBooks that support this emphasis. The physical and electronic collections continue to be built through faculty recommendations and requests, as well as from librarian selection based upon their knowledge of the curriculum and its needs. The journal collection is also based on faculty requests and is fine-tuned by means of an annual analysis of journal use. This analysis helps the Library focus its expenditures (and finite budget) on those journals that are regularly needed and used by the institution's students. The collections have been enriched with digital information. The Library subscribes to numerous online databases including the Association for Computing Machinery (ACM) Digital Library, ProQuest Research Library, ABI Inform, IEEE, Lexis-Nexis and over 100 others. Most of the material indexed in these databases includes direct access to the full text of the articles indexed. For those articles not available in full-text, the Library provides speedy interlibrary loan service at no extra cost to all DSU students, faculty, and staff.

The Library holds an extensive collection of electronic books on computer security and information assurance, which are discoverable via the library catalog. In addition, the Library subscribes to O'Reilly for Higher Ed, which provides access to 150 titles that provide hands on training in many areas of technology. The Library also provides access to LinkedIn Learning, which provides digital tutorials in almost every area of technology, marketing, education, and career planning.

The Karl E. Mundt Library is a member of several library consortiums, and maintain borrowing and lending agreements with academic libraries across the country and around the world. As such, the Library can attain materials in digital and/or physical formats for any scholarly need. In addition to the collections, systems and services offered, Library staff also provide assistance and instruction to faculty and students through workshops, classroom instruction, online tutorials, and one-to-one assistance and training. Library faculty collaborates with course faculty to ensure students have the research background necessary to complete course assignments. Library faculty develops tutorials, subject guides, and other instructional materials to support classroom learning on campus and online. It is also the Library's goal to graduate students who are able to find, evaluate, and use information to solve problems and to make decisions

effectively. Graduates should have the knowledge and skills to function successfully as continuous learners in a continuously changing information world. To successfully meet its goals, the Library provides excellent collections, information systems, services, instruction, and staff.

## Online @DSU Support Services

The Office of Online Education (OOE) is responsible for program planning, marketing, program implementation and overall management of courses and programs offered by alternative delivery (i.e., Internet, DDN) or at off-campus locations by Dakota State University. Working in partnership with the colleges and the institution's academic support areas, Extended Programs works to design and develop active and collaborative degree programs at a distance or at off-campus sites such as the University Center in Sioux Falls

The OOE staff is located in the Tunheim Classroom Building. The staff serves the needs of students who are enrolled in the online and videoconferencing courses at DSU and in courses at off-campus locations. The office is the mainstay of distance services to students, working with the administrative offices of DSU to provide these services. The office staff assists faculty in the design and implementation of courses delivered by various forms of technology. Proctoring services for online courses are provided by the OOE office at DSU.

## Academic Advising

First year students are assigned to a team of professional advisors in DSU's Title III office. Students work directly with their advisors to choose a class schedule for the upcoming year. After the first year working with professional advisors, students are then transitioned to faculty advisors to handle their registration, class selection, college, and career advice. Most faculty that are active with advising typically work with between typically advise between 40 and 80 students.

## Computer Infrastructure

DSU's Information Technology Services department is responsible for most compuing that takes place on campus. The ITS department manages DSU's 1:1 initiative, issuing new Lenovo ThinkPad X1 Yoga laptops to all students. ITS maintains a helpdesk for students and employees to walk in or schedule appointments for service and services as a warranty center for all hardware issued to end users.

In addition to end user computing, ITS handles all network access across campus, ensuring that high speed and reliable wifi is accessible in all spaces on campus, paying special care to ensure that excess capacity is available in all academic spaces.

## Financial Support

Many opportunities exist for financial aid to students that are funded from institutional priorities, private donors, and federal scholarship programs. These scholarships include:

DSU Champion Scholarships are open to all students and range from $3,000 per year to $5,000 per year depending on a student's ACT score

The DSU Rising Annual Scholarship was established as an annual scholarship of $5,000 per year for students that are high academic achievers with a declared major in the Beacom College.

DSU actively participates in the NSF's CyberCorps Scholarship for Service as well as the DoD's Cyber Security Scholarship Program. These programs offer the potential for a full ride scholarship to selected students as well as a competitive stupid and professional development allowance.

The full list of scholarships available to students through the university can be found here: https://dsu.edu/admissions/undergraduate/cost-aid/scholarships.html

# Part 7: Facilities and Equipment

## Campus Facilities

The NetSec program is primarily administered in the Beacom Institute of Technology and East Hall. The Beacom Institute of Technology finalized construction in 2017 and is the newest academic facility on campus. The facility is dedicated to technical programs and is the home of the Beacom College. East Hall, one of the oldest state-owned buildings in South Dakota, was recently renovated and has a modern appeal. The facility is shared by faculty and staff of the Beacom College as well as the College of Business and Information


*Figure 1 The Beacom Institute of Technology's Academic Server Room under construction*

## Academic Server Room

Hands on learning experiences are pivital to the success of our students at Dakota State University. Upon receiving a financial gift, the university involved faculty in the designing of the Beacom Institute of Technology. Given the vision for what the facility was to become, faculty proposed an idea of having a dedicated server room specifically for student and classroom usage. The end result is a facility that's students to get hands on experience that will be relevant to their future careers.

*Figure 2 The Academic Server Room's Initial Assembly*

With a dedicated space allocated during the facility planning process, Beacom College faculty led a team to more formally plan what the room would become. This started with the initial planning of what courses would use the space and how curriculum could be adapted to leverage it. With the curricular objectives established, faculty worked to assemble the master list of equipment that would be needed to complete the vision.

The construction phase required faculty to manage the logistics of the state purchasing system, tracking equipment and ensuring everything arrived in time (and dealing with things that *didn't* arrive on time). Faculty assembled a team that began the final assembly phase just in time for the grand opening of the Beacom Institute of Technology. In addition, faculty were able to work directly with the construction engineers during the building's construction. This included advising on power requirements and concluded itself with revamping the construction of the flooring throughout the northern side of the Beacom Institute of Technology.

*Figure 3 The rear facing academic server room*

Today the room is constantly in use, housing hands on environments for several classes as well as hosting extracurricular activities. Students can typically be seen, cabling their equipment so they can configure their own routers, switches, firewalls, and servers. Over time, this facility has allowed faculty of the Beacom College to completely revamp our approach to teaching in our classes.

*Figure 4 The front of the academic server room*

This experience proves to be invaluable to our graduates. This environment not only allows them to interact when things are at their best, but to experience situations at their worst. Students understand technology better when things go wrong. The academic server room is now one of the cornerstones of the education we provide to our students and we're proud that we can mark it as an accomplishment of the Beacom College!

## Information Assurance Lab

Technology education is inherently hands-on by nature; it is a major component of constructivist learning. Much like a biology or chemistry lab, a great deal of setup goes into creating a hands-

on lab for technology labs. Multiple computers are required, plus networking gear to connect them together, plus any additional accessories such as a firewall, router, cellular telephones, etc. Once all of these are properly configured, the hardware setup must be duplicated several times for utility by multiple students. This process is effective but is very time consuming and outright prevents online students from participating on hands-on labs.

Several needs exist for an effective lab implementation that has a focus on technology education. The lab must give students the ability to practice what they learn; this is what sets students apart when they enter the workforce. Several challenges exist that must be overcome:

Challenge 1, Extensibility: The need within the technology program is a system that can provide the same user experience to students, online or on-campus. The default tends to be that online students are second-class students, unable to participate in physical labs.

Challenge 2, Efficiency: The creation of labs can be considerably time consuming for a single on-class, upwards of 8-10 hours per lab. Couple this time requirement with having to replicate the lab many times over for both on-campus and online populations, it simply isn't possible for a single faculty member to manage their own labs with courses of 40-90 students.

Challenge 3, Versatility: Any lab environment for use in the technology area needs to support all areas of technology. Being restricted to a single platform (such as Microsoft Windows) creates restrictions that are impossible to overcome. The lab solution needs to support any/all technology platforms.

Challenge 4, Safety: Teaching cybersecurity fundamentals can have grave consequences with beginners. A simple typo can make the difference between a basic lab exercise and launching a real-world cyber attack against another organization. Any lab environment used must protect the learners from themselves.

DSU's information Assurance Lab is our custom designed solution to the problems of technology education. Our lab was designed and implemented in 2009 and its use has continually grown ever since with the additions of new classes plus growing enrollment.

The IA Lab allows for an instructor to focus their time on creating and testing their lab. Once their lab is created, it can be cloned for testing in a matter of minutes. Once the lab is finalized, the lab administrator can copy unique instances of the lab to all students within the class. This process takes approximately 20 minutes total, depending on the size of the class.

The lab has the ability to run any x86 platform (namely Windows, MacOS, FreeBSD, or Linux), in addition to popular firewall and router platforms as well as cellular base stations. These labs are all safely contained so that students are safe when practicing any cybersecurity concepts. Due to the self service nature of our lab implementation, it can be used for projects far beyond the classroom. The IA Lab hosts research projects for undergraduate and graduate students, in addition to housing research projects for faculty members. Due to the safe/secure nature of the lab, it also houses DSU's High Performance Computing/Hadoop environment.

The labs users vary from semester to semester, but largely include students from all technology programs at DSU.

In order to facilitate the large lab environment, enterprise grade hardware is required. This is the type of hardware that would be found in any large scale corporate IT environment and includes:

- Virtualization software/scripts that are both custom-created for our unique needs coupled with software from VMWare
- Wireless/Cellular/Mobile modules to create GSM base satiations leveraging software defined radios
- Enterprise servers
    - Approximately 150 hosts
    - Large memory capacity per server, in excess of 128 GB
    - High network throughput, in excess of 4X gigabit interfaces
    - Storage Area Network connectivity, dual 10GB iSCSI
- Large-scale networking equipment (from Juniper Networks)
- Large storage capacity for storing student/staff labs and research from HP/3PAR
- Overall, the raw capacity of the lab is approximately:
    - 15TB RAM
    - 1100 CPU Cores
    - 700TB of storage

# Part 8: Assessment and Strategic Plans

## Program Assessment

The NetSec program's learning outcomes were defined at the program's initial instantiation. Since that time the program's curriculum has shifted to meet industry demands, relevant trends, and at the advice of our Industry Advisory Board. As an artifact of these changes, the program's learning outcomes have not been updated to reflect the forward momentum of the program. Regardless, the learning outcomes are defined as:

1. Implement the network confidentiality integrity and availability of basic security services
2. Engage web applications with vulnerabilities and patch them
3. Apply penetration testing procedures to exploit vulnerable systems
4. Configure firewall and IDS for secure network systems

The faculty within the program welcome feedback to these outcomes to ensure they're effective at measuring the overall state of the program.

In the fall of 2019, the assessment exams for all Beacom College majors were re-written to better match the curriculum of the program. Due to this change, the results from pre-2019 are not included in this report. It should also be noted that due to the COVID-19 pandemic, the South Dakota Board of Regents suspended all exit exam requirements for graduation for Spring 2020 through the Spring of 2021. As such, the exit exam results are somewhat limited in their breadth for the term of this report.

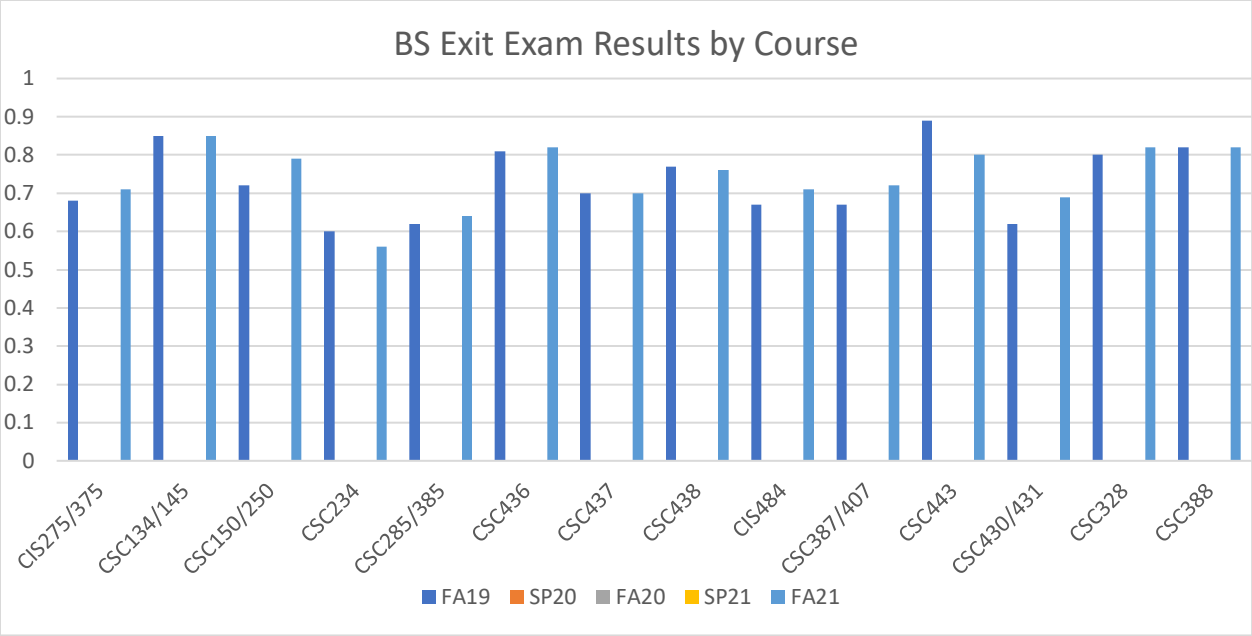


*Table 7 Exit exam results for the BS Netsec program*

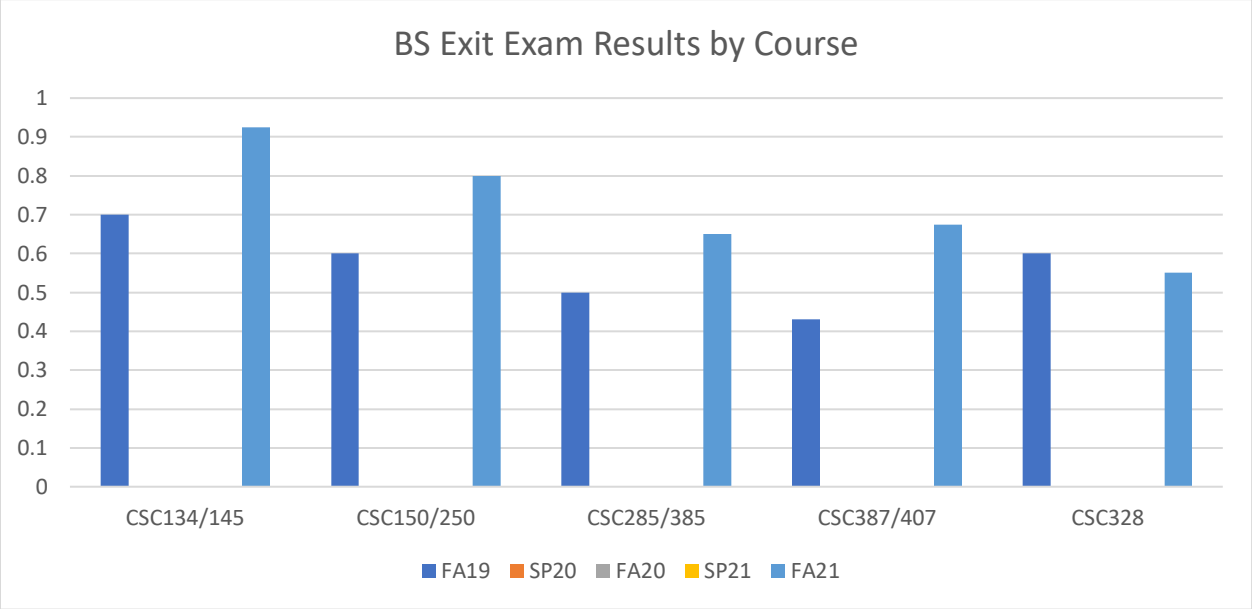


*Table 8 Exit exam results of the AS Netsec program*

We look forward to a more stable future to allow more consistent data collection for the purposes of program assessment.

## Strategic Planning

DSU's strategic plan, named DSU 2025, has been in the planning process since early 2019. Unfortunately due to the COVID pandemic, organizing the relevant groups to establish the plan

was severely delayed. As such, DSU's strategic plan is still under review at this time and has not yet been established. The university's major academic plan (MAP) is a major component of this plan which will directly impact the programs within the Beacom College of Computer and Cyber Sciences. A draft copy may be available at the time of the site review.