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SENATE RESOLUTION #2757

TITLE:	ASUW's Recommendation Regarding the Creation of a School of Computing
DATE INTRODUCED:	October 19, 2021
AUTHOR:	Senators Engel-Cartie and Rhymes; President Swilling; Vice President Anderson; Chief of Legislative Affairs Carrier
SPONSORS:	Senators Castronovo, Smith, and Wilkins

1. WHEREAS, the purpose of the Associated Students of the University of Wyoming (ASUW)

2. Student Government is to serve our fellow students in the best manner possible; and,

3. WHEREAS, the creation of a School of Computing (SoC) was proposed in 2021 as a part of

4. the University of Wyoming's (UW) proposed Academic Restructuring Plan; and,

5. WHEREAS, according to the University of Wyoming School of Computing Preliminary Plan

6. (Preliminary Plan) the vision of the SoC is "to create a unique and inspirational School of

7. Computing with national impact and global reach, providing Wyoming and the world with

8. agile and ethical computing professionals, empowered to address societal challenges that are

9. inherently interdisciplinary;" as stated on page one (1) of the Request for Authorization

10. (RFA) for the SoC as shown in Addendum A; and,

11. WHEREAS, the SoC would provide the following academic degrees: "multi-pathway BA

12. and BS programs in Computing, minors in Computing, certificates, possibly stackable, in

13. Digital/Computing, and MA/MS/PhD in Computing," as shown on page three (3) of the RFA

14. in Addendum A; and,

15. WHEREAS, the ASUW has been asked to provide a formal recommendation regarding the

16. SoC by Provost Carman, in accordance with UW Regulation 2-119, which states that the

17. Provost shall include a letter that affirms, among other things, that, "The University

18. community, including but not limited to Executive Team, Deans and Directors, Faculty

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Senate, Staff Senate, and ASUW, must have been provided the opportunity to review and present feedback.”; and,

WHEREAS, ASUW is thus obliged to provide a formal recommendation on the proposed SoC; and,

WHEREAS, in order to fulfill this duty, and to represent student opinion in the best manner possible, the ASUW Ad-Hoc Restructuring Committee has thoroughly reviewed the authorization request for the SoC and its preliminary draft proposal; and,

WHEREAS, the committee has used these discussions, as well as feedback from the Student Issues Survey, as shown in Addendum B, to come to a recommendation; and,

WHEREAS, as stated in the request for authorization, computer science and information technologies are transforming all sectors of society and every academic discipline can find use of computing in their curriculum; and,

WHEREAS, ASUW recognizes that digital literacy and competencies are critical skills for many students to know in order for them to be competitive in job markets; and,

WHEREAS, ASUW recognizes that the UW must be competitive by offering broader, more robust, and intensive studies in digital fields to ensure students are ready for the growing demand and need of computer science workers as stated on page six (6) of the RFA in Addendum A; and,

WHERAS, ASUW recognizes that UW contributes to the State of Wyoming’s economic development, and educating students for work in emerging fields is critical to the diversification of Wyoming’s economy; and,

WHEREAS, while the ASUW understands the necessity and importance of achieving these goals, the Preliminary Plan, as well as the RFA, both lack clarity

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and explanation in how these goals will be achieved; and,

WHEREAS, this lack of detail fails to assuage the numerous concerns that have been brought up by various stakeholders involved in this process, including questions regarding execution, communication, transparency, and cost; and,

WHEREAS, the plan for executing and creating this school in such an abbreviated timeline is not laid out in any documentation publicly available; and,

WHEREAS, ASUW believes there has been a lack of communication with the students, faculty, and staff that comprise the UW community of what the preliminary plan entails and both budgetary and non-budgetary impacts of the plan; and,

WHEREAS, this is exemplified by the fact that even after being given a brief synopsis of the proposed plan, 43% of students felt that they did not have enough information to give an opinion regarding the creation of this school, as shown in Addendum B; and,

WHEREAS, ASUW feels that student voices have not been sufficiently involved in the creation of this plan; and,

WHEREAS, ASUW also feels that student opinion and student voice is an essential component of shared governance, exacerbated in this instance by the fact that the SoC's stated goals are to benefit students and provide them with the skills necessary to succeed in the job market; and,

WHEREAS, in addition to a lack of student feedback being incorporated, ASUW also feels that the preliminary plan lacks a critical analysis of the school's potential weaknesses or threats; and,

WHEREAS, in addition to concerns with the execution and planning, ASUW also notes that the Preliminary Plan has failed to explicitly detail why the computing discipline is distinct

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from the established computer science discipline, only saying “the computing major would differ in organization and emphasis from the present Computer Science and Computer Engineering degrees, complementing them rather than competing.”, and listing credit hour differences, but providing no further details; and,

WHEREAS, there is no publicly available information on assessment of potential alternative plans that could achieve similar stated goals as the SoC, such as the combination of already established programs incorporated into the SoC, or the addition of pathway-specific computing classes offered by specific Colleges being integrated into select degree programs; and,

WHEREAS, it is unclear why computing programs requires the creation of an entire school with associated expensive start up and administrative costs and what financial and organizational benefits there are from forming an entire SoC; and,

WHEREAS, the Preliminary Plan failed to offer reasonable justification for the expense of a new school during a period of financial difficulty for UW and state of Wyoming as a whole; and,

WHEREAS, page seven (7) of the RFA as shown in Addendum A outlines the numerous personnel and administrative supports that will be needed; and,

WHEREAS, these administrative and personnel costs are concerning given that other portions of the University are seeing a reduction in resources in these areas; and,

WHEREAS, the ASUW believes that the proposal for the SoC, while containing elements that will benefit students and the state, needs organizational reform and communicative clarity before it can be effectively implemented in a way that benefits the UW and the state as a whole population.

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88. THEREFORE, be it resolved that the Associated Students of the University of Wyoming
89. (ASUW) Student Government understands and supports the vision of the University of
90. Wyoming School of Computing as outlined in both the Preliminary Plan and the Request for
91. Authorization; and,
92. THEREFORE, be it further resolved that although the ASUW supports this vision, the
93. ASUW cannot support the creation of a School of Computing as outlined in the Preliminary
94. Plan due to lack of clarity proposed execution strategies, lack of communication and
95. transparency with the UW community, and exorbitant additional cost in a time of significant
96. budget reductions; and,
97. THEREFORE, be it further resolved that the ASUW will offer support for the creation of this
98. school once communication increases, transparency is seen, alternatives have been
99. transparently assessed, and the aforementioned concerns have been addressed.

Referred to: Ad-Hoc Restructuring; Advocacy, Diversity, and Policy; Programs and Institutional Development

Date of Passage: October 26, 2021 **Signed:** _____

(ASUW Chairperson)

"Being enacted on October 26, 2021 **, I do hereby sign my name hereto and approve this Senate action."** _____

ASUW President

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Addendum A

Authorization Request for the School of Computing (SoC)

August 2021

The vision of the School of Computing (SoC) is ambitious! Through the SoC, (and each of the other pillars), UW envisions forging new trails that will enable UW to become **a national leader in education, engagement and research**.

The SoC will be a hub of innovation and knowledge exchange providing UW students, faculty and Wyoming businesses and citizens with a **"backpack" of computational tools and approaches to drive transformation**.

The SoC will champion the broader efforts aimed at **making UW more digital** through partnerships throughout UW and Wyoming.

1. Introduction

This document is a Request for Authorization (RFA) to establish a School of Computing (SoC) at the University of Wyoming. The request describes characteristics of a BA and a BS degree in Computing that will be SoC's initial curricular foci and will provide the foundation and structure for future minors to be developed and offered with other departments and programs across the campus. These degree programs will be fully developed in the first 18 months of the SoC, and informed by a new Dean and new hires and a SoC Curriculum Advisory Committee that will include faculty from UW and experts from outside UW. Additionally, a description of the SoC's leadership role in the campus-wide effort to make UW more digital is given. The BA and BS, as well as future curricular programs (e.g. minors, MA, MS and PhD degrees in Computing) will follow the approval process at the appropriate times in coming years.

This RFA references

a) A **feasibility study and market analysis** on the BS in Computing Degree from the Education Advisory Board (EAB).
b) The **School of Computing Preliminary Plan** that provides a detailed description, analysis and tentative budget for all aspects (Educational, Economic and Workforce Development, Research, Partnerships, and enhanced funding opportunities).
c) The **Notice of Intent** and the accompanying presentation to the Board of Trustees.
d) The **Digital Pillar Report** prepared in Spring 2021 by a committee of 19 UW faculty, staff and students at the bequest of the UW Provost that gives a broad overview of the need, the benefits and suggest actions for UW to become more digital.
e) **Various reports** from national organizations and think-tanks on the need for computing.

For convenience each of these is included in the package for this request, or can be accessed via the link: supporting files.

2. Purpose and need for the proposed Academic Program

The following quotes from two recent studies summarize the overarching needs for the proposed academic programs at UW.

> Computer science and information technologies have transformed all sectors of society, businesses, and government. Today, the transformation continues and much is driven by artificial intelligence, robotics, the Internet of Things, information security, and data science. A wide range of jobs in virtually all sectors demand computing skills to an unprecedented extent. And every academic discipline finds itself incorporating computing into its research and educational mission. [NAS 2018]

> Computing is and will continue to be an essential component in shaping the future for humanity, The computing disciplines need to attract quality students from a broad and diverse cross-section of the public and prepare them to be capable and responsible professionals. [CC2020]

These needs are even deeper at UW. The productivity across UW in computational education and research is far below that of our peers, and the needs of UW graduates.[1] Access to cutting-edge research, world-class infrastructure and

[1] "It is important to note the scale that is needed for UW to have impact, and what is common across the nation. UW's current CS department has 8 professors (only 2 with an AI specialty) and the Advanced Research Computing Center (ARCC) has 4 current staff. Comparing the relative sizes of CS departments is only one, very limited indicator, but it does give a sense of where UW is. In 2020 UIUC, about three times UW's size, hired 23 new faculty in CS alone. Boise State, about twice UW's size, has more than 20 CS professors and plans to double in size. Notre Dame, a predominantly humanities and social sciences university, is almost exactly UWs size and has more than 4 times our CS faculty, and a unit like our ARCC with over 50 staff (almost entire funded on soft money through grants). In all cases these activities are a foundation for economic development in their region." [S20]

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workforce training in computing and data is therefore critical for Wyoming citizens, and most importantly for UW's students.

The primary purposes of the SoC curricular programs are to

- lead UW in the incorporation of value-added, disciplinary-specific **digital experiences in all** disciplines,
- **provide more students with career pathways that utilize** the power of computing and technology,
- provide new opportunities to **increase the diversity among UW students utilizing computing** in their disciplines and careers, and
- establish **a pipe-line of tech-savvy graduates for Wyoming's and the global economy**.

Additionally, the SoC will provide UW researchers new tools and cutting-edge computational expertise to better address grand challenge problems of importance to Wyoming and region that they are studying, and serve as a hub for Wyoming's innovation economy.

3. Proposed curriculum

The SoC is envisioned to ultimately house the following academic programs:

- Multi-pathway BA and BS programs in Computing,
- Minors in Computing,
- Certificates, possibly stackable, in Digital/Computing,
- MA/MS/PhD in Computing.

When feasible, all parts of the curricula will be offered online. The SoC will also work with Academic Affairs to be the champion for the envisioned "Digital for All" component of the USP.

The initial ideas of these programs are more fully discussed in the SoC Preliminary Plan, and the Digital Pillar report. The full development of these programs will involve Academic Affairs, Faculty Senate, the USP committee, faculty and students, and will be overseen by a SoC Curriculum Advisory Committee. All will be fully studied and follow the process for approval and creation of new academic programs.

Here we focus primarily on the characteristics and vision for the BA and BS in Computing programs; as they are the most critical for UW students and for Wyoming, and will be the first developed. Before that we will briefly describe the vision and plans for the other programs. All programs will be greatly informed by the recently released report "*Computing Curricula 2020: Paradigms for Global Computing Education* [CC2020] that was developed by a 50-member task force drawn from 20 countries, CC2020 outlines international recommendations for baccalaureate degrees in computing.

Digital For All Experiences.

The Digital Pillar report recommends that the university community consider the creation of a "digital course" requirement in the University Studies Program for all students. Their reasoning is that it is important that all UW undergraduate students learn how digital and computational methods/tools/approaches are increasingly part of their chosen discipline and all aspects of life. At a general level, students should be exposed to the variety of ways that digital tools can be used to accomplish task (many of them are new tasks never before possible in areas from medicine to art and music to engineering and society) and gain introductory experience in using them. Students should gain understanding of how to analyze the human, social and scientific impacts the existence and use of these tools bring. At a specific level, students should learn in greater detail and expertise how to use the digital tools available in their fields of study and understand the theory of how digital approaches and computational methods will change their fields in the future. The SoC plan proposes an Associate Dean with joint appointment between the SoC and Academic Affairs tasked with leading efforts to make UW more digital through the proposed digital curriculum embedded in the USP.

Minors in Computing.

Job prospects likely also contribute to the demand for CS courses from non-majors, but this portion of the enrollment increase is also driven by the impact of CS and computing in other fields. Computer

> science and its related endeavors such as data science have produced powerful tools and software systems that are used by and affect every discipline, giving rise to exciting subfields, such as computational biology, computational economics, computational chemistry, and digital humanities, with more emerging. These subfields require expertise in the traditional domain and a general fluency in tools and methods from computer science. The advantages of a deeper knowledge of computer science in many domains has also led to the recent emergence of new degree programs at several institutions that fuse curricula and formal requirements of CS with those for one of a range of disciplines (referred to as "X+CS"). [NAS 2018}

As the above quote indicates, increasingly students in many disciplines find great value-added in incorporating computing classes into their studies. Having disciplinary minors in computing will give UW Alums a competitive advantage throughout their careers, catalyze working partnerships between UW departments and the SoC faculty, and will be a valuable recruiting tool for students, graduate students and faculty. All minors will be vetted, and submitted through approval through the standard UW processes.

Certificates, Possibly Stackable, in Digital/Computing.
The Digital Pillar Report mentions the emerging mechanisms of certificates and stackable certificates in higher education. The SoC envisions partnering with entities like the Ellbogen Center, the Visualization Center, the Innovation Wyrkshop, the Advanced Research Computing Center and UW Libraries to explore the feasibility of developing suites of (possibly stackable) certificate courses that enable a diverse audience of students, including non-traditional students and life-long learners, the opportunities to gain specific 21st-century skills through short-courses, self-paced courses with competency exams.

Graduate degree programs.
In years 2 and 3, the SoC will plan and developing MA and MS degrees in Computing, with a focus on creation and use of innovative computing tools in the context of grand challenge problems in a wide range of disciplines. Desired characteristics of these programs will be diversity of student body, various academic pathways for entrance, collaborative projects involving different disciplines and stakeholders, ties through internships/externships with Wyoming and regional companies. A PhD in Computing will be studied and considered in years 4 and 5; other Schools of Computing support robust PhD programs through corporate partnerships, external funding, and partnerships with national labs. Initially, the graduate curricula will be operated using existing programs in the ongoing Interdisciplinary Graduate Minor in Scientific Computing.

We now return attention to the most critical programs in the SoC, the BA and BS programs in computing.

Multi-pathway BA and BS Programs in Computing.
The BA and BS in Computing will be the initial and central part of the SoC curricula, and form the backbone for multiple minors. The BA/BS in Computing will be distinctly different than those in CS or ECE at UW, and thereby enable UW to serve a more diverse set of students.

The BS and BA programs will be more fully developed during the first 18 months of the SoC and informed and developed by SoC hires and the SoC Curricular Advisory Committee, and be symbiotic with the "new" CS/ECE BS and graduate programs.

It is anticipated that all Computer Science related degrees at UW will share a highly common first year which will aid in recruiting, advising, costs, and most importantly give students the opportunity to discover their own areas of interest within computing.

Characteristics of the proposed undergraduate degrees in computing are described in Table 1. Table 2 gives the basic structure of UW's existing BS in Computer Science. and of the proposed BS and BA degrees in Computing.

Characteristics of the BA and BS programs in Computing

Focus on "computing in context."
This is the use of computers and related technologies to study complex real-world problems. This will require students to develop disciplinary expertise as well as computing expertise.

Common set of beginning courses to allow students to explore.
First year courses will be designed with CS/ECE and other units as an on-ramp to expose students to the power of computing through diverse applications, practical and broad aspects of the development and use of application, and various career tracks in computing. The remainder of the curricula will be designed to offer many possible pathways to students, and to provide a platform for future minors from other disciplines to be offered.

Competency-based.

Competency = Knowledge + Skills + Dispositions… in Context

Following trends supported by educational research and best practices in leading computing program, the curriculum will be designed around competencies and domains, that is, a curriculum that "focuses on an individual's capability to perform and to apply their computing education in a practical and professional service to society. A curriculum founded on students Knowing what, Knowing how and Knowing Why. [CC2020]

"Competency-based curricula provide more pathways for students, the ability to quickly adjust to curricula to cover emerging topics, and provide the ability to "promote and clearly describe the practical benefits of computing programs to stakeholders: students, parents, employers, corporate partners, donors." [CC2020]

Core competencies (e.g. problem-formulation and solving, interpersonal, management and entrepreneurial skills, ethics, collaborating, communicating, working in interdisciplinary and multicultural teams), technical competencies (e.g. DevOps, Software Development, Data Wrangling, Modelling, Technical Writing), and advanced competencies in selected areas of contemporary computing (e.g. Security, Artificial Intelligence, Internet of Things, FinTech, Contemporary Database & Interfaces, Design Tools, Human Computer Interaction*s)* for the programs will be identified as required elements.

Each course offered by the SoC, and its partners including timely topics courses) will have an associated approved list of competencies. Students can master core competencies in different ways based upon their interests and their strengths. Over next year, a list of core competencies will be developed through consultation with an external advisory board, and a SoC Curriculum Advisory Committee that will include representatives from disciplines across UW, and from Wyoming companies.

Quantitative skills for computing.
Appropriate Mathematics and Statistics concepts will either be offered within existing quantitative courses, embedded within new SoC courses, or offered in freshly designed courses for SoC majors in mind. Different tracks within quantitative offerings will be available for students with different career interests.

Experiential and collaborative learning. This will be emphasized through class projects, internships, externships and senior design projects.

Table 1. Characteristics of SoC undergraduate programs

	BS in Computer Science	BS in Computing	BA in Computing
USP outside major	18 hours	18 hours	18 hours
Quantitative	18 hours Calculus based	15 hours math/stats for computing (modeling, optimization and data)	9 hours math/stat for arts/humanities/social science applications of computing
Math Science electives	12 hours		
CS core	42 hours	16 hours	16 hours
SoC core competency courses		12 hours (Computing in context, experiential and project based))	12 hours (Computing in context, experiential and project based))
Disciplinary concentration		12 hours (in agriculture, science , math, statistics or engineering)	18 hours (in education, arts, humanities, social sciences)
CS electives	12-21 hours		
General electives	15 hours	12 hours	12 hours
SoC advanced competencies based on interests		15 hours	15 hours
SoC electives		12 hours	12 hours
Capstone project		8 hours	8 hours
Total hours	120-128 (depending on concentration)	120 hours	120 hours

Table 2. A comparison of the different bachelor's programs.

4. Anticipated enrollment in BA/BS programs

The following quote (emphasis added) from the recent report [NAS2018] help frame this discussion.

> The demand for employees with computer science and computing expertise is high and has grown steadily over time. According to data from the Bureau of Labor Statistics (BLS), employment in computer occupations grew by nearly a factor of 20 between 1975 and 2015, nearly twice as fast as production of CIS bachelor's degrees. BLS has projected that **demand for computer science workers will continue to grow over the next decade at a rate higher than that of overall job growth, particularly as computing becomes more central to a wider range of industrial sectors.** Employment demand is particularly intense in some specialty areas, including cybersecurity, data science, and machine learning.

Estimated enrollments for the BS in Computing program given in Table 3 are based on the above report and the data from market research performed by EAB. It is anticipated that enrollments for the BA in Computing program would be similar. Once the BA and BS programs are more fully designed, a market analysis, as well as an evaluation of credential design and curricular recommendations for both programs will be performed.

Estimating enrollments is difficult for the following reasons: we are envisioning programs that have unique components (e.g., a focus on computing in context of applications and interdisciplinarity) and which include emerging areas (e.g., data science) that are too young for EAB or the Bureau of Labor Statistics to include in their analyses. Additionally, the analyses tend to be too broad geographically to capture need in Wyoming and may underestimate demand for new types of occupations. Members of the committee that developed this report, indicate that they have

frequent inquiries from companies in Wyoming about the availability of computing savvy graduates, and that often we are unable to meet their needs. The growth in small tech companies in Wyoming will only increase this demand. In addition to the demand in the marketplace for these types of graduates, there is also a demand among UW students for more opportunities to learn value-added computing skills. It is felt that the estimates are realistic, and perhaps on the conservative side, based on the available data.

2023-2024	2024-2025	2025-2026	2026-2027
36	66	91	116

Table 3. Estimated enrollments in BS in Computing in first 5 years of program

We note that in 2019, there were 262 CS majors, and 243 ECE majors. Combining the estimated BA and BS in Computing programs, we estimate the SoC will have around 232 undergraduate majors five years after the program is started.

SoC's education impact down the road will also reach a large number of students (in the range of 240) through computing minors (there are at least 6 departments already considering minor programs). Through its role as champion for "digital for all" the SoC will impact every undergraduate at Wyoming. The demand for these will be evaluated as the programs are developed and proposed.

5. Budget Narrative and existing or new resources required to deliver the Academic program

A detailed five year/two-phase plan for the roll-out of the SoC and its associated programs is given in Pages 21-29 of the SoC Preliminary Plan. Table 4 below gives the projected expenses. The full version of this table was presented to the Trustees in their July 2021 meeting. Some notes are the following.

- There are some differences between this table and budget presented in the preliminary SoC plan, and the notice of intent. This is due to a combining of Phase 0 (the initial 6 months) and Phase 1, The budget below should be taken as the formal proposed budget.

- UW administration has identified several possible funding sources for the SoC, including America Recovers Program (ARP) funding for one-time costs. The details of how the State will distribute ARP funding are still being discussed. Thus, details of funding sources for the SoC are not provided at this time. Once the ARP funding and other infrastructure funding is settled, the UW administration will provide a detailed fiscally solid plan for where the SoC funding for its first 5 years comes from.

At the end of five years the plan targets having the following levels of personnel and programs:

- Dean
- 2 Associate Deans (one devoted to curricula, Digital for All efforts, and programs with community colleges, and one devoted to industry/research lab partnerships and workforce and economic development.
- 1 business manager, 1 office manager, 1 workforce development lead, 1 special projects lead
- a position devoted to working with community colleges
- 21 faculty (3-4 being existing faculty, remaining will new hires with joint appointments in other departments)
- 4 research scientists (it is expected that another 4-5 research scientist will be supported by external grants secured by SoC faculty and research scientists)
- 27 graduate assistants.
- Operating budget
- Start-up funds to be devoted to equipping specialized labs for students, or special computing equipment
- A Visiting Faculty Program
- A Computing Scholars Program for undergraduates

Total projected costs at the end of year 5 are $10.4 M per year.

The following should be noted:

- The projected costs are the anticipated all-in costs, and include programmatic elements such as a scholarship fund for undergraduates, and a visiting scholar program;
- The targeted size of the SoC is designed to ultimately support the planned MS, MA and PhD programs, as well as aggressive research programs.
- To encourage collaborations, help support departments, all SoC faculty will be joint hires with other departments.
- All SoC faculty and research scientists will have significant expectations for securing external funding through grants and corporate partnerships; by the end of 5 years SoC faculty and research scientists should bring in an additional $7.5 M/year in external funding.
- As with other such schools or centers, the SoC should provide excellent opportunities for investments from corporations, and individuals. Fund-raising to support SoC programs will be a priority of the SoC administration and faculty.
- The SoC will work closely with the UW Search Equity Advisors initiative to ensure that the net is cast wide to encourage a large pool of talented diverse candidates.

EXPENSES	FY22	FY23	FY24	FY25	FY26
Administration	**934,760**	**934,760**	**1,743,450**	**1,743,450**	**1,743,450**
Faculty Compensation	**319,500**	**1,739,500**	**3,017,500**	**3,656,500**	**4,295,500**
Start-up Funds	**900,000**	**3,500,000**	**3,000,000**	**1,500,000**	**1,500,000**
Visiting Faculty/Computing Scholars	**500,000**	**660,000**	**740,000**	**570,000**	**570,000**
Research Scientists	**426,000**	**639,000**	**852,000**	**852,000**	**852,000**
Graduate Research Students	**168,034**	**436,889**	**672,137**	**806,564**	**907,385**
Operating expenses	**300,000**	**375,000**	**500,000**	**500,000**	**500,000**
TOTAL	**3,548,294**	**8,285,149**	**10,525,087**	**9,628,514**	**10,368,335**
Funding sources (TBD once ARP, WIP funding is settled)					

Student Tuition		**192,000**	**350,000**	**728,514**	**768,335**

Table 4. Projected expenses, and tuition revenues for first 5 years

6. Timeline for implementation

A detailed five year/two-phase plan for the roll-out of the SoC and its associated programs is given in Pages 21-29 of the SoC Preliminary Plan. The timeline for the development and roll-out of the BS and BA computing majors is given in Table 5.

Spring 2022	Interim Dean and Associate Deans, and initial SoC faculty will create a Curriculum Advisory Committee that includes international experts in computing education, UW alums using computing in their careers, Wyoming tech companies, UW CS/ECE and Math-Stat faculty to design the courses for the BA/BS.
Fall 2022-Spring 2023	Offer a few trial SoC undergrad courses, fully develop other SoC courses, secure accreditation of BA/BS program, and work through UW's CARF process for pertinent courses, establish 2+2 agreements with Wyoming Community Colleges, recruit first class of SoC undergraduates.
Fall 2023	Enroll inaugural SoC class of undergraduates
Fall 2023 and Spring 2024	Design, develop and seek approval to offer MS and PhD programs in Computing. Evaluate, assess and make needed modifications to BA/BS programs. Work with other UW programs on developing computing minors.
Fall 2024	Enroll inaugural SoC class of graduate students
Spring 2027	Graduate first SoC class

Table 5. Project timeline of SoC roll-out

7. Plan to assess the Academic Program

Assessment of the proposed BA and BS programs will be based on student attainment of core competencies that outline in Section 3, the learning objectives described in Section 8, and informed by the SoC Educational Board and the studies such as "Computing Curricula 2020" [CC2020].

Specific assessment activities for the BA/BS programs will include:

- Pre- and post-degree exams on core and technical computing competencies
- Capstone course with assessment of final projects, including collaboration, critical thinking and communication;
- Feedback from corporate and educational partners involved in internships or capstone projects
- Surveys with Wyoming companies employing SoC graduates
- Student course evaluations
- Exit interviews with graduates

8. Plans for accreditation

Accreditation for the program will be established through the Higher Learning Commission (HLC), and informed by a SoC Curricular Advisory Committee. In order to enable to train a more, diverse student population in computing the BS/BA programs will not be ABET accredited–ABET accreditation is more restrictive on the disciplinary courses (e.g. must be science oriented) and the mathematics and statistics courses than the envisioned SoC programs. The SoC programs are not intended to be less rigorous, but to have more options in disciplinary content, and have mathematics and statistics courses more aligned with students' interests and with the computing classes. Students desiring an engineering degree can pursue a BS from the ABET accredited program in CS/ECE, and if desired use their elective courses to take courses in the SoC.

Tentative learning outcomes are:

- **Outcome 1 – Communication:** Students will be able to communicate in written and oral forms in such a way as to demonstrate their ability to work with a variety of stakeholders, and to present information clearly, logically, and critically.
- **Outcome 2 – Application:** Students will be able to utilize and modify state-of-the-art computing tools and concepts to explore and analyze disciplinary problems

- **Outcome 3 – Coding:** Students will be able to code efficient programs on their own to model phenomena.
- **Outcome 4 - Depth of Knowledge**: In a selected domain/concentrations students will demonstrate a depth of knowledge appropriate to graduate study and/or lifelong learning in that area. Students should be able to read for understanding materials in that area beyond those assigned in coursework.
- **Outcome 5 - Preparation for Career and Further Education**: Students will be prepared for a career in industry, government agencies or non-profits or for graduate study in scientific or technical fields.

Continuous improvement of the program will be fostered through annual presentations and feedback with the SoC Curriculum Advisory Committee.

9. Benefits of the Academic Program to the University

The proposed School of Computing will position Wyoming's land grant institution as

- A national leader in computational research, education, and engagement, providing academic excellence in teaching, intellectual distinction in research, and transformative innovation for entrepreneurship. The SoC will **champion interdisciplinarity** across campus by fusing computation, digital, and data science curricula with all domains.
- A computational hub for students, faculty, staff, community and our state, industrial and academic partners. The SoC will skillfully **leverage corporate and knowledge partnerships** to unite learners, educators, entrepreneurs, and stakeholders, and create a sustainable robust digital ecosystem.
- A steward, supporter, and developer of digital skills/literacy and computational thinking for all. The SoC purpose is to **nurture computing curiosity across disciplines and backgrounds**, to enhance interdisciplinarity, and to capitalize upon emerging innovations for teaching, research, and economic diversification.

10. The ability of the University to carry out the Academic Program

UW is positioned well to successful carry out this academic plan, as it will build upon past investments, existing strengths at UW, and can take advantage of many pending opportunities (such as the planned large increases of funding at national agencies, American Rescue Program funding, the Wyoming Innovation Partnership, new technologies and businesses around blockchain, and enhanced corporate partnerships around technology). The new BA/BS curricula will leverage partnerships and in particular in the co-development and delivery of courses whenever possible. The "Digital for All" program is envisioned to be a central part of a newly crafted University Studies Program.

Wyoming has consistently sought to contribute to its future by investing in the education and training of its citizens through the University of Wyoming. Recent investments, including the Tier 1 Engineering Initiative (T-1), Science Initiative (SI), and Trustee's Education Initiative (TEI), along with capital investments in facilities provide a firm basis that focuses on the importance of Science, Technology, Engineering and Mathematics (STEM). These strengths will support the interdisciplinary, computing in context focus of the SoC.

In the past decade, computing has become an increasingly crucial tool for research, for our graduates, and for almost all sectors of the economy. The University of Wyoming has responded by hiring faculty who use computing in their discipline, establishing programs like the Data Science Center and the Advanced Research Computing Center, and by developing a partnership with the University Cooperation for Atmospheric Research (UCAR) and its NSF-funded National Center for Atmospheric Research (NCAR) around the NCAR-Wyoming Supercomputer Center (NWSC). These have supported new modes of faculty research and increased awareness of computing across the campus. The SoC will benefit from as well as greatly strengthen this existing computational ecosystem

Today, computing's impact is found in virtually every discipline, and simulation and modeling are more important than ever, but are joined by new data science technologies like artificial intelligence (AI), machine learning and blockchain that are starting to transform every academic discipline, every industry, and every aspect of modern society. Access to world-class infrastructure and workforce training in computing and data is therefore critical for Wyoming citizens, and for UW's students.

The SoC, along with the broader Digital Pillar plan, outline a strategic response to the computational-related needs of UW and Wyoming Community College students, Wyoming's business and agencies. Through the SoC there are also great prospects for the University of Wyoming to emerge as a leader in rural computing and data, drive opportunities such as those anticipated via the Endless Frontiers Act and the Wyoming Innovation Partnership.

11. The likely value to, and impact on, students and residents of Wyoming.

The BA/BS in Computing will produce professionals fluent in the computing/digital arena. UW graduates interacting with the SoC via interdisciplinary initiatives with departments will benefit from knowledge and experience of the application of computing in their chosen domain, equipping them to be perceptive and cognizant graduates with experience in innovative applications of computing – and thus competitive in the workplace. Specific outcomes for the BA/BS degree are given in Section 8.

The SoC undergraduate programs will provide Wyoming companies and agencies with employees who identify problems (or opportunities for improvement, and successfully bring to bear computing and technology to re-solve the problem (or help the company or agency advance through seizing the opportunity).

Citizens of Wyoming can from having SoC graduates helping agencies analyze complex problems (e.g. wildfire management, rural health, etc) of importance to local communities and to Wyoming.

References

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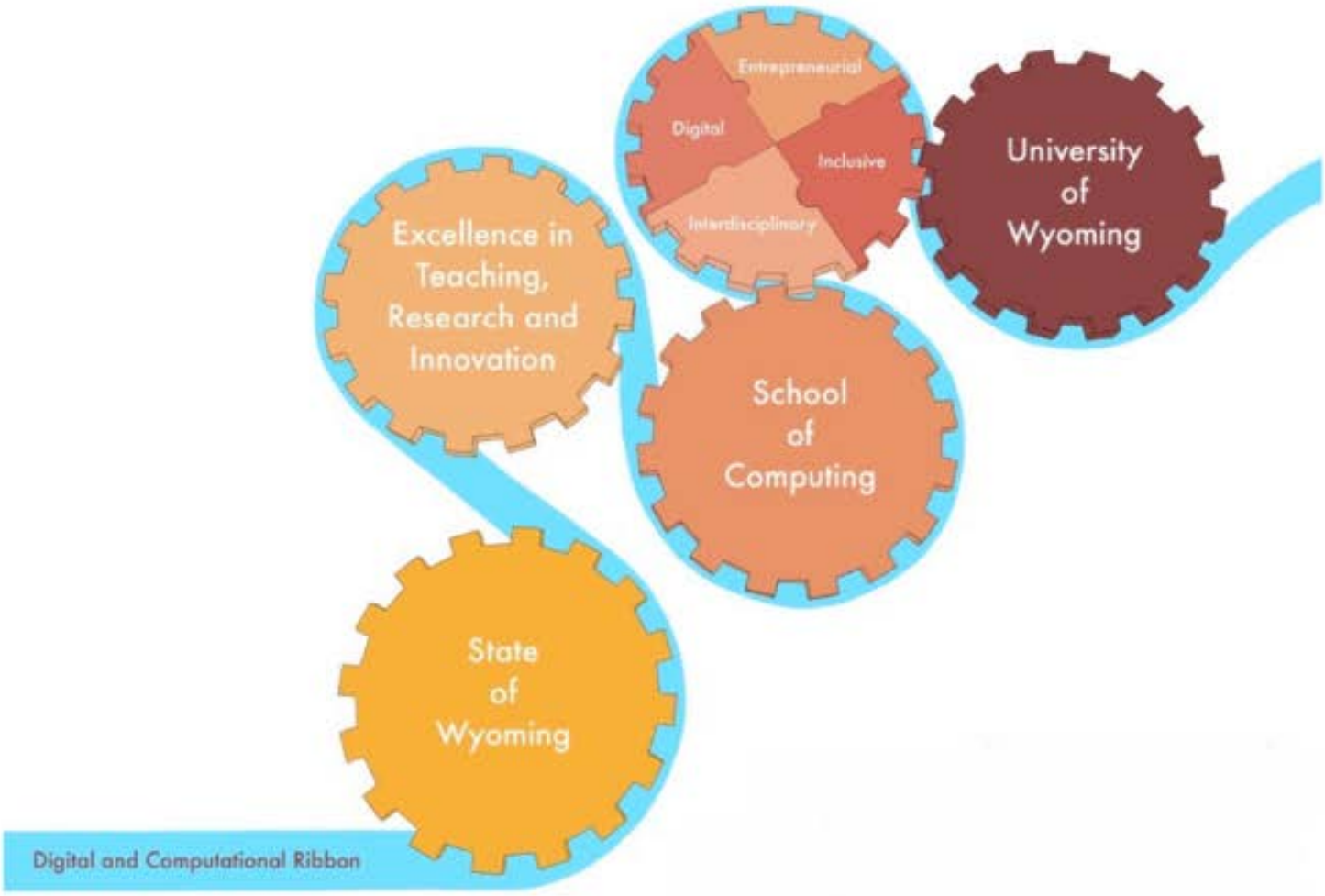

The School of Computing is designed to strategically mesh together existing resources and initiatives, the other pillars (more inclusive, more interdisciplinary, and more entrepreneurial), UW's existing strengths in research and teaching, and partnerships throughout UW and across Wyoming, into a system that drives UW to its vision of becoming a best in-class university true to Wyoming's roots.

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Addendum B