



Provost and Senior Vice President for Academic Affairs

November 7, 2019

The Honorable Dr. James D. Fielder
Maryland Higher Education Commission
6 N. Liberty Street, 10th Floor
Baltimore, MD 21201

Dear Dr. Fielder,

We are submitting the following new academic program proposal to your office for review and approval. The Board of Regents of Morgan State University at its November 5, 2019 meeting approved the following program.

Bachelor of Science in Cloud Computing

We are taking this step with full confidence in Morgan's capacity to offer this program as presented. Morgan State University is quite able to financially support this proposed program.

Please keep us informed as to the review process. If you need any additional information, please do not hesitate to contact me at lesia.young@morgan.edu or (443)885-3350.

Sincerely,

Dr. Lesia Crumpton-Young
Provost and Senior Vice President for Academic Affairs

CC: Dr. David Wilson, President
Dr. Farzad Moazzami, Interim Assistant Vice President for Academic Affairs
Dr. Hongtao Yu, Dean, School of Computer, Mathematical and Natural Sciences
Mr. Craig Scott, Interim Dean, School of Engineering
Dr. Fikremariam Boghossian, Dean, School of Business and Management
Dr. Emily Dow, Assistant Secretary for Academic Affairs, Maryland Higher Education Commission



Cover Sheet for In-State Institutions New Program or Substantial Modification to Existing Program

Institution Submitting Proposal	Morgan State University
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Each action below requires a separate proposal and cover sheet.

- | | |
|---|---|
| <input checked="" type="radio"/> New Academic Program | <input type="radio"/> Substantial Change to a Degree Program |
| <input type="radio"/> New Area of Concentration | <input type="radio"/> Substantial Change to an Area of Concentration |
| <input type="radio"/> New Degree Level Approval | <input type="radio"/> Substantial Change to a Certificate Program |
| <input type="radio"/> New Stand-Alone Certificate | <input type="radio"/> Cooperative Degree Program |
| <input type="radio"/> Off Campus Program | <input type="radio"/> Offer Program at Regional Higher Education Center |

Payment <input checked="" type="radio"/> Yes	Payment <input type="radio"/> R*STARS	Payment \$850	Date
Submitted: <input type="radio"/> No	Type: <input type="radio"/> Check	Amount:	Submitted: 11/7/2019

Department Proposing Program	Computer Science - School of Computer, Mathematical, & Natural Sciences		
Degree Level and Degree Type	Bachelor of Science		
Title of Proposed Program	Cloud Computing		
Total Number of Credits	120		
Suggested Codes	HEGIS: 07.0701	CIP: 11.0103	
Program Modality	<input checked="" type="radio"/> On-campus	<input checked="" type="radio"/> Distance Education (fully online)	
Program Resources	<input type="radio"/> Using Existing Resources	<input checked="" type="radio"/> Requiring New Resources	
Projected Implementation Date	<input checked="" type="radio"/> Fall	<input type="radio"/> Spring	<input type="radio"/> Summer
	Year: 2020		
Provide Link to Most Recent Academic Catalog	URL: http://catalog.morgan.edu/		

Preferred Contact for this Proposal	Name:	Farzad Moazzami
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President/Chief Executive	Type Name:	Dr. Lesia Crumpton-Young
	Signature:	<i>Lesia Crumpton-Young (PM)</i> Date: 11/07/2019
	Date of Approval/Endorsement by Governing Board:	11/5/2019

Revised 3/2019

Morgan State University

Proposal for a Bachelor of Science Degree in Cloud Computing

Morgan State University (Morgan)¹ proposes a new instructional undergraduate degree program, Bachelor of Science in Cloud Computing (hereafter the “BS in Cloud Computing” or the “Program”). The Program is offered through the Department of Computer Science² in the School of Computer, Mathematical and Natural Sciences (SCMNS)³ in collaboration with the School of Business and Management (Information Sciences & Systems) and the School of Engineering (Electrical Engineering).

The BS in Cloud Computing is designed for students to gain knowledge in cloud computing⁴, develop skills in cloud computing services and applications, have careers in cloud computing within industry, academia, and government as cloud administrators, architects, modelers, engineers, application developers, security specialists, analytics specialists, analysts, and researchers.

The BS in Cloud Computing will be offered in both online and face-to-face formats.

A. Centrality to Institutional Mission and Planning Priorities

A.1. Provide a description of the Program, including each area of concentration (if applicable), and how it relates to the institution’s approved mission

Guided by Morgan’s mission statement and its planning priorities, this proposal for a Bachelor of Science degree in Cloud Computing is consistent with Morgan's current mission of serving "the community, region, state, nation, and world as an intellectual and creative resource by supporting, empowering and preparing high-quality, diverse graduates to lead the world," which is firmly grounded in *Enhancing Student Success*, the first goal of Growing the Future, Leading the World: The Strategic Plan for Morgan State University, 2011-2021. In an effort to realize its institutional mission, its legislative designation as Maryland’s Preeminent, Public, Urban, Research Institution and its strategic planning goals, Morgan has focused on developing unique high demand degree Programs to offer both in traditional classroom face-to-face settings as well as online.

Cloud services and the accompanying applications are establishing the demand for new knowledge, skills, and competencies. Increasingly the demand for data infrastructures that can be stored, secured, and accessed, from any locations requires a cloud-based solution. These cloud-based data solutions create new opportunities to prepare students to be employed with knowledge, skills, and competencies to help businesses become more agile and cost effective. By providing infrastructure, platforms and software as a service, cloud computing allows users to access and implement important business and technology tools whenever and wherever they need and perform tasks that they would otherwise difficult with traditional standalone systems, such as machine learning. Acquiring knowledge, skill, and competency in cloud computing is particularly appropriate for online instruction as well as in the classroom. Morgan’s proposed BS in Cloud Computing Program is a new instructional stand-alone undergraduate Program offered in both online and traditional face-to-face instructional formats. The Program will be hosted in the Department of Computer Science under the SCMNS at Morgan with the goal of preparing students with knowledge and practical skills in cloud computing and related areas for the workforce.

¹ Appendix I – Morgan State University

² Appendix III – Department of Computer Science

³ Appendix II – School of Computer, Mathematical and Natural Sciences

⁴ Appendix VIII – Cloud Computing

The Program serves to implement the Morgan’s core values of “innovation and excellence” and to enhance educational opportunities for adults and non-traditional students. Specifically, the BS in Cloud Computing is designed to assist students in:

- developing skills in cloud computing;
- preparing for careers in cloud computing within industry, academia, and government; and,
- serving as cloud administrators, architects, modelers, engineers, application developers, security specialist, analytics specialists, data analysts.

Uniqueness of the Program

1. Curriculum: A multidisciplinary curriculum that is coherent, cohesive, rigorous, theoretical, practical and workforce-oriented.
2. Courses: Well-structured courses utilizing case studies, research studies, scenario-based immersion, student-centered teaching, active learning, and targeted applications.
3. Learning Approach: Project-based hands-on learning approach that integrates the latest cloud computing tools, services and methods.
4. Collaboration: Collaborate with Amazon local headquarters and other high tech companies for internships and work-based learning.
5. Novelty: The first cloud computing degree in the State of Maryland and one of the few in the country.

Courses

There will be nine (9) cloud computing required courses (27 credits) for the Program plus 6 computer science, 2 business, 3 math, and 2 elective courses. The total major requirements consist of 22 courses (70 credits) and the Program consists of a total of 39 courses (120 credit). Details see Table 1 and 2.

Table 1: Graduation Requirements for Students Earning Degrees in SCMNS

General Education Core Requirements	...	13 courses -	42 credits
- University Core Requirements	...	2 courses -	2 credits
- Complementary Study Requirements	...	2 courses -	6 credits
- Major Requirements	...	22 courses -	70 credits
Total:	...	39 courses -	120 credits

Table 2: Cloud Computing Major Requirements

- Cloud Computing Required Courses	...	9 courses - 9×3	27 credits
- Computer Science Required Courses	...	6 courses - 2×4 + 4×3	20 credits
- Business Required Courses	...	2 courses - 2×3	6 credits
- Math Required Courses	...	3 courses - 2×4 + 1×3	11 credits
- Elective Required Courses	...	2 courses - 2×3	6 credits
Total:	...	22 courses -	70 credits

Required Elective Courses can be chosen from the existing:

- Computer Science Courses
- Mathematics Courses
- Information Science and Systems Courses
- Electrical and Computer Engineering Courses

The BS in Cloud Computing Program will offer innovative, inclusive, and distinctive educational experiences to a broad cross-section of the population in a comprehensive range of disciplines at the baccalaureate level.

A.2. Explain how the proposed Program supports the institution’s strategic goals and provide evidence that affirms it is an institutional priority.

Growing the Future, Leading the World: The Strategic Plan for Morgan State University (2011 - 2021) (the Strategic Plan)⁵ consists of five broad goals including Enhancing Student Success, Enhancing Morgan’s Status as a Doctoral Research University, Improving and Sustaining Morgan’s Infrastructure and Operational Processes, Growing Morgan’s Resources, and Engaging with the Community. These Strategic Plan goals guide the development and implementation of the University’s academic programs, student services, and institutional budgets. The BS in Cloud Computing supports the Strategic Plan goals:

Goal 1: Enhancing Student Success

The Program supports Morgan’s goal in leading the state of Maryland in graduating underrepresented minority students in STEM disciplines by offering challenging, internationally relevant academic curricula. The establishment of the BS in Cloud Computing enhances Morgan’s instructional capacity to train professionals to serve the City of Baltimore, the State of Maryland, the region and nation by attracting underrepresented minority students to this unique Program. This Program will also contribute to the Strategic Initiatives of the SCMNS, which includes “to expand academic Program offerings, including new and online degree Programs and up-to-date curricula,” and “to enhance research and scholarly activities, including the improvement of infrastructure and capabilities.”

The BS degree in Cloud Computing also advances two other initiatives of this goal including: (a) increasing student enrollment by “developing unique high demand online degree programs” and (b) “enhancing students’ educational experiences by expanding the curriculum to include more internships, and more interdisciplinary courses and degree Programs.” By offering the BS in Cloud Computing online as well as on campus, students are able to combine on-campus classes with on-line courses and thereby be afforded maximum flexibility in completing degree requirements. This Program will attract students and professionals by providing high-demand career opportunities with in-depth knowledge and technical skills in cloud computing, and by preparing students for technically significant careers within industry and governmental agencies in the surrounding region.

Goal 4: Growing Morgan’s Resources

The Program expands Morgan’s human capital as well as its financial resources by investing in the professional development of faculty, staff, and students, establishing collaborative relationships with private and public entities. For example, a team of Morgan faculty, staff, and administrators are already working with a team of Amazon Web Services (AWS) Educate to support faculty development, enhance employer engagement, and to increase support for career services. Morgan and AWS teams are collaborating to provide access to core AWS computer storage, database, and application services and access to AWS conferences and convenings to support faculty development. To enhance employer engagement the two teams are pursuing access to AWS’s Global Partners as a source of employment and apprenticeship for students and alumni. And, increased support for career services include, but is not limited to access to AWS game day training exercises as well as access to AWS and its Global Partners to assist Morgan’s Office of Career services to prepare students for career competencies in emerging cloud computing careers. In summary, the planning for the BS in Cloud Computing anticipates collaborating with AWS Educate and its vast network of global partners to grow the available resources at Morgan to support the Office for Career Development.

⁵ Appendix V - Strategic Goals of Morgan State University

Goal 5: Engaging with the Community

The Program collaborates with Amazon HQ2 in learning, internships, and employment. It also engages with community residents and officials in the use of knowledge derived from faculty and student research. Specifically, Morgan's President, Dr. David Wilson, has worked with the Vice President of AWS to encourage the development of "flex degrees" that that could incorporate professional credentials, prior learning experiences, and testing in cloud computing and related technologies into a degree pathway that would accommodate the needs of industry professionals, adults, and non-traditional as well as traditional age students.

AWS expects to collaborate with Morgan in providing paid internships for students enrolled in the Cloud Computing Program across the vast network of government and industry partners utilizing AWS. Morgan has already developed similar "learn and earn" opportunities for its students with other technology and cloud reliant companies including Google, Microsoft, Facebook, Intel, Apple, etc.

A.3. Provide a brief narrative of how the proposed Program will be adequately funded for at least the first five years of Program implementation.

The University will recruit three new full-time cloud computing faculty members, one to be the Program Director and two to be a tenure-track faculty, to teach both online and face-to-face courses and guide student training in cloud computing. A full-time equivalent of adjunct/part-time faculty will be recruited to teach either online or the regular courses. In addition, an administrative assistant, one part-time IT support person will also be recruited to support the Program.

The Department of Computer Science has faculty with extensive experience in cloud computing, machine learning, and data analytics. In addition, the Department of Information Systems in the School of Business and the Department Electrical Engineering offer cloud-related courses and have faculty with expertise in cloud computing.

Morgan has established collaborations with Google, Facebook, Intel and Apple, and has an agreement with AWS for using AWS materials and expertise in teaching. The Computer Science Department also plans to collaborate with other cloud computing companies, such as IBM and Microsoft, and conduct fund-raising through these partnerships.

A.4. Provide a description of the institution's commitment

The BS in Cloud Computing has received full support from Morgan's President, Dr. David Wilson, from the Provost and Senior Vice President for Academic Affairs, Dr. Lesia Crumpton-Young. President Wilson convened the initial meeting of university officials to initiate the planning for the degree in cloud computing. He assigned Vice President for Academic Outreach and Engagement (Dr. Maurice Taylor) to work with faculty and deans to develop the cloud computing initiative. The President also supported the travel of five faculty and staff to the Washington DC headquarters of AWS Educate and then to the AWS Cloud Computing IMAGINE international conference in Seattle to gain firsthand experience and knowledge on cloud computing programs.

Morgan will support the BS in Cloud Computing with three new faculty members, one of whom will serve as the Director of the Program. Spaces with necessary furniture, phones, the Internet access, computers, printers, smart and standard boards, classrooms, two computer labs with 20 working stations each, printer, smart and standard boards, two cloud computing labs, study rooms, library resources, offices including a Program Director's office suit with space for an administrative assistant, and a waiting room. The University has committed to establish the BS in Cloud Computing Program with full financial and institutional support.

B. Critical and Compelling Regional or Statewide Need as Identified in the State Plan

The Program is consistent with the State of Maryland's goals for maintaining and strengthening a preeminent, statewide array of postsecondary institutions. It responds to the crucial need as highlighted in the 2017-2021 Maryland State Plan for Postsecondary Education, Student Success with Less Debt (State Plan), by ensuring “equitable access to affordable and quality postsecondary education for all Maryland residents.” It promotes and implements “practices and policies that will ensure student success” by fostering “innovation in all aspects of the Maryland higher education to improve access and student success.”⁶ The State of Maryland enjoys a national and international reputation for being “among the nation’s leaders of innovation in higher education, highly ranked in research and development with 72 federal laboratories.”⁷ Similarly, Morgan was officially designated as Maryland’s Preeminent Public Urban Research University,⁸ and innovation is one of the institution’s core values.⁹ Understanding the importance of computing education and relevant career opportunities in the IT sector, the State of Maryland allocated a \$7 million investment over three years to bring computer science to every school, and to make the State the Silicon Valley of the East by recently (May, 2018) passing bill HB 281.¹⁰

The BS in Cloud Computing is consistent with the three primary goals outlined in the State Plan including access, success, and innovation.

1. Access

In addition to its well-established array of baccalaureate (45), master’s (38), doctoral and professional degrees (17), Morgan has also established a strong online presence through the establishment of the office of Morgan Online, an administrative unit for oversight of the new innovative online degree and certificate programs offered by the University. The intent in establishing these online programs is, in large measure, an effort by the University to fulfill its access mission by offering highly flexible degree programs on campus as well as online to expand educational opportunities for traditional students as well as for working students, adult learners, and non-traditional students. As noted in the State Plan¹¹,

Non-traditional students now comprise the majority of postsecondary students. Many students have delayed initial enrollment or are returning after earlier enrollment, enroll part-time, are financially independent of parents, support a family, or work full-time. These students have needs and expectations that are often quite different from those of the traditional high school-to-college student.

The BS in Cloud Computing is consistent with Morgan’s access mission in that by offering the degree on campus and online to more students, specifically non-traditional students, who will have the opportunity to earn a degree in a unique, high demand STEM based program. As African Americans and other minorities continue to be underrepresented in STEM disciplines, offering the BS in Cloud Computing at Morgan, one of the State’s HBIs, serves to improve access for students underrepresented in this discipline and career pathway.

⁶ <https://mhec.state.md.us/About/Pages/2017StatePlanforPostsecondaryEducation.aspx>

⁷ “The Maryland Higher Education Commission Maryland State Plan for Postsecondary Education 2017-2021: Increasing Student Success with Less Debt,” p. 11.

<https://mhec.state.md.us/About/Documents/2017.2021%20Maryland%20State%20Plan%20for%20Higher%20Education.pdf>.

⁸ <https://news.Morgan.edu/Morgan-is-marylands-preeminent-public-urban-research-university/>.

⁹ “The Strategic Plan for Morgan State University (2011-2021),” p. 4.

https://issuu.com/Morganstateu/docs/strategicplan2011-21_final?e=2119971/60089621.

¹⁰ <http://mgaleg.maryland.gov/WEBMGA/frmMain.aspx?stab=01&pid=billpage&tab=subject3&ys=2018rs&id=HB0281>

¹¹ State Plan pg. 14.

2. Success

Morgan has a number of well-established initiatives to increase the educational success of underserved populations. A key aspect of student success at Morgan is the 50 by 25 Campaign to increase the six-year graduation rate to 50% by 2025. The President reported to the General Assembly¹²:

Beginning with the entering class of 2010, the University has significantly increased its freshman-sophomore and sophomore-junior retention rates. Second-year retention rates have been above 70% for the past nine years. Third-year retention rates are at 60%. Fourth year retention rates have risen to 56%. Our six-year graduation rates have increased from 31% for the fall 2009 cohort to 43% for the fall 2013 cohort.

In summary, the BS in Cloud Computing degree will be integrated in an ongoing set of strategic initiatives focused on ensuring student success. The University has storied history of success in graduating African Americans, particularly women, and other underrepresented minorities with bachelor degrees in most of the STEM disciplines.

3. Innovation

In March (2019), Morgan celebrated its 6th Annual ‘Innovation Day’ in Annapolis, Md. at the Miller Senate Office Building. Morgan Innovation Day, which serves in part as an annual progress report on the State’s premier public urban research institution, “Taking the lead in innovation and providing a pipeline to new technologies is consistent with Morgan’s strategic goals and our historical mission of preparing a diverse student body to help the world meet tomorrow’s challenges.” The BS in Cloud Computing enhances Morgan’s tradition of providing unique, high demand, and innovative academic programs.

In Maryland, several community colleges offer associate degree in cloud computing related programs and one private institution offers a master’s degree. No higher education institution in Maryland offers a bachelor’s degree in cloud computing. Collaborating with AWS Educate, the BS in Cloud Computing is an innovative degree program designed to provide maximum flexibility to undergraduates, working adults, and non-traditional students to acquire instruction, skills, and competencies in a leading-edge career pathway essential to jobs and vocations essential to the business of the State and the nation. In summary, the proposed the BS in Cloud Computing is unique in the State Maryland and does not duplicate any bachelor degrees at other institutions in Maryland.

1. Demonstrate demand and need for the Program in terms of meeting present and future needs of the region and the State in general based on one or more of the following:

a) The need for the advancement and evolution of knowledge

Research methods in the areas of science, engineering and business have changed significantly over the past few decades. Progress in computer science, information technology, computational science, and cloud computing and data science have been the main driving force behind the advances of technologies. Cloud computing has emerged as one of the burgeoning new disciplines in the last decade.

Cloud computing professionals are in high demand across all areas of STEM and social sciences and economics. For today’s graduates, it is one of the most valuable career skills. Just as Silicon Valley benefits from its tech giants, such as Google, Facebook and Apple, the Baltimore region and the State of Maryland could benefit from their proximity to the metropolitan DC area, including Northern Virginia, where cloud computing giant Amazon will bring thousands of new jobs in HQ2.

¹² Dr. David Wilson. Legislative Testimony FY 2020 Operating Budget. February 2019: Pg. 9

Large Maryland employers seeking expertise in cloud computing include:

- Federal agencies: NASA, NSA, NSF, NIH, NIST, FDA, EPA, DHS, USDA;
- Military: RDECOM, CECOM, Naval Air Systems Command, ARL, APL;
- Healthcare: MedStar Health, CareFirst BlueCross BlueShield, LifeBridge Health, Magellan Health Services Inc., Greater Baltimore Medical Center Healthcare Inc.;
- Banks-Investment: Legg Mason Inc., Bank of America Corporation, T. Rowe Price Group Inc., Mercantile Bankshares Corporation, M&T Bank Corporation.

Cloud Computing Jobs in the State of Maryland (spring 2019)¹³

Job Type	Experience Level	Salary Estimate	Organization	Location
Full-time (738)			Smartronix(42)	Annapolis Junction, MD(105)
Contract(50)	Mid Level(355)	\$85,000(629)	Medical Science & Computing, Inc.(28)	Bethesda, MD(87)
Part-time(12)	Senior Level(166)	\$100,000(501)	Brilliant(25)	Baltimore, MD(65)
Temporary(2)	Entry Level(75)	\$110,000(379)	SAIC(24)	Fort Meade, MD(64)
Commission(1)		\$120,200(269)	Amazon Web Services, Inc.(20) ¹⁴	Columbia, MD(51)
Internship(1)		\$130,000(154)		

b) Societal needs, including expanding educational opportunities and choices for minority and educationally disadvantaged students at institutions of higher education

For a variety of reasons, the high-tech industry is substantially less diverse than the broader workforce. This lack of diversity is especially acute in the case of African Americans. According to the Equal Opportunity Employment Commission’s (EEOC) Special Report on Diversity in High Tech, African Americans make up 14.4% of employees in overall private industry, but only 7.4% of employees and less than 2% of executives in high tech, the lowest rates of any measured racial or ethnic group.¹⁵

The State of Maryland is home to more than 60 federal agencies and twice as many federal laboratories (74) and features a diversified economy with the fourth highest concentration of professional and technical workers among the states in the U.S.¹⁶

The Baltimore – Washington DC area has a diversified population with a wide variety of job opportunities from defense to computer science and information technology, from health care to biotechnology for students who have acquired skills, training, and competencies.¹⁷

Thanks to the State of Maryland’s diverse population and burgeoning tech industry, Morgan is well positioned to contribute to the remediation of these inequities. African Americans make up 30.8% of Maryland’s population,¹⁸ in contrast with 13.4% the United States’ population.¹⁹

¹³ <https://www.indeed.com/jobs?q=Cloud+Computing&l=Maryland>

¹⁴ <https://aws.amazon.com>

¹⁵ <https://www.eeoc.gov/eeoc/statistics/reports/hightech/>.

¹⁶ <https://open.maryland.gov/why-maryland/our-strategic-location/>

¹⁷ <https://www.intelligencecareers.gov/iccareers.html>

¹⁸ United States Census Bureau, <https://www.census.gov/quickfacts/md>.

¹⁹ United States Census Bureau, <https://www.census.gov/quickfacts/fact/table/US/PST045218>.

According to the Computing Technology Industry Association 2019 report, the State of Maryland is the sixth in the country for total tech workers in the workforce at 10.2%.²⁰ The State of Maryland is also the second in the nation for the total number of Computer and Information Research Scientists, ranking only behind California.²¹ The City of Baltimore has also been ranked the second best city for women in technology based on tech jobs filled by women (31.1%), income after housing costs, and growth in tech employment over 2017-2019 (28%).²² In this environment, graduates of the BS in Cloud Computing Program who are underrepresented minorities will easily find jobs in cloud computing.

As the State of Maryland's Preeminent Public Urban Research University and largest Historically Black University,²³ Morgan has a central role to play in preparing underrepresented minority graduates for the high-tech industry. The EEOC's Special Report of Diversity in High Tech attributes high levels of attrition among African American (and especially African American women) to feelings of isolation and inhospitable work cultures. With one of the highest ratios of African American students (78%)²⁴ and the highest number of African American full-time faculty at the University of Maryland System (206),²⁵ Morgan offers its STEM students a positive and welcoming environment with relatable role models. It is at least partly for this reason, and due to the committed efforts of our faculty, that in this past academic year, our enrollment and degrees awarded in the Department of Computer Science reached all-time highs of 289 and 35, respectively. Moreover, in the past year, 30 Computer Science students participated in internships at such companies as Google, Facebook, Apple, JP Morgan Chase, IBM and others. Our Department of Computer Science is ripe for expansion into the realm of cloud computing and for preparing diverse graduates for rewarding careers with the world's largest high-tech companies.

The BS in Cloud Computing will expand the field of educational opportunities and choices for minority and educationally disadvantaged students.

c) [The need to strengthen and expand the capacity of historically black institutions to provide high quality and unique educational Programs](#)

An important strategy of the State Plan in promoting student success for Maryland to “continue supporting the unique missions of Historically Black Colleges and Universities (HBCUs)²⁶” As the largest and most comprehensive of the State's four public HBCUs, Morgan is a major economic engine for the City of Baltimore and the State of Maryland annually producing \$1 billion in statewide economic impact, supporting 6,500 jobs and generating \$47 million in state tax revenues.²⁷ Its close proximity to Baltimore, Washington DC, Annapolis and Northern Virginia and the demand for computer science and

²⁰ https://www.cyberstates.org/pdf/CompTIA_Cyberstates_2019.pdf, p. 11.

²¹ US Bureau of Labor Statistics, Occupational Employment Statistics Query System, May 2018 Release. <https://data.bls.gov/oes/#/home>.

²² <https://smartasset.com/checking-account/the-best-cities-for-women-in-tech-in-2019>.

²³ Based Morgan's on total enrollment in 2018 (7,712) in comparison with Bowie State University (5,112), Coppin State University (2,162), and the University of Maryland Eastern Shore (3,193). The Maryland Higher Education Commission (MHEC), “Trends in Enrollment by Race and Gender (2018).” <https://mhec.maryland.gov/publications/Documents/Research/AnnualReports/2018EnrollbyRaceGender.pdf>.

²⁴ Ibid.

²⁵ MHEC Annual Data Book, 2019.

<https://mhec.maryland.gov/publications/Documents/Research/AnnualPublications/2019DataBook.pdf>. The next highest is Bowie State University with 135. The average number of African American faculty at institutions in the UMD System excluding Morgan is 36.

²⁶ State Plan. Pg.49

²⁷ <https://www.Morgan.edu/economicimpact>.

information technology professionals here necessitate the degree. Morgan is uniquely positioned to offer the BS in Cloud Computing as it already leads other higher education institutions in the State in awarding bachelor degrees to African Americans in STEM related disciplines including Engineering. The BS in Cloud Computing is a unique, high-demand, innovative Program that will strengthen and expand the capacity of Morgan to recruit new students, enhance the diversity, and collaborate with tech industries and provide high quality educational experiences for our undergraduates.

Morgan is committed to the policy that all persons shall have equal access to Programs without regard to race, sex, religion, national origin, handicap, age, or status as a disabled or Vietnam-era veteran.

The BS in Cloud Computing will offer to the students a wide range of benefits including being the first in the State of Maryland with the BS degree in Cloud Computing at Morgan State University, an HBCU.

2. Provide evidence that the perceived need is consistent with the Maryland State Plan for Postsecondary Education.

The need for a BS in Cloud Computing is consistent and well aligned with the three primary goals of Maryland’s 2017-2021 State Plan for Postsecondary Education: Access, Success and Innovation.²⁸ The proposed Program conforms to the first goal to “ensure equitable access to affordable and quality postsecondary education for all Maryland residents.” The State of Maryland seeks to close the accessibility and achievement gap through its ongoing commitment to addressing equal access, success, and opportunity through a variety of focused Programs. A BS Program in cloud computing serving underrepresented minority and diverse non-African American populations with an education that is both high-quality and lower in cost compared with other private and public universities in this region brings the State a step closer to fulfilling its fundamental commitment to equity, equality, and embracing diversity.

One of the key strategies for supporting the State Plan’s second goal of promoting student success is to support “the unique missions of Historically Black Colleges and Universities,” and to enhance “diversity by fostering collaborations between Historically Black Colleges and Universities and traditionally white institutions.” As previously noted, the proposed Program strongly supports Morgan State University’s mission by “supporting, empowering and preparing high-quality, diverse graduates to lead the world.”²⁹ By providing the State’s diverse students with unique expertise in a high-demand field, they will be positioned to pursue career-oriented internships and ultimately find meaningful employment at the forefront of the world’s leading technological firms.

Similarly, the BS in Cloud Computing promotes Maryland’s goal of pursuing innovation by promoting “business-driven credentials.” Consumer technologies are increasingly dependent on cloud-driven applications, and firms across all industries are finding that they require expertise in this area in order to connect with their customers effectively and meet their business needs. Moreover, graduates of the Program will be poised to pursue “long-term graduate education opportunities,” in a variety of quickly growing research fields, such as big-data.

²⁸ <https://mhec.state.md.us/About/Pages/2017StatePlanforPostsecondaryEducation.aspx>, retrieved 7/24/2019.

²⁹ “The Strategic Plan for Morgan State University (2011-2021),” p. 3.
https://issuu.com/Morganstateu/docs/strategicplan2011-21_final?e=2119971/60089621.

C. Quantifiable and Reliable Evidence and Documentation of Market Supply and Demand in the Region and State:

1. Describe potential industry or industries, employment opportunities, and expected level of entry (*ex: mid-level management*) for graduates of the proposed Program.

C.1.1. Potential of the Cloud Computing Industry

The cloud computing industry offers potential opportunities and capabilities. Cloud computing opens a new world of jobs, services, platforms, and applications. There are thousands of possibilities beginning to form as the future of cloud computing starts to take off.

Ten industries that can directly benefit from cloud computing solutions are: financial, healthcare, insurance, hospitality, production, real estate, legal, automotive, education and non-profit.

For instance, cloud computing can be an invaluable tool for education, where funding is often tight. It is important for schools to have access to the latest technology to provide the best possible education. By centralizing information and promoting online communication, students are empowered to access the information they need all in one place. Instructors can distribute assignments with greater ease. The collaboration between students and instructors will improve immensely.

C.1.2. Employment Opportunities in Cloud Computing

Cloud computing is one of the hottest technologies with a high demand for qualified professionals in cloud infrastructure, cloud architecture, cloud engineering, and cloud security.

Cloud computing is a key part of enterprise digital transformation strategies, with cloud services projected to become a \$300 billion business by 2021.³⁰ As the cloud begins to dominate the business landscape, job seekers and employers interested in positions related to cloud computing have increased substantially.

C.1.3. Salaries in Cloud Computing

The median salary for cloud computing professionals in 2016 was \$124,300 and in 2018 was \$146,350.³¹

C.1.4. The BS in Cloud Computing Program Graduates Level of Entry

Expected entry-level positions for graduates of the BS in Cloud Computing Program include cloud administrator, architect (associate), engineer, application developer, network engineer, automation engineer, security manager [source: Techrepublic].

Area	Related Jobs
Cloud Computing	Platform Engineer, Cloud Architect
Virtualization	Cloud Network Engineer, Cloud Network Administrator
Middleware and Integration Software	IT Manager, Systems Integration Engineer
Web Architecture and Development Framework	Web Developer, Full Stack Web Developer
User Interface Design	User Interface Designer
Software Systems	Software Engineer

³⁰ <https://www.techrepublic.com/article/15-most-in-demand-cloud-computing-jobs/>.

³¹ <https://www.forbes.com/sites/louiscolombus/2018/11/27/where-cloud-computing-jobs-will-be-in-2019/#6c3f7d606add>.

Mobile Development	Mobile Engineer, Mobile Application Developer
Network and Information Security	Information and Cyber Security Specialist
Database Management and Software	Database Specialist, Database Administrator
Data Engineering and Data Warehousing	Software Engineer, Database Developer, Data Analyst
Storage Systems and Management	Database Administrator, System Administrator
Algorithm Design	Software Engineer, Lead Software Engineer, Lead Developer
Perl/Python/Ruby/C-C++/Java	Software Engineer, Data Scientist
Shell Scripting Languages	Unix Administrator, System Engineer, Programmer
Windows, Unix, Mac Systems	System Administrator
Software Quality Assurance and User Testing	Software Quality Assurance Engineer, User Experience Testing Engineer

2. Present data and analysis projecting market demand and the availability of openings in a job market to be served by the new Program.

C.2.1. Data and Analysis Projecting Cloud Computing Market Demand

There are 50,248 cloud computing positions available in the U.S. today available from 3,701 employers, and 101,913 open positions worldwide. The following graphic shows the distribution of salaries for the 50,248 cloud computing jobs currently available in the U.S. alone. [source: Forbes]



Demand for cloud computing expertise continues to increase exponentially. The Hiring Scale is 78 for jobs that require cloud computing skillsets (where higher scores indicate greater difficulty finding applicants suited to the position), with the average job post staying open 46 days.



C.2.2. Availability of Openings in a Cloud Computing Job Market

In late 2018, Oracle, Deloitte, and Amazon had the most open cloud computing jobs. IBM, VMWare, Capital One, Microsoft, KPMG, Salesforce, PricewaterhouseCoopers, U.S. Bank, and Booz Allen Hamilton, Raytheon Corporation, SAP, Capgemini, Google, Leidos and Nutanix each had over 100 open cloud computing positions. The following graphic shows competitive concentration of employers in cloud computing.

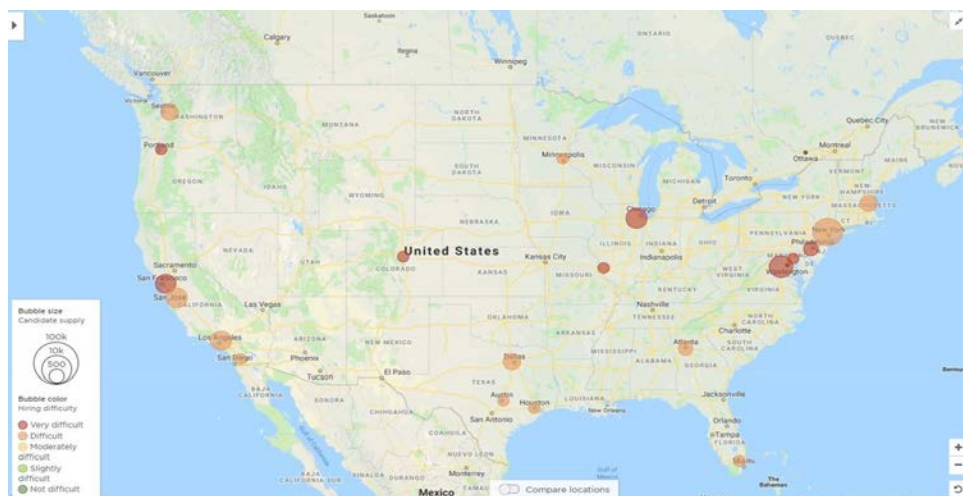


Java, Linux, Amazon Web Services (AWS), Software Development, DevOps, Docker, and Infrastructure as a Service (IaaS) are the most in-demand skills.

The top five cities where cloud computing jobs anticipated in 2019 are:

- Washington DC
- Arlington-Alexandria, VA
- San Francisco-Oakland-Hayward, CA
- New York-Newark-Jersey City, NY
- San Jose-Sunnyvale-Santa Clara, CA
- Chicago-Naperville-Elgin, IL.

The following map shows the distribution of job volume, salary range, candidate supply, posting period and hiring scale.



The following graphic shows the markets with the highest supply of talent with cloud computing skills.

Location Comparison Chart
How do my selected locations compare on key statistics?

Compare locations

Location Type	Candidate supply	Job demand	Relative supply	Hiring difficulty	Estimated salary (USD \$)
Metropolitan Area	All	All	All	All	All
1. New York-Newark-Jersey City MSA, NY	42,752	2,779	Low	Difficult	\$151,600
2. Washington-Arlington-Alexandria MSA, DC	29,915	3,472	Very low	Very difficult	\$151,950
3. Los Angeles-Long Beach-Anaheim MSA, CA	25,674	1,703	Low	Difficult	\$136,750
4. San Francisco-Oakland-Hayward MSA, CA	25,220	2,977	Very low	Very difficult	\$160,700
5. San Jose-Sunnyvale-Santa Clara MSA, CA	23,133	2,452	Very low	Difficult	\$173,300
6. Chicago-Naperville-Elgin MSA, IL	21,658	2,034	Very low	Very difficult	\$141,400
7. Boston-Cambridge-Newton MSA, MA	19,444	1,828	Very low	Difficult	\$152,100
8. Seattle-Tacoma-Bellevue MSA, WA	19,219	2,080	Very low	Difficult	\$141,750

As these data show, nearly all major metropolitan areas are in need of graduates with expertise in cloud computing, and this need is especially pronounced in our own local Washington-Baltimore region.

3. Discuss and provide evidence of market surveys that clearly provide quantifiable and reliable data on the educational and training needs and the anticipated number of vacancies expected over the next 5 years.

The demand for cloud computing skills is on the rise as more and more companies are adopting cloud services. According to Forbes, the worldwide spending on cloud computing services will grow at a 19.4% compound annual growth rate (CAGR) from nearly \$70 B in 2015 to more than \$141 B in 2019. According to a market survey conducted by Gartner, Inc., the total worldwide market (revenues) for public cloud services is expected to grow by from \$175.8 B in 2018 up to \$278.3 B in 2021.³² With such growth comes demand for the cloud professionals who will manage the cloud computing and information technology infrastructure and services. Skills most needed in cloud computing in 2019 include the following: cloud security, machine learning and artificial intelligence, cloud migration and deployment within multi-cloud environments, serverless architecture, database skills, Programming languages, Linux certification and DevOps.³³

4. Provide data showing the current and projected supply of prospective graduates.

Data from market analyses presented above show that there will be a rapid and steady growth of cloud computing jobs, and the supply of cloud computing professionals is insufficient to meet both current and projected labor market demands. As major companies in tech, finance and other industries continue to invest in cloud services and architecture, cloud computing professionals will be needed to operate, maintain and grow these investments. Our online searches reveal that there are currently very few nationally available degree programs in this quickly growing field. We found that, although several universities offer certificates or master degree Programs, bachelor degrees in cloud computing

³² <https://www.gartner.com/en/newsroom/press-releases/2018-09-12-gartner-forecasts-worldwide-public-cloud-revenue-to-grow-17-percent-in-2019>.

³³ <https://www.akraya.com/blog/the-must-have-cloud-computing-skills-for-2019>.

specifically are exceedingly rare. Bachelor programs are currently offered at Purdue University, Full Sail University and Western Governors University. George Mason University and Northern Virginia Community College are now in the process of jointly developing a bachelor degree Program in cloud computing.³⁴ Institutions of higher education across the United States are beginning to appreciate the urgent need to prepare specialists in cloud computing. The Proposed BS in Cloud Computing Program provides the Morgan and the State of Maryland a unique opportunity to gain an early foothold in this valuable area of study.

D. Reasonableness of Program Duplication:

1. Identify similar Programs in the State and/or same geographical area. Discuss similarities and differences between the proposed Program and others in the same degree to be awarded.

The proposed the BS in Cloud Computing Program is unique in the State Maryland and does not duplicate any existing Programs.

A survey of cloud computing courses, certificates, and/or degree in Maryland reveals the following:

Frederick Community College	Cloud Computing	Lower Division Certificate
Montgomery College	Cloud Computing	Lower Division Certificate
Capitol Technology University	Secure Cloud Computing	Post-Baccalaureate Certificate
Univ. of Maryland University College	Cloud Computing Architecture	Master's Degree

Frederick Community College and Montgomery College only offer lower division certificate in cloud computing. UMUC and Capital Technology University offer graduate Programs. With this Proposal, Morgan State University will join few other institutions in the nation offering a 4-year cloud computing degree.

Frederick Community College (Required Courses)

Cloud Computing Certificate

CMIS 120	PC Operating Systems	3 credits
CMIS 121	PC Repair & Diagnostics	3 credits
CMIS 111V	Virtualization and Cloud Essentials	3 credits
CMIS 280	Networking Fundamentals	
or		
CMIS 290	Cisco 1 Network Fundamentals	3 credits
CMIS 295	Cloud Security	3 credits
CMIS 266	Cloud System Administration	3 credits
Total:		18 credits

Montgomery County Community College (Required Courses)

Cloud Computing and System Administrator Certificate

NWIT 101	Introduction to the Internet of Things (IoT)	3 credits
NWIT 105	Introduction to Cloud Computing	3 credits
NWIT 127	Microcomputer Essentials	3 credits
NWIT 170	Network Operating Systems	3 credits
NWIT 203	Microsoft Windows Server	3 credits
NWIT 204	Network Virtualization and System Administrator	4 credits
Total:		19 credits

³⁴ [https://www.educationdive.com/news/amazon-expands-cloud-curriculum-with-bachelors-degree/556703/.](https://www.educationdive.com/news/amazon-expands-cloud-curriculum-with-bachelors-degree/556703/)

Capitol Technology University (Required Courses)

Post-Baccalaureate Certificate in Secure Cloud Computing

IAE 680	Perimeter Protection	3 credits
IE 712	Design of Cloud Networks and Services	3 credits
CS 620	Operating System Principles for Information Assurance	3 credits
CS 710	Bigdata Warehousing and Analytics Systems	3 credits
Total:		12 credits

University of Maryland University College (Required Courses)

Cloud Computing Architecture Master's Degree

DCL 600	Decisive Thinking, Communicating, and Leading	6 credits
CCA 610	Cloud Services and Technologies	6 credits
CCA 620	Cloud Management	6 credits
CCA 630	Cloud Infrastructure Planning, Design, and Configurations	6 credits
CCA 640	Cloud Computing Implementations and Migrations	6 credits
CCA 670	Cloud Computing Orchestration	6 credits
Total:		36 credits

2. Provide justification for the proposed Program.

There is no BS in Cloud Computing degree programs in the state of Maryland and there is a great need for professionals with a bachelor's degree in cloud computing as demonstrated by the data reflected in the sections above.

E. Relevance to High-demand Programs at Historically Black Institutions (HBIs)

There is no such a Program at Maryland's other three HBIs (Bowie, Coppin, and UMES) and it is expected to have no negative impact on HBIs. The Program is anticipated to be in high-demand and benefit Morgan State University substantially.

F. Relevance to the identity of Historically Black Institutions (HBIs)

Morgan is the largest and most comprehensive of the State's four HBIs. In 2017, Morgan was designated by the General assembly as Maryland's Preeminent Public Urban Research University. Morgan serves an ethnically diverse student body consisting of full- and part-time college age students and adult learners. Morgan is committed to the academic success and achievement of all its students. None of these four HBIs have/offer undergraduate or graduate degrees in Cloud Computing (or similar) Program. For reasons previously discussed (particularly in Sections 1 and 2), the proposed Program is an essential initiative serving Morgan's unique mission and identity as an HBI.

G. Adequacy of Curriculum Design, Program Modality, and Related Learning Outcomes (as outlined in COMAR 13B.02.03.10):

1. Describe how the proposed Program was established and describe the faculty who will oversee the Program.

G.1.1. Establishment of the Program

Dr. David Wilson, President of MORGAN, initiated the establishment of the BS in Cloud Computing Program. Dr. Hongtao Yu, Dean of the School of Computer, Mathematical, and Natural Sciences supports the establishment of the Program, along with other schools at Morgan. The Program will be managed by the Department of Computer Science under the SCMNS and with support from faculty in The Earl G. Graves School of Business and Management and The Clarence M. Mitchell, Jr. School of Engineering.

G.1.1. Oversight of the Program

The Program director of the BS in Cloud Computing to be hired will oversee the Program with duties including: report to the Computer Science Department Chair, recruit and manage the faculty including adjunct faculty, make class schedule, gather data and issue assessment reports, supervise related apprenticeships and internships, evaluate program design and effectiveness, enrollment, retention, and graduation rates, student, faculty and employer satisfaction, and represent the Program. The ideal candidate for the Program coordinator should have strong education experience in cloud computing with a relevant record of scholarly accomplishments in research, publication, and funding in cloud computing.

2. Describe educational objectives and learning outcomes appropriate to the rigor, breadth, and (modality) of the Program.

G.2.1. Educational Objectives of the Program

The educational objectives of the BS in Cloud Computing are to provide students with the knowledge to understand principles, developments, applications, power and importance of cloud computing and to follow the cloud computing trends; skills suitable for work in cloud computing and necessary for advancement in career in cloud computing; and proficiency in cloud computing technologies to solve real-world cloud computing oriented problems.

G.2.2. Learning Outcomes of the Program

Students receiving the BS in Cloud Computing degree will possess knowledge in cloud computing and the preparation needed to:

- Solve real-world Cloud Computing oriented problems;
- Apply cloud computing techniques, skills and services necessary for practice;
- Analyze the local and global impact of cloud computing on individuals, organizations and society;
- Examine and follow the trends in cloud computing;
- Analyze a problem and identify and define the computing requirements appropriate to its solution;
- Function effectively in a team to accomplish a common goal;
- Exhibit professional, ethical, legal, security and social issues and responsibilities;
- Communicate effectively with a range of audiences;
- Recognize the need for and an ability to engage in continuing professional development.

3. Explain how the institution will:

a) Provide for assessment of student achievement of learning outcomes in the Program

Morgan State University has an Office of Assessment led by Dr. Solomon Alao, the Assistant Vice President for Outcome Assessment and Program Review. The Office of Assessment supports the strategic

initiatives of Morgan by directing the implementation of the Comprehensive Assessment Plan and the General Education Program. The Office also works with other Morgan divisions to collect, analyze, report on and use data related to institutional effectiveness, accreditation; student success, satisfaction and retention; and campus performance against key benchmark indicators.

b) Document student achievement of learning outcomes in the Program

Morgan will document student achievement of learning outcomes in the BS in Cloud Computing Program in accordance with the Morgan Comprehensive Assessment Plan. The Assessment Plan includes all procedures for collecting, analyzing, reporting on and using data related to the Program effectiveness, student success, satisfaction and retention.

4. Provide a list of courses with title, semester credit hours and course descriptions, along with a description of Program requirements

The BS in Cloud Computing Program consists of 15 general education and university requirements courses (44 credits), 22 major required courses (70 credits), and 2 elective courses (6 credits). The total courses of the program is 39 and the total credits of the program are 120.

G.4.1. List of the Cloud Computing Major Required Courses

There are 22 Required Courses for a total of 70 credit hours as listed below. Among them three new Cloud Computing core courses and two elective courses will be developed.

Ten (10) Cloud Computing Degree Required Courses 30 credits

BUAD 200	Introduction to Business	3
CLCO 261	Introduction to Cloud Computing	3
COSC 349	Computer Networks	3
COSC 354	Operating System	3
CLCO 401	Cloud Applications	3
COSC 470	Artificial Intelligence	3
COSC 458	Software Engineering	3
EEGR 481	Introduction to Network Security	3
CLCO 490	Senior Project in Cloud Computing	3
INSS 494	Information Security and Risk Management	3

Six (6) Computer Science Required Courses 20 credits

COSC 112	Introduction to Computer Science II	4
COSC 220	Data Structures and Algorithms	4
COSC 243	Computer Architecture	3
COSC 251	Introduction to Data Science	3
COSC 351	Cybersecurity	3
COSC 459	Database Design	3

Three (3) Math Required Courses 11 credits

MATH 113	Introduction to Mathematical Analysis I	4
MATH 241	Calculus I	4
MATH 312	Linear Algebra I	3

Three (3) Restricted Elective Courses 9 credits

Cloud Computing Elective Courses

CLCO 411	Cloud Security	3
CLCO 471	Data Analytics in the Cloud	3
COSC 491	Conference Course	3
COSC 498	Senior Internship	3
COSC 499	Senior Research or Teaching/Tutorial Assistantship	3

Computer Science Elective Courses

COSC 238	Object-Oriented Programming	4
COSC 239	Java Programming	3
COSE 243	Computer Architecture	3
COSC 323	Introduction to Cryptography	3
COSC 458	Software Engineering	3
COSC 470	Artificial Intelligence	3
COSC 472	Introduction to Machine Learning	3

Math Elective Courses

MATH 242	Calculus II	4
MATH 313	Linear Algebra II	3
MATH 331	Applied Probability and Statistics	3
MATH 345	Mathematics for Insurance and Investment	3
MATH 346	Financial Mathematics	4
MATH 361	Introduction to Mathematical Modeling	3

Information Science and Systems Elective Courses

INSS 220	Analytical Decision-making for Business&Management	3
INSS 326	Business, Ethics, and Society	3
INSS 380	Data & Information Management	3
INSS 391	IT Infrastructure & Security	3

Computer Engineering Elective Courses

EEGR 161	Introduction to C Programming	3
EEGR 317	Electronic Circuits	4
EEGR 463	Digital Electronics	3
EEGR 483	Introduction to Security Management	3

G.4.2. Recommended Course Sequence

**MORGAN STATE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE
BACHELOR OF SCIENCE IN CLOUD COMPUTING
SUGGESTED CURRICULUM SEQUENCE**

FRESHMAN YEAR (FIRST SEMESTER)

MATH 113	Intro to Math Analysis	4
COSC 111-IM	Introduction to Computer Science I	4
ENGL 1*1-EC	English Composition Core	3
PHIL 1-9-CT	Introduction to Logic	3
ORNS 106	Freshman Orientation	1
		15

FRESHMAN YEAR (SECOND SEMESTER)

HIST 3*0-CI	Introduction to the African Diaspora	3
COSC 112	Introduction to Computer Science II	4
ENGL 1*2-EC	English Composition Core	3
XXXX-HH	Health and Healthful Living	3
PHEC XXX	Physical Education Activity	1
		14

SOPHOMORE YEAR (FIRST SEMESTER)

MATH 241-MQ	Calculus I	4
COSC 220	Data Structures and Algorithms	4
BUAD 200	Introduction to Business	3
XXXX-AH	Arts and Humanities Core	3
		14

SOPHOMORE YEAR (SECOND SEMESTER)

COSC 243	Computer Architecture	3
COSC 251	Introduction to Data Science	3
COSC 349	Computer Networks	3
CLCO 261	Introduction to Cloud Computing	3
XXXX-AH	Arts and Humanities Core	3
		15

JUNIOR YEAR (FIRST SEMESTER)

MATH 312	Linear Algebra I	3
COSC 351	Cybersecurity	3
COSC 354	Operating System	3
XXXX	Elective	3
XXXX-BP	Biological & Physical Sciences Core	4
		16

JUNIOR YEAR (SECOND SEMESTER)

CLCO 401	Cloud Applications	3
COSC 459	Database Design	3
INSS xxx	Information Systems Elective	3
XXXX	Elective	3
XXXX-BP	Biological & Physical Sciences Core	4
		16

SENIOR YEAR (FIRST SEMESTER)

INSS 494	Info Security and Risk Management	3
COSC 470	Artificial Intelligence	3
COSC xxx	CS Elective	3
CLCO xxx	Cloud Computing Elective	3
XXXX-SB	Social & Behavioral Science Core	3
		15

SENIOR YEAR (SECOND SEMESTER)

EEGR 481	Introduction to Network Security	3
COSC 458	Software Engineering	3
CLCO 490	Senior Project in Cloud Computing	3
CLCO xxx	Cloud Computing Elective	3
XXXX-SB	Social & Behavioral Science Core	3
		15

TOTAL CREDIT HOURS 120

G.4.3. Course Descriptions

Required Courses

Cloud Computing Required Courses

BUAD 200 Introduction to Business – 3 hours; 3credits. This course is for non-business majors. The course is designed to assist students in exploring the field of business as a career. Topics such as Private Enterprise and its challenges, global business, forms of business ownership, financing, marketing, etc., are discussed in their most basic levels. **Prerequisites:** ENGL101AND102 (with minimum grade of “C”) and sophomore standing. (FALL, SPRING)

CLCO 261 Introduction to Cloud Computing – 3 hours of lecture; 3 credits. Basic terminology, basic concepts, a brief history of cloud computing, fundamental models, cloud architecture and services, types of clouds, cloud computing characteristics, benefits of cloud computing adoption, business drivers, technology innovations, challenges of cloud computing, building, testing, and deploying the first application, cloud technologies. **Prerequisite:** COSC 243.

COSC 349 Computer Networks – 3 hours of lecture; 3 credits. This course covers the theory and practice of computer networks, emphasizing the principles underlying the design of network software and the role of the communications system in distributed computing. Topics include data representation, channel, semantics, synchronization, resource. **Prerequisite:** COSC 220.

COSC 354 Operating Systems - 3-hour lecture; 3 credits. Principles underlying computer operating systems are presented from a computer designer's perspective. Concepts explained include process concurrence, synchronization, resource management, input/ output scheduling, job and process scheduling, scheduling policies, deadlock, semaphore, consumer/ producer relationship, storage management (real storage management policies in a multiprogramming environment), virtual memory management (segmentation and paging), and an overview of contemporary operating systems with these principles. Students program in a high-level language. **Prerequisites:** COSC 220.

CLCO 401 Cloud Applications – 3 hours of lecture; 3 credits. Basic terminology, cloud application model, main cloud-based application tasks: email, file storage and sharing, order entry, word processing, data collection; main benefits of cloud apps: fast response to business needs, simplified operation, instant scalability, application Programming interface (API), gradual adoption, reduced costs, improved data sharing and security; popular apps: Google Apps, Facebook, YouTube. **Prerequisite:** CLCO 261.

COSC 458 Software Engineering – 3 hours of lecture; 3 credits. This course presents the fundamental concepts of software engineering starting from feasibility study, covering development and testing phases, to deployment and maintenance ensuring standard software development life cycle (SDLC). This course also covers Formal methods, software re-engineering, reverse engineering, version control, reliability, risks, legal aspect (e.g. software ethics), organizing and managing a project and team. Students will be organized into teams to develop a large software project. **Prerequisites:** COSC 220.

COSC 470 Artificial Intelligence – 3 hours of lecture; 3 credits. This course is an introduction to the agent-oriented approach to artificial intelligence. The course covers: foundations and history of artificial intelligence, intelligent agents, search techniques, knowledge and reasoning, logic (propositional and predicate logic), reasoning with logic, forward and backward chaining, resolution, and applications (mechanical theorem proving and expert systems). **Prerequisite:** COCS 220.

EEGR 481 Introduction to Network Security - 3 hours lecture; 3 credits. This course will provide the basic concepts in many aspects of security associated with today's modern computer networks including local area networks and the internet. It includes the fundamentals of network architecture, vulnerabilities, and security mechanisms including firewalls, guards, intrusion detection, access control, malware scanners and biometrics. **Prerequisite:** COSC 349.

CLCO 490 Senior Project in Cloud Computing – 3 hours of lecture; 3 credits. Graduating seniors selecting this course will work on a project reflecting new and latest developments in Cloud Computing under the guidance of a BS in Cloud Computing Program faculty. **Prerequisite:** CLCO 401.

INSS 494 Information Security and Risk Management - 3 hours, 3credits. This course will prepare students to develop skills in information security and risk management. This is a survey course that will cover a range of information security topics, from technical areas such as cryptology and network security to a policy area such as risk management. **Prerequisites:** COSC 349.

Computer Science Required Courses

COSC 111 Introduction to Computer Science I – 3 hours of lecture & 1 hour of lab; 4 credits. A first course in the Computer Science sequence, it is required for all Computer Science majors. Course objectives include: introduction to problem solving and computational thinking (CT) concepts, including Decomposition, Abstraction, Pattern Recognition and Algorithmic Thinking; pseudo-code and flow-chart based visual Programming, overview of a high-level and/or interpreted Programming language, including syntax, semantics, primary data types, variables, expressions and statements, input/output and library functions, decision making, iteration, coding, debugging, and successfully executing Programs. This course has labs with Programming assignments. **Prerequisite:** None!

COSC 112 Introduction to Computer Science II – 3 hours of lecture & 1 hour of lab; 4 credits. This is the second computer science course in a two-semester course sequence for computer science majors. Course objectives include introduction to simple data structures, such as list, tuples, and dictionaries, functions and modules, string handling, file input/output, exception, recursion, and introduction to classes and objects. This course has labs with Programming assignments based on using editors to compile/execute large Programs. **Prerequisite:** COSC 111.

COSC 220 Data Structures and Algorithms – 3 hours of lecture & 1 hour of lab; 4 credits. This course focuses on fundamental data structures and algorithms that act on data structures, data relationships and storage representations. Basic concepts of data structures such as strings, lists, arrays, stacks, queues, dictionaries, maps, trees, graphs, and algorithms of the data structure operations such as inserting, deleting, updating, traversing, searching, sorting along with corresponding time/space complexities are presented and extended toward problem solving through implementation and Programming. **Prerequisite:** COSC 112.

COSC 243 Computer Architecture - Three-hour lecture; 3 credits. This course is an introduction to computer organization and architecture. The computer is described as a hierarchy of levels, each performing some well-defined function. Comparisons are made in the way the levels and functions are implemented in various computer systems. This course focusses on fundamental knowledge on CPU organization and control, instruction set architecture, memory organizations, input/output structure, and parallel architectures. **Prerequisite:** none.

COSC 251 Introduction to Data Science – 3 hours of lecture; 3 credits. This course introduces the use of computers for the analysis, interpretation and visualization of both simple and complex, high-volume, high-dimensional and structured/unstructured data from varying sources based on applying data analysis, modelling, data mining, data visualization and search techniques. **Prerequisite:** COSC 112.

COSC 351 Cybersecurity – 3 hours of lecture; 3 credits. This course presents threats analyzing and prediction, vulnerabilities and risks. Topics include identification and authentication, encryption and certifications, security in UNIX and Windows environments, malicious software, trusted computer systems, network attacks and defenses, firewalls, intrusion detection and prevention, database security. **Prerequisite:** COSC 112.

COSC 459 Database Design – 3 hours of lecture; 3 credits. A student selecting this course will study functions of a database system, data modeling, and logical database design. The course will cover tuples, relations, attributes, keys, relationships, E-R diagram, Normalizations, ACID test, query languages and processing (both SQL and No-SQL), query optimization, efficient data storage and access, as well as concurrency control and recovery. **Prerequisite:** COSC 220.

Math Required Courses

MATH 113 Introduction to Mathematical Analysis I - *Four hours; 4 credits.* This is the first half of a unified course in algebra, trigonometry, and analytic geometry. Topics to be discussed include: fundamentals of algebra, functions and graphs, exponential and logarithmic functions, analytic geometry, and introduction to the conic sections. (FALL/SPRING).

MATH 241 Calculus I – *4 hours of lecture; 4 credits.* Topics to be discussed include limits and continuity of real functions of one variable; differentiation and anti-differentiation of algebraic, trigonometric, exponential, and logarithmic functions; the chain rule, the Rolle's Theorem, and the Mean Value Theorem; applications of differentiation to various problems including optimization problems and curve sketching; and an introduction to definite and indefinite integrals. **Prerequisite:** MATH 114 or MATH 141 with a grade of "C" or better or departmental permission. (FALL/SPRING).

MATH 312 Linear Algebra I – *3 hours of lecture; 3 credits.* This course is designed to cover the following topics: a study of linear transformations and matrices, vector spaces, eigenvalues and canonical forms and other topics as time permits. **Prerequisite:** MATH 241 with a grade of "C" or better. (FALL/SPRING).

Elective Courses

Cloud Computing Elective Courses

CLCO 411 Cloud Security – *3 hours of lecture; 3 credits.* Data security: data security life cycle, data classification, data privacy, personally identifiable information; application security: application security management process, application security risks, cloud computing threats. **Prerequisite:** CLCO 261.COSE 349.

CLCO 471 Data Analytics in Cloud – *3 hours of lecture; 3 credits.* Big data: definition, characteristics, classification, history of big data; big data storage systems, big data processing techniques, Hadoop, MapReduce, comparison of big data and cloud computing, cloud-based big data service, the future of data analytics in cloud. **Prerequisite:** CLCO 261, COSC 220.

Computer Science Elective Courses

COSC 238 – Object-Oriented Programming – *4 hours of lecture; 4 credits.* This course presents the fundamental concepts of object-oriented Programming (e.g. abstraction, encapsulation, inheritance, polymorphism, class, objects) and involves problem solving, for both static and dynamic data structures, using an object-oriented Programming language. The course also, covers relevant concepts of object-oriented analysis and design (OOAD) using UML. **Prerequisite:** COSC 112.

COSC 239 - Java Programming – *3 hours of lecture; 3 credits.* This course includes Java's syntax and Program structure, objects, classes and object-oriented Programming, introductory data structures in Java, annotations and self-documentation of Java Programs, Programming practices and software development principles, graphical user interface, and Programming practice in Java. **Prerequisite:** COSC 112.

COSC 243 Computer Architecture – *3 hours of lecture; 3 credits.* This course is an introduction to computer organization and architecture. The computer is described as a hierarchy of levels, each performing some well-defined function. Comparisons are made in the way the levels and functions are implemented in various computer systems. This course focuses on fundamental knowledge on CPU organization and control, instruction set architecture, memory organizations, input/output structure, and parallel architectures. **Prerequisite:** COSC 112.

COSC 323 – Introduction to Cryptography – 3 hours of lecture; 3 credits. Cryptography is an essential approach towards protecting information and securing communication in computer and network systems. This course features an introduction to modern cryptography, with an emphasis on the fundamental cryptographic aspects such as, digital signatures, pseudo-random number generation, and basic protocols and their required computational aspects. This course will be self-contained as the statistical and mathematical requirement will be covered. Throughout the course students will be exposed with new and practical open problems in this field. **Prerequisites:** COSC 238 or permission of instructor, MATH 312.

COSC 472 Introduction to Machine Learning – 3 hours of lecture; 3 credits. This data science course is an introduction to machine learning and data mining. You will develop a basic understanding of the principles of machine learning, data mining, statistical learning theory, supervised and unsupervised learning, decision trees, deep learning and derive practical solutions using predictive analytics. We will also examine why algorithms play an essential role in big data analysis. **Prerequisites:** COSC 112, MATH 312.

Math Elective Courses

MATH 242 Calculus II – 4 hours of lecture; 4 credits. This course is the continuation of MATH 241 and is designed to cover the following topics: definite integrals and their applications, fundamental theorem of calculus, techniques of integration, approximate integration, and improper integrals. Integrals yielding inverse trigonometric functions, infinite sequences and series, and other topics are also discussed. **Prerequisite:** MATH 241 with a grade of "C" or better or departmental permission. (FALL/SPRING).

MATH 313 Linear Algebra II – 3 hours of lecture; 3 credits. This is a follow-up course to MATH 312. Special topics, applied and abstract, are studied. These topics include Hermitian Matrices, Quadratic Forms, Positive Definite Matrices, Canonical Forms, and other applications as time permits. **Prerequisite:** MATH 312 with a grade of "C" or better. (OFFERED AS NEEDED).

MATH 331 Applied Probability and Statistics – 3 hours of lecture; 3 credits. This is a first course in statistics with emphasis on applications in engineering and the sciences, including the role of statistics in quality control, descriptive statistics, basic probability, discrete and continuous probability models, sampling distributions, drawing inferences from population samples via estimation and significance tests, brief exposure to regression and analysis of variance. Students are required to complete computer projects using statistical software systems. **Prerequisite:** MATH 242 with a grade "C" or better. (FALL/SPRING).

MATH 345 Mathematics for Insurance and Investment – 3 hours of lecture; 3 credits. This course is designed to cover the following topics: theory of life insurance, life annuities, premiums, financial derivatives and related fields, with emphasis on applications of current insurance and investment principles, exposure to health, disability, long-term care and property/casualty insurance, presentations by speakers and stock market labs. **Prerequisite:** MATH 331 with a grade of "C" or better or departmental permission. (OFFERED AS NEEDED).

MATH 346 Financial Mathematics – 4 hours of lecture; 4 credits. This course provides an understanding of financial mathematics and financial economics as well as their applications to real world business situations and risk management. Provides preparation for the Society of Actuaries/Casualty Actuarial Society (SOA/CAS) Actuarial Exam FM/2. **Prerequisite:** MATH 242 with a grade of "C" or better. (FALL).

MATH 361 Introduction to Mathematical Modeling – 3 hours of lecture; 3 credits. This course is an introduction to the basic principles of formulation, analysis, and simulation of mathematical models.

Deterministic, dynamic, and stochastic models will be discussed. **Prerequisite:** MATH 242 with a grade of “C” or better. (SPRING).

Course descriptions for other elective courses can be found in the MORGAN Catalog.

G.4.4. New Courses v. Existing Courses

The Program consists of 39 courses (120 credits): 5 new courses - 15 credits and 34 existing courses - 105 credits. All new courses are Cloud Computing courses. Existing courses are:

- General Education Requirements: 13 courses - 42 credits
- University Requirements: 2 courses - 2 credits
- Complementary Studies: 2 courses - 6 credits
- Computer Science: 5 courses - 17 credits
- Business: 2 courses - 6 credits
- Engineering: 1 course – 3 credit
- Mathematics: 3 courses - 11 credits
- Elective: 2 courses - 6 credits; Cloud Computing elective courses are new courses.

5. Discuss how general education requirements will be met, if applicable.

G.5.1. General Education Requirements Courses

- I. Information, Technological and Media Literacy - (IM) – 4-credits
Computer literacy course required by the major/discipline
COSC 111–IM Introduction to Computer Science I – 4-credits
- II. English Composition - (EC) – 6-credits
- III. Critical Thinking - (CT) 3-credits
PHIL 109–CT Introduction to Logic – 3-credits
- IV. Mathematics and Quantitative Reasoning - (MQ) – 4-credits
MQ course required by the major/discipline
MATH 241-MQ Calculus I – 4-credits
- V. Arts and Humanities - (AH) – 6-credits
- VI. Biological and Physical Sciences - (BP) – 8-credits
- VII. Social and Behavioral Sciences - (SB) – 6 credits
- VIII. Health and Healthful Living - (HH) – 3 credits
- IX. Contemporary and Global Issues, Ideas and Values - (CI) – 3-credits
HIST 350-CI Introduction to the African Diaspora

G.5.2. University Requirements Courses

- ORNS 106 - Freshman Orientation – 1-credit
- PHEC XXX - Physical Education Activity – 1-credit or FIN 101 - Financial Literacy – 1-credit

G.5.3. Complementary Studies Courses

All students earning degrees in SCMNS Programs are advised to complete a six-credit Complementary Studies Program of two (2) 3-credit courses or any (credit) combination thereof totaling six credits, designed to broaden their college exposure and education. Courses used to meet the Complementary

Studies requirement may not be used simultaneously to satisfy other requirements. In order to qualify for graduation, students must choose any two courses that are different from the courses already selected to satisfy their General Education Requirements, University Requirements, and the Major Requirements.

G.5.4. Externship / Internship / Assistantship / Workforce Learning

Elective courses and/or complementary studies courses can be substituted with externship / internship / assistantship / workforce learning.

The externship / internship / assistantship / workforce learning allows students to gain experience in the application of the knowledge and skills in Cloud Computing. It allows students to hone their skills by functioning as apprentices, practitioners, externs, interns, assistants, and workforce learning especially in urban and suburban settings, both on-campus and off campus. It also enables students to earn credit for approved workforce experience at their current place of employment. In support of the Morgan's commitment to service, students may be assigned to a variety of Morgan community service projects such as the Morgan Community Mile, and to community organizations and projects in the Baltimore metropolitan area or other urban or suburban projects and organizations in areas where students are located; or they may be assigned projects and Programs at their current place of employment, under the joint cooperation between their work-site supervisor and Morgan faculty.

The externships / internships / assistantships / workforce learning may assign students to the same agency or project for both semesters, and they may assign students to different agencies each semester. Students may also utilize externships / internships / assistantships / workforce learning related specifically cloud computing or another disciplinary focus. These externship / internship / assistantship / workforce learning assignments must be university approved. Students must receive prior approval to utilize their current employment sites. In all cases, students are monitored and counseled by the on-site and Morgan supervisors, and must submit regular written reports of their progress.

Externship / internships / assistantships / workforce learning will be coordinated with the student, the designated representative at the institution / agency / organization where the apprenticeships, internships and workforce learning will occur and administered by the BS in Cloud Computing Program coordinator. The externships / internships / assistantships / workforce learning should be agreed upon by the student and the BS in Cloud Computing Program coordinator in the semester immediately preceding the activity.

6. Identify any specialized accreditation or graduate certification requirements for this Program and its students.

No specialized accreditation or graduate certification requirements for this Program and its students are required.

7. If contracting with another institution or non-collegiate organization, provide a copy of the written contract.

The Program will not be contracting with another institution or non-collegiate organization.

8. Provide assurance and any appropriate evidence that the proposed Program will provide students with clear, complete, and timely information on the curriculum, course and degree requirements, nature of faculty/student interaction, assumptions about technology competence and skills, technical equipment requirements, learning management system, availability of academic support services and financial aid resources, and costs and payment policies.

Morgan provides students with all necessary information, services, and help.

Academic Unit	Document
University	University Catalog
School/College	School/College Catalog
Program	Program Handbook, Program Brochure Course Description Sheets, Suggested Curriculum Sequence Sheets
Course	Course Syllabus and Course Outline.
Help Office	All kinds of help
Academic Advisor	All kinds of academic advising

Documents in digital form are posted on Morgan web pages and in paper form can be found in the University Library, School/College and Department Offices.

9. Provide assurance and any appropriate evidence that advertising, recruiting, and admissions materials will clearly and accurately represent the proposed Program and the services available.

Morgan has Offices/Services for Advertising, Recruiting, Admission, etc. They have all necessary materials which clearly and accurately represent the Programs. These materials are written by the faculty members of the Program and distributed to the “customers” – prospective students – by the Offices.

H. Adequacy of Articulation

1. If applicable, discuss how the Program supports articulation with Programs at partner institutions. Provide all relevant articulation agreements.

H.1. Articulation with Programs at Partner Institutions

There are no articulation agreements in place.

I. Adequacy of Faculty Resources (as outlined in COMAR 13B.02.03.11).

1. Provide a brief narrative demonstrating the quality of Program faculty. Include a summary list of faculty with appointment type, terminal degree title and field, academic title/rank / status (full-time, part-time, adjunct) and the course(s) each faculty member will teach in the proposed Program.

I.1.1. Quality of Program Faculty

Department of Computer Science and Department of Mathematics have distinguished faculty with background and expertise in Computer Science, Cloud Computing, and Mathematics.

The following faculty will be involved in the Program:

First	Family	Appointment Type	Degree & Field	Academic Title/Rank	Status	Courses will teach
Shuangbao	Wang	Tenured	Ph.D. CoSc.	Chair and Professor	Full-Time	CLCO 411, CLCO 490

Vojislav	Stojkovic	Tenured	Ph.D. CoSc	Associate Professor	Full-Time	CLCO 301, COSC 459
Eric	Sakk	Tenured	Ph.D. EE	Associate Professor	Full-Time	CLCO 471, COSC 243
Md Mahmudur	Rahman	Tenured	Ph.D. CoSc	Associate Professor	Full-Time	CLCO 471, COSC 251
Edward	Dillon	Tenure-Track	Ph.D. EE	Assistant Professor	Full-Time	CLCO 490
Iman Abdollah	Dehzangi	Tenure-Track	Ph.D. Bioinformatics	Assistant Professor	Full-Time	CLCO 451, Elective
Monir	Sharker	Tenure-Track	Ph.D. CoSc	Assistant Professor	Full-Time	CLCO 261, COSC 220
Monireh	Debaghchian	Tenure-Track	Ph.D. CoSc	Assistant Professor	Full-Time	CLCO 361, CLCO 401, CLCO 461
Sam	Tannouri	Adjunct	Ph.D. Eng	Lecturer	Full-Time	COSC 351
Gholam	Khaksari	Adjunct	Ph.D. InfSys	Lecturer	Full-Time	COSC 349, COSC 459
Grace	Steele	Adjunct	M.S. Business	Lecturer	Full-Time	COSC 111
Roshan	Paudel	Adjunct	M.S. Bioinformatics	Lecturer	Full-Time	COSC 111, COSC 112
Shirley	Russell	Adjunct	M.S. Math	Lecturer	Full-Time	MATH 113, 114
Peter	McCalla	Adjunct	Ph.D. Math	Lecturer	Full-Time	MATH 113, 114
Asamoah	Nkwanta	Tenured	Ph.D. Math	Professor	Full-Time	MATH 241
Najat	Ziyadi	Tenured	Ph.D. Math	Associate Professor	Full-Time	MATH 312
Sanjay	Bapna	Tenured	Ph.D. MIS	Professor & Chair	Full Time	INSS 141, 220 BUAD 220
Gregory	Ramsy	Tenured	Ph.D. IDS	Associate Professor	Full Time	INSS 326,380
Jigish	Zaviri	Tenured	Ph.D. MIS	Professor	Full Time	INSS 391, 494
Kevin	Kornegay	Tenured	Ph.D. EECS	Professor	Full Time	EEGR410,481,483
Kofi	Nyarko	Tenured	D. Eng.	Associate Professor	Full Time	EEGR 317, 463

2. Demonstrate how the institution will provide ongoing pedagogy training for faculty in evidenced-based best practices, including training in:

At the beginning of each semester, Morgan has 3-day Faculty Institute, School/College Meeting, and Department Meeting. The keynote presentation, guest presentations are always pedagogy and learning management system oriented.

The Morgan Foundation financially supports faculty members' attendance with presentations at local and/or national "professional/technical" conferences.

The Amazon AWS team provides on-site training for Morgan faculty in cloud computing. The CS department plans to work with other cloud vendors, e.g., IBM and Google, for faculty training.

a) **Pedagogy that meets the needs of the students**

During the academic year the School of Computer, Mathematical and Natural Sciences and the College of Liberal Arts organize faculty development workshops, seminars, lectures on all kinds pedagogy topics/issues.

b) **The learning management system**

Morgan provides learning management system (Canvas) for both on-site and online classes. During the academic year, University Academic Computing organizes workshops, seminars, lectures on new technical, computing, etc. opportunities.

c) **Evidenced-based best practices for distance education, if distance education is offered.**

During the academic year the Morgan Online Programs Office organizes workshops, seminars, lectures, demonstration on distance education opportunities.

J. Adequacy of Library Resources (as outlined in COMAR 13B.02.03.12).

1. **Describe the library resources available and/or the measures to be taken to ensure resources are adequate to support the proposed Program.**

J.1.1. Morgan Library³⁵

The students will have access to Morgan State University Earl S. Richardson Library (Morgan Library). The MORGAN Library offers a range of resources and services to the MORGAN community. Most library resources (USMAI Catalog, WorldCat MORGAN, Libguides, Collections, etc.) and services can be accessed remotely.

J.1.2. Required Library Resources

The BS in Cloud Computing Program requires modest additional library resources - books and journals on cloud computing, data science, data mining, data science tools, visualization, image processing, pattern recognition, machine learning, high performance computing, etc.

J.1.3 Bookstore³⁶

Morgan State University bookstore will sell cloud computing textbooks, journals, and software, as required for the appropriate courses.

K. Adequacy of Physical Facilities, Infrastructure and Instructional Equipment (as outlined in COMAR 13B.02.03.13)

³⁵ <https://library.Morgan.edu/home>

³⁶ <https://Morgan.bncollege.com/shop/Morgan/home>

1. Provide an assurance that physical facilities, infrastructure and instruction equipment are adequate to initiate the Program, particularly as related to spaces for classrooms, staff and faculty offices, and laboratories for studies in the technologies and sciences.

K.1.1. Physical Facilities

The BS in Cloud Computing will be offered by the Computer Science Department and coordinated by the Program Director. It is administered by the Computer Science Department, Calloway Hall 205 and housed in existing facilities of the Computer Science Department in Calloway Hall, Carnegie Hall and McMechen Building.

Students will also have access to other facilities on Campus as needed. The BS in Cloud Computing Program does not require additional physical facilities.

K.1.2. Infrastructure Equipment

The BS in Cloud Computing Program does not need additional infrastructure equipment.

K.1.3. Instruction Equipment

Morgan has comparable research facilities to the other higher education institutions in the State of Maryland. SCMNS facilities include many research and study labs in Computer Science (robotics, bioinformatics, computer networks and cyber security) and Mathematics. Morgan has licenses for widely used software such as SAS, MATLAB, etc.

K.1.4. Cloud Computing Laboratory

The Cloud Computing Laboratory is in Calloway Hall, Room 304. It has 20 PCs connected in a network. Each computer has specific computing platforms installed. Windows 10 and Linux Operating Systems are available.

The laboratory has a variety of software for computer science, information technology, cloud computing, virtualization, networking, and data science; cybersecurity and IoT, bioinformatics and computational biology; concurrent, parallel, and distributed computing; modeling and simulation, and visualization.

The laboratory also has an extensive collection of Programming languages such as Python, C, C++, Java, C#, Microsoft Visual Programming Language, MATLAB, Mathematica, Perl, etc.

K.1.5. Required Computer Resources

The proposed BS in Cloud Computing requires additional computer-hardware resources such as laptops, tablets, smart phones, etc. and computer-software resources.

2. Provide assurance and any appropriate evidence that the institution will ensure students enrolled in and faculty teaching in distance education will have adequate access to:

- a) An institutional electronic mailing system, and
- b) A learning management system that provides the necessary technological support for distance education

The Morgan email system is provided by Google’s Gmail, and the online learning platform is Canvas. The BS in Cloud Computing will use both the traditional classroom or face-to-face instruction delivery model and a web-based learning environment, because the web-based learning environment offers incredible opportunities for creative activities including learning and research.



L. Adequacy of Financial Resources with Documentation (as outlined in COMAR 13B.02.03.14)

1. Complete **Table 1: Resources and Narrative Rationale**. Provide finance data for the first five years of Program implementation. Enter figures into each cell and provide a total for each year. Also provide a narrative rationale for each resource category. If resources have been or will be reallocated to support the proposed Program, briefly discuss the sources of those funds.

L.1. Resources

L.1.1. Resource Allocation Table

TABLE 1: RESOURCES					
Resource Categories	Year 1	Year 2	Year 3	Year 4	Year 5
1. Reallocated Funds	0	0	0	0	0
2. Tuition/Fee Revenue (c+g)	160,160	320,320	480,480	640,640	800,800
a. Number of F/T Students	20	40	60	80	100
b. Annual Tuition/Fee Rate	8,008	8,008	8,008	8,008	8,008
c. Total F/T Revenue (a*b)	160,160	320,320	480,480	640,640	800,800
d. Number of P/T Students[#]	0#	0#	0#	0#	0#
e. Credit Hour Rate	331.50	331.50	331.50	331.50	331.50
f. Annual Credit Hour Rate	30	30	30	30	30
g. Total P/T Revenue (d*e*f)	0	0	0	0	0
3. Grants, Contracts, and Other External Sources	4,000	8,000	12,000	16,000	20,000
4. Other Sources^{&}	260,000	520,000	780,000	1,040,000	1,300,000
Total (Add 1-4)	424,160	848,320	1,272,480	1,696,640	2,120,800

[#]The number of part-time students is factored into the full-time students.

[&]The contribution of the State of Maryland of \$13,000 per one full-time student

L.1.2. Resource Allocation Justification

1. *Reallocated Funds*. Program does not have reallocated funds.

2. Tuition/Fee Revenue.

Number of Students	Year 1	Year 2	Year 3	Year 4	Year 5
Full Time Equivalent	20	25	32	35	39
Total: 75% 1 st year & 90% 2 nd - 4 th year retention rates	20	40	60	80	100

	Tuition	Fees	Total
Full-Time			
Resident	2,738.50	1,265.50	4,004.00
Non-Resident	7,974.50	1,265.50	9,240.40
Part-Time (per credit hour)			
Resident	250.00	81.50	331.50
Non-Resident	629.00	81.50	710.50

3. Grants, Contracts, and Other External Sources

The Program does not have grants and contracts.

The Program fundraising will be active. The Computer Science Department has collaborations with Google, Facebook, Intel, Apple, Amazon and plans to establish collaborations with IBM and Microsoft.

Fundraising				
Year-1	Year-2	Year-3	Year-4	Year-5
\$4,000 \$200 per student 20 students	\$8,000 \$200 per student 40 students	\$12,000 \$200 per student 60 students	\$16,000 \$200 per student 80 students	\$20,000 \$200 per student 100 students

4. Other Sources

The State of Maryland provides \$13,000 per one full-time student. Since 20% or more of the students are non-resident students whose tuition is \$10,472 more per year. In the online Program, the percent of non-resident students will likely be much higher.

2. Complete [Table 2: Program Expenditures and Narrative Rationale](#). Provide finance data for the first five years of Program implementation. Enter figures into each cell and provide a total for each year. Also provide a narrative rationale for each expenditure category.

L.2. Expenditures

Courses	Number of Credits/120	Number of Instructors/5
General Education (without CS & Math)	34	1.42
University	02	0.08

Complementary Studies	06	0.25
Cloud Computing	27	1.125
Computer Science	30	1.25
Math	15	0.625
Elective	06	0.25

MORGAN needs to hire one new cloud computing faculty member each in the first three years to teach the 35 credit hours of courses in cloud computing given progressively when students enroll in the program. Other courses are existing courses and they will be leveraged from other departments on campus. One of the three faculty members will spend 50% of the time to Coordinate/Administrate the BS in Cloud Computing Program. The Program will need a full-time Administrative Assistant.

L.2.1. Expenditures Table

TABLE 2: EXPENDITURES					
Expenditure Categories	Year 1	Year 2	Year 3	Year 4	Year 5
1. Faculty (b+c)	213000	355000	497000	497000	497000
a. # FTE	1	2	3	3	3
b. Total Salary	150000	250000	350000	350000	350000
c. Total Benefits	63000	105000	147000	147000	147000
2. Administrative Staff (b+c)	63900	63900	63900	63900	63900
a. # FTE	1	1	1	1	1
b. Total Salary	45000	45000	45000	45000	45000
c. Total Benefits	18900	18900	18900	18900	18900
3. Support Staff (b+c)	75200	75200	75200	75200	75200
a. # FTE	1.25	1.25	1.25	1.25	1.25
b. Total Salary	60000	60000	60000	60000	60000
c. Total Benefits	25200	25200	25200	25200	25200
4. Equipment	5000	5,000	5000	5000	5000
5. Library	5000	5,000	5000	5000	5000
6. New or Renovated Space	0	0	0	0	0
7. Other Expenses	23,500	46,500	72,800	95,000	119,000
TOTAL (Add 1–7)	\$385,600	\$550,600	\$718,900	\$741,100	\$765,100

L.2.2. Expenses Justification

1. Faculty and staff

Three full-time faculty members will be recruited to cover cloud-computing courses with one of them as the 12-month director. The salary for the 9.5-month tenure-track assistant professor will be \$100,000 and for the 12-month director \$150,000 plus 42% fringe benefit.

A full-time administrative staff will be recruited to assist the Program director for office duties and financial matters with a salary of \$45,000/year plus 42% fringe benefit.

Part-time faculty or adjunct faculty equivalent to one full-time faculty (salary request \$40,000) will be recruited to cover some of the online courses for cloud computing. A part-time staff member (salary request \$20,000) to work on IT issues of the Program will be recruited.

4. Equipment

Program will use computer-hardware resources,³⁷ computer-software resources, such as free open source software and commercial software, such as Cloud Computing Tools, Data Science Tools: RapidMiner, DattaRobot, BigML, Google Cloud Prediction API, Weka, etc. Data Visualization Tools: Microsoft Power BI, Tableau Desktop, Looker, Domo, Chartio, etc. Cost of licenses depend on the number of students.

Equipment				
Year-1	Year-2	Year-3	Year-4	Year-5
\$2,500 \$100 per student 25 students	\$5,000 \$100 per student 50 students	\$8,000 \$100 per student 80 students	\$11,000 \$100 per student 110 students	\$12,000 \$100 per student 120 students

5. Library

Digital library resources – books and journals: data science, statistics, data mining, visualization, pattern recognition, high performance computing, modeling and simulation, etc.

Library				
Year-1	Year-2	Year-3	Year-4	Year-5
\$2,500 \$100 per student 25 students	\$5,000 \$100 per student 50 students	\$8,000 \$100 per student 80 students	\$11,000 \$100 per student 110 students	\$12,000 \$100 per student 120 students

6. New or Renovated Space

No new or renovated space will be needed. However, the University planned to move the Computer Science Department the McMechen Building on campus.

7. Other Expenses

Faculty Development Fund is required mainly to train faculty to develop and teach online courses.

Faculty Development Fund				
Year-1	Year-2	Year-3	Year-4	Year-5
\$1,250 \$1,000 per faculty 1.25 faculty	\$2,500 \$1,000 per faculty 2.5 faculty	\$3,800 \$1,000 per faculty 3.8 faculty	\$5,000 \$1,000 per faculty 5 faculty	\$5,000 \$1,000 per faculty 5 faculty

Student Financial Support Fund will be used for student financial support.

Student Financial Support Fund				
Year-1	Year-2	Year-3	Year-4	Year-5

³⁷ Subject to the availability of Morgan resources and funds. It will be determined at Morgan administrative level.

\$10,000 \$500 per student 20 students	\$20,000 \$500 per student 40 students	\$30,000 \$500 per student 60 students	\$40,000 \$500 per student 80 students	\$50,000 \$500 per student 100 students
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Operating Fund

Operating fund will be used to cover Program running' expenses.

Operating Fund				
Year-1	Year-2	Year-3	Year-4	Year-5
\$2,000 \$100 per student 20 students	\$4,000 \$100 per student 40 students	\$6,000 \$100 per student 60 students	\$8,000 \$100 per student 80 students	\$10,000 \$100 per student 100 students

Marketing Expenses Fund

Marketing Expenses Fund will be used to cover marketing expenses. Effective marketing will be a key to get this new program a good start.

Marketing Expenses Fund				
Year-1	Year-2	Year-3	Year-4	Year-5
\$2,500 \$125 per student 20 students	\$5,000 \$125 per student 40 students	\$7,500 \$125 per student 60 students	\$10,000 \$125 per student 80 students	\$12,500 \$125 per student 100 students

Fundraising Expenses Fund

Fundraising Expenses Fund will be used to cover fundraising expenses.

Fundraising Expenses Fund				
Year-1	Year-2	Year-3	Year-4	Year-5
\$2,500 \$125 per student 20 students	\$5,000 \$125 per student 40 students	\$7,500 \$125 per student 60 students	\$10,000 \$125 per student 80 students	\$12,500 \$125 per student 100 students

Other Expenses (cumulative)					
	Year-1	Year-2	Year-3	Year-4	Year-5
Faculty Development Fund	1,250	2,500	3,833	5,000	5,000
Student Financial Support Fund	12,500	25,000	40,000	55,000	60,000
Operating Fund	2,500	5,000	8,000	11,000	12,000
Marketing Expenses Fund	2,500	5,000	8,000	11,000	12,000
Fundraising Expenses Fund	2,500	5,000	8,000	11,000	12,000
Total	21,250	42,500	67,833	93,000	101,000

L.3. Program Profitability

Program Profitability					
	Year-1	Year-2	Year-3	Year-4	Year-5
a. Enrollment (FTE)	20	40	60	80	100
b. Revenue	\$424,160	\$848,320	\$1,272,480	\$1,696,640	\$2,120,800
c. Expenditures	\$385,600	\$550,600	\$718,900	\$741,100	\$765,100
d. Net Profit (a-b)	\$38,560	\$297,720	\$553,580	\$1,116,840	\$1,355,700

The total profit will likely be larger because the calculation did not include 20% of non-resident student tuition, which is \$10,472 more per year. In the online Program, the percent of non-resident students will likely be higher.

M. Adequacy of Provisions for Evaluation of Program (as outlined in COMAR 13B.02.03.15).

Morgan’s, SCMNS, and Department of Computer Science has, and therefore the BS in Cloud Computing Program will have, evaluation procedures for administrators (Dean, Department Chair and Program Coordinator), faculty members, students, Programs, and courses.

Students’ performance in courses will be evaluated on the basis of graded assignments, tests, quizzes, attendance, etc. Each semester, students will submit online evaluations of their courses and instructors. Each year, the department chair will evaluate faculty and provide feedback for improvement using faculty annual reports the SCMNS Faculty Evaluation Instrument. The Program coordinator will also evaluate faculty with respect to their performance in the Cloud Computing Program. Each year, the department chair will evaluate the Program coordinator, the dean will evaluate the department chair, and the provost will evaluate the dean.

Evaluations at each stage are based on specific and well-defined procedures and criteria that are made known in advance, including syllabi, questionnaires, reports, job descriptions and evaluation forms. Collecting, managing, and reporting data are a time-consuming and very important process.

The main goals of the evaluations are to 1) build stronger school, departments, Programs, and courses; 2) track and improve the performance administrators, faculty members and students; 3) increase the rigor of teaching and learning; 4) promote more effective services.

In case of an overall unsatisfactory evaluation, a Performance Improvement Plan must be developed the next semester or academic year and be approved by the Program director or department chair.

1. Discuss procedures for evaluating courses, faculty and student learning outcomes.

At the end of each semester, the Program coordinator will evaluate each course, course instructor, and student performance; meet with the course instructor to go over the evaluation results and to make suggestions for goals and objectives for the new semester. At the end of each academic year the Program coordinator will evaluate faculty member of the Program performance; evaluate the Program performance; meet with the faculty member of the Program to go over the evaluation results and to make suggestions for goals and objectives for the new academic year.

M.1.1. Criteria for Course Evaluation

- Course Organization
 - Are the following policies clearly stated in the syllabus?
 - Course objectives
 - Requirements
 - Grading
 - Attendance
 - Is the content taught suited to the stated course objectives?
 - Does the instructor use technology appropriately?
 - Is class time used productively?
 - Does the course use active learning pedagogy?
 - Does the course cater to a variety of learning styles?
- Assignments
 - Are the following appropriate for this course?
 - Homework
 - Paper assignments
 - Projects
 - Tests
 - Textbooks and other assigned reading
 - Do assignments effectively promote positive student learning outcomes?
- Grading
 - Does the instructor provide useful feedback on assignments?
 - Do examinations reflect important aspects of the course?
 - Is the grading system fair and clearly explained at the beginning of the semester?
 - Are assignments graded properly and promptly?
- Communication
 - Does the instructor explain complex ideas well?
 - Does the instructor show and inspire enthusiasm for the subject?
 - Does the instructor answer students' questions clearly?
 - Does the instructor use examples and illustrations to clarify material?
- Interaction with students
 - Does the instructor treat all students respectfully, fairly and without bias?
 - Does the instructor respond to student communications promptly?
 - Does the instructor encourage student participation in the classroom?
 - Is the instructor open to different points of view?
 - Is the instructor available to provide individual help to students?
 - Does the instructor seem genuinely concerned with students' progress in the course?

M.1.2. Criteria for Program Evaluation

The main criteria for Program evaluation are:

- student enrollment
- student graduation
- student retention
- cost-effectiveness
- assessments of student learning outcomes
- student and faculty satisfaction
- student placement in internships and employment

M.1.3. Criteria for Faculty Evaluation

A faculty member must satisfy the following criteria:

- Prepare quality syllabi, tests, quizzes, and assignments
- Demonstrate mastery of classroom management
- Deliver quality course materials aligned with the advancement of the profession
- Attend classes as scheduled and be punctual
- Submit grades and other required documents in a timely manner
- Use University approved student advisement and teaching tools (e.g., Starfish, Degree Works)
- Hold regular office hours
- Keep a satisfactory grade book
- In courses with high DFW rates, provide a narrative for reasons for high DFW rates and possible interventions.

Failure to meet any one of these criteria will automatically result in an unsatisfactory rating for Teaching.

M.1.4. Criteria for Student Learning Outcomes Evaluation

The course instructor will tailor assignments to measure students' aptitude against the objectives of the course and the desired student learning outcomes.

After completing the BS in Cloud Computing degree students will have the knowledge and skills needed to successfully:

- Solve real-world Cloud Computing oriented problems
- Use current cloud computing techniques, skills and services necessary for practice
- Analyze the local and global impact of cloud computing on individuals, organizations and society
- Understand and follow the trends in Cloud Computing
- Analyze a problem and identify and define the computing requirements appropriate to its solution
- Function effectively in a team to accomplish a common goal
- Exhibit professional, ethical, legal, security and social issues and responsibilities
- Communicate effectively with a range of audiences

2. Explain how the institution will evaluate the proposed Program's educational effectiveness, including assessments of student learning outcomes, student retention, student and faculty satisfaction, and cost-effectiveness.

The Cloud Computer Program coordinator will submit annual reports to the department chair and dean detailing students' performance in Program courses, student enrollment, retention and graduation rates, placement in internships and employment, student and faculty satisfaction, and the Program's cost-effectiveness.

N. Consistency with the State's Minority Student Achievement Goals (as outlined in COMAR 13B.02.03.05).

1. Discuss how the proposed Program addresses minority student access & success, and the institution's cultural diversity goals and initiatives.

The BS in Cloud Computing Program is designed to recruit, retain, graduate and place students, especially minority students, in meaningful employment in one of the largest and fastest growing technology sectors in the United States and the world. These goals are consistent with Morgan State

University's goals and initiatives to promote minority student access and success, and to recruit diverse, high-quality faculty.

O. Relationship to Low Productivity Programs Identified by the Commission:

1. If the proposed Program is directly related to an identified low productivity Program, discuss how the fiscal resources (including faculty, administration, library resources and general operating expenses) may be redistributed to this Program.

There is no relationship with low-productivity programs identified by the Commission.

P. Adequacy of Distance Education Programs (as outlined in COMAR 13B.02.03.22)

1. Provide affirmation and any appropriate evidence that the institution is eligible to provide Distance Education.

The Maryland Higher Education Commission (MHEC) has approved Morgan to offer ten (10) online degree and five (5) online post-baccalaureate certificate programs. As of academic year, 2018-2019 two hundred and forty-seven (247) faculty members have been trained through Quality Matters to develop and teach online courses and more than sixty-two hundred (6,200) students have enrolled in the University's online courses.

The Office of Morgan Online was established in 2013 and a full-time Director was hired in 2014 as a function of the President's reorganization of his administration to better realize the 2011 – 2021 Strategic Plan goals. Morgan is a member institution of Maryland Online a consortium of community colleges and senior institutions in the state of Maryland dedicated to championing distance education and enhancing the quality and availability of e-learning in Maryland and worldwide³⁸. The Director of Morgan Online is a Vice President of Maryland Online.

The University has invested substantial resources in an effort to improve its recruitment, admission, instruction and degree completion of online student. Morgan is, for example, a member of The National Council for State Authorization Reciprocity Agreements (NC SARA) which in collaboration with the four regional higher education compacts (including the Southern Regional Education Board of which Morgan is also a member) "was established to develop and implement an effective and efficient reciprocal state-level authorization process for postsecondary distance education."³⁹ In addition to its institutional memberships, Morgan has expended budgeted funds to strengthen its infrastructure to improve the delivery of online and distance education. Specifically, funds have been expended to:

- provide faculty incentives;
- to develop Americans with Disabilities Act (ADA) compliant programs and courses;
- train faculty, staff and graduate students in online program best practices;
- acquire Open Educational Resources (OERs) to support online General Education course initiatives; and,
- obtain online technologies for program and course development including, but not limited to, technologies ReadSpeaker, Respondus, Atlas/Ares, Biosig, Panapto, and Amazon Web Services.

³⁸ <http://www.marylandonline.org/>

³⁹ <https://nc-sara.org/mission-statement>

In summary, Morgan is fully invested in supporting its online degree and certificate programs. Its faculty are appropriately trained through Quality Matters to develop and teach online courses. The University's Board of Regents has approved a Policy for Online and Hybrid Courses that is published in the Faculty Handbook⁴⁰ in order to establish criteria and guidelines for the development and delivery of high quality online and hybrid courses and online programs. Finally, Morgan is approved by MHEC to provide Online/Distance Education.

2. [Provide assurance and any appropriate evidence that the institution complies with the C-RAC guidelines, particularly as it relates to the proposed Program.](#)

Morgan complies with the Council of Regional Accrediting Commissions (C-RAC) guidelines - Interregional Guidelines for the Evaluation of Distance Education. C-RAC guidelines are not related to the proposed BS in Cloud Computing Program, because it is not a distance education Program.

⁴⁰ https://www.morgan.edu/faculty_handbook/section_30.html

Appendices

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Appendix I

Morgan State University

Morgan is Maryland's preeminent public urban research university and the only university designated a National Treasure. Founded in 1867, the Baltimore-based HBCU is celebrating its 152nd of excellence in higher education.

For 152 years, Morgan has been an important part of the higher education system in Baltimore City, the State of Maryland, and the United States of America. Throughout its history, Morgan has served the community with distinction while meeting the educational needs of an increasingly diverse society. Morgan is one of the few historically black institutions nationally to offer a comprehensive range of academic programs from computer science, mathematics, and natural sciences to engineering, business, and education.

The Carnegie Foundation recognizes Morgan as a Doctoral Research University (R2: High Research Activity). Morgan is also designated as Maryland's Preeminent Public Urban Research University.

Morgan has Middle States Association of Colleges and Schools, Commission on Higher Education Accreditation from 01/01/1925! Morgan is comprised of one college and nine schools:

- James H. Gilliam's College of Liberal Arts
- School of Architecture and Planning
- Earl G. Graves School of Business and Management
- School of Community Health and Policy
- School of Computer, Mathematical, and Natural Sciences
- School of Education and Urban Studies
- Clarence M. Mitchell School of Engineering
- School of Global Communication
- School of Graduate Studies
- School of Social Work

Morgan has academic Programs at both undergraduate and graduate levels:

- 45 bachelor's degree Programs
- 10 post-baccalaureate's certificates
- 37 master's degree Programs
- 16 doctoral degree Programs

Morgan has several distinguished faculty in the School of Computer, Mathematical and Natural Sciences, the School of Engineering, and the School of Business and Management who have the background and expertise to deliver the BS in Cloud Computing Program and courses.

Morgan enrolls 7,800 students in programs ranging from baccalaureate to doctoral degrees. Morgan attracts students from each state and many foreign countries. Approximately 35% of all students enrolled at Morgan are from outside the state of Maryland. Most matriculating students are from Maryland, New York, New Jersey, and Pennsylvania. Nationally, Morgan is one of the leading institutions for receiving admission applications from African American high school graduates.

Morgan awards more bachelor's degrees to African American students than any other college or university in the state of Maryland. Morgan accounts for large percentages of degrees received by African Americans from Maryland universities and colleges. Morgan has ranked among the top public university/college nationally in the number of minority graduates receiving doctorates.

While Morgan is an HBCU, it has served students of all racial and ethnic backgrounds. Its mission today is to enroll a student body that is diverse in its socioeconomic and academic status and to provide the full range of experiences and services that permit it to serve students with a wide variety of goals and needs.

Appendix II

School of Computer, Mathematical and Natural Sciences

The School of Computer, Mathematical and Natural Sciences is comprised of five departments and two professional Programs:

- Department of Biology (which contains the Medical Technology Program)
- Department of Chemistry
- Department of Computer Science
- Department of Mathematics (which contains the Actuarial Science Program)
- Department of Physics and Engineering Physics

SCMNS offers:

- 8 bachelor's degree Programs
- 3 master's degree Programs (MS Bioinformatics, MS in Science with concentrations in Biology, Chemistry and Physics and MA in Mathematics)
- 2 doctoral degree Programs: Bioenvironmental Science, Industrial and Computational Mathematics

The School also offers General Education Requirement courses in the sciences and mathematics to all Morgan students, regardless of their major field of study.

The faculty of the School of Computer, Mathematical and Natural Sciences includes:

- 17 Full Professors
- 32 Associate Professors
- 12 Assistant Professors
- 33 Instructors
- 23 Staff members
- 960 students

The undergraduate Program in Computer Science prepares students for entry into the computing and informatics profession, for graduate study in computer, computational, cloud computing, cybersecurity, data science, and bioinformatics, and for the many challenges that will confront them in their professional experiences and personal life. The Computer Science Program also prepares students to apply their knowledge and training to produce solutions to specific and esoteric problems. Students learn to define the problem, determine its tractability, determine when consultation with outside experts, evaluate and choose an appropriate solution strategy, and study, specify, design, implement, test, modify, and document a solution. They are also to evaluate alternatives and perform risk analysis on a chosen design, integrate alternative techniques and technologies into a solution, and finally communicate a solution to colleagues, professionals in other fields, and the public. Keys to all of this are the ability of the problem-solver to work within a team environment throughout the entire problem-solving process.

The Department currently offers the following degrees and certificates:

- Bachelor of Science (B.S.) in Computer Science
- Post-Baccalaureate Certificate in Bioinformatics
- Master of Science (M.S.) in Bioinformatics

Department of Computer Science has 16 faculty members: 1 tenured full professor, 3 tenured associate professors, 4 tenure track assistant professors, 4 full-time lecturers, and 4 part-time lectures. Ten of the faculty members have PhD and 6 have MS.

- 1 Full Professor:
 - Shuangbao Wang (shuangbao.wang@Morgan.edu) - Chairperson
- 3 Associate Professors:
 - MD Rahman (md.rahman@Morgan.edu)
 - Eric Sakk (eric.sakk@Morgan.edu)
 - Vojislav Stojkovic (vojislav.stojkovic@Morgan.edu)
- 3 Assistant Professors:
 - Edward Dillon (edward.dillon@Morgan.edu)
 - Monir Sharker (monir.sharker@Morgan.edu)
 - Iman Dehzangi (iman.dehzangi@Morgan.edu)
 - Monireh Dabaghchian (Monireh.Dabaghchian@morgan.edu)
- 4 Full Time Lecturers:
 - Gholam Khaksari (gholam.khaksari@Morgan.edu)
 - Roshan Paudel (roshan.paudel@Morgan.edu)
 - Grace Steele (grace.steele@Morgan.edu)
 - Sam Tannouri (sam.tannouri@Morgan.edu)
- 4 Part Time Lecturers:
 - Harriet Gantt (harriett.gantt@Morgan.edu)
 - Joshua Robinson (joshua.robinson@Morgan.edu)
 - Jamal Theodore (jamal.theodore@Morgan.edu)
 - Lavern Woodland (lavern.woodland@Morgan.edu)
- 1 Administrative Assistant:
 - Wendy Smith (wendy.smith@Morgan.edu)

Most of faculty are distinguished and experienced professionals. Each faculty has a strong commitment to excellence in teaching.

Appendix IV

Mission of Morgan State University

Mission Statement

Morgan State University serves the community, region, state, nation, and world as an intellectual and creative resource by supporting, empowering and preparing high quality, diverse graduates to lead the world. The University offers innovative, inclusive, and distinctive educational experiences to a broad cross-section of the population in a comprehensive range of disciplines at the baccalaureate, master's, doctoral, and professional degree levels. Through collaborative pursuits, scholarly research, creative endeavors, and dedicated public service, the University gives significant priority to addressing societal problems, particularly those prevalent in urban communities.

Growing the Future

Five broad goals represent the foundation of this strategic plan. Over the next ten years, these goals will guide Programs, services, and budgets that are designed to grow Morgan's future by implementing the strategic initiatives for each goal. The goals include:

Goal 1: Enhancing Student Success

Morgan will create an educational environment that enhances student success by hiring and retaining well-qualified, experienced, and dedicated faculty and 5 staff, offering challenging, internationally relevant academic curricula, and welcoming and supporting a diverse and inclusive campus community.

Goal 2: Enhancing Morgan's Status as a Doctoral Research University

Morgan will enhance its status as a Doctoral Research University through its success in securing grants and contracts and its faculty's achievements in basic and applied research, professional expression, artistic creation, and creative inquiry. Additionally, initiatives will be designed to enhance doctoral achievement in the science, technology, engineering, and mathematical (STEM) and non-STEM disciplines for underrepresented students of color.

Goal 3: Improving and Sustaining Morgan's Infrastructure and Operational Processes

Morgan will enhance its infrastructure and processes by improving the efficiency and efficacy of its operating procedures, by focusing on the environmental sustainability of its facilities, and by meeting the technological customer service needs of its students, faculty, staff and community.

Goal 4: Growing Morgan's Resources

Morgan will expand its human capital as well as its financial resources by investing in the professional development of faculty, staff, and students, seeking greater financial support from alumni, the State and federal governments, private and philanthropic sources, and establishing collaborative relationships with private and public entities. The issue of indirect costs associated with contracts and grants will be revisited.

Goal 5: Engaging with the Community

Morgan will engage with community residents and officials in the use of knowledge derived from faculty and student research, the sharing of mutually beneficial resources, and the appropriate and timely dispatch of University experts and professionals to collaborate in addressing community concerns.

Appendix VI

Priorities and Enhanced Goals, 2019-2023

Enhancing Student Success and Experiences

Targets: improved student housing, increased retention rate, increased graduation rate (to 50 percent by 2025), additional student activities and amenities, and more study abroad opportunities

Improving Morgan's Infrastructure

Targets: capital improvements and additions, opening of a branch campus and addressing deferred maintenance

Enhancing Doctoral Research University Standing

Targets: Carnegie R2 rating, increased contracts and grant amounts, strengthened Computer Science Department, School of Engineering expansion, addition of new research centers and labs, creation of two to five start-up companies and strengthening Tech Transfer operation

Increasing Resources

Targets: increased State of Maryland support, increased alumni giving percentage (from 17 percent to 21 percent) and completion of \$250-million Sesquicentennial Anniversary Campaign

Managing Student Enrollment

Targets: the growth of online degrees and online Programs, increased number of international students, enhanced campus diversity, 9,000–10,000 student enrollment count and more in-state and out-of-state students

Expanding Community Engagement and Support

Target: further collaboration along and surrounding Hillen Road corridor

Advancing Athletics

Targets: Academic Progress Rate improvement in all 13 sports and attainment of MEAC championships

Morgan State Extends, Bolsters Its Strategic Plan for the Next Five Years

Larry Jones, University PR, December 11, 2018

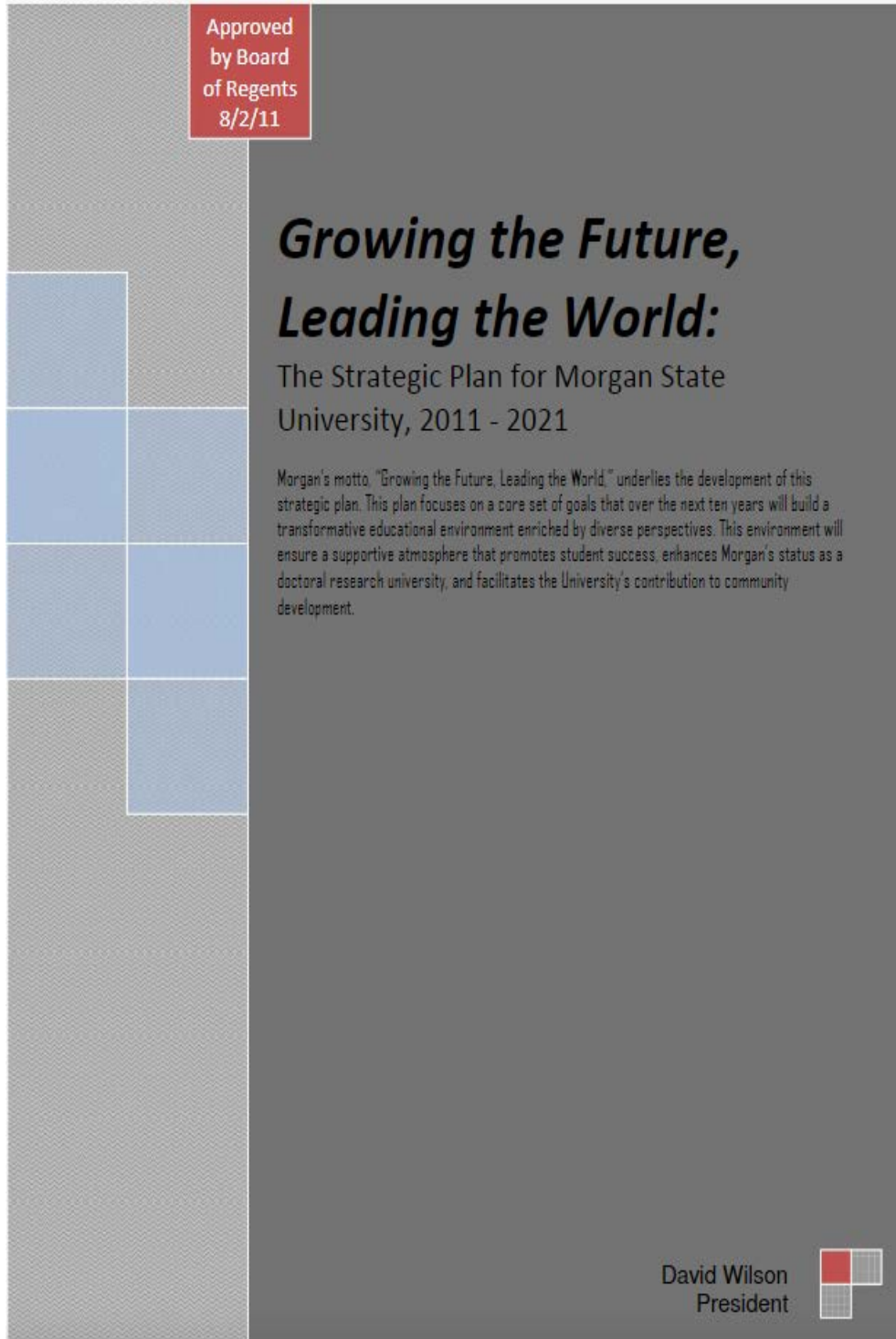
<https://news.Morgan.edu/next-five-years/>

Appendix VII

Growing the Future, Leading the World: The Strategic Plan for Morgan State University, 2011 – 2021

Approved by Board of Regents 8/2/11

https://issuu.com/Morganstateu/docs/strategicplan2011-21_final?e=2119971/60089621



Definitions

Oxford Dictionary defines cloud computing as “the practice of using a network of remote servers hosted on the internet to store, manage, and process data, rather than a local server or a personal computer”.

Wikipedia defines cloud computing as “the on-demand availability of computer system resources, especially data storage and computing power, without direct active management by the user”.

National Institute of Standards and Technology (NIST) defines cloud computing as “a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models”.

In short: cloud computing is an information technology uses the internet and central remote servers to maintain data and applications. Cloud computing allows users to use applications without installation and to access their personal files at any computer with internet access.

Why do we need cloud computing?

Flexibility: Cloud-based services are ideal for businesses with growing or fluctuating bandwidth demands.

Disaster recovery: Cloud computing helps in robust disaster recovery.

Automatic software updates: The suppliers take care of servers for the customers and roll out regular software updates – including security updates. The customers do not have to worry about wasting time maintaining the system by themselves. Leaving customers free to focus on the things that matter.

Capital-expenditure Free: Cloud computing cuts out the high cost of hardware. The customers simply pay as they go and enjoy a subscription-based model that is kind to their cash flow.

Work from anywhere: With cloud computing, if a customer has an internet connection then the customer can be at work. With most serious cloud services offering mobile apps, the customers are not restricted by which device they have to hand.

Security: Lost laptops are a billion-dollar business problem. It potentially losses sensitive data inside it. Cloud computing gives customers greater security when this happens. Because the customer’s data is stored in the cloud, the customer can access it no matter what happens to the customer’s machine. The customer can even remotely wipe data from lost laptops so it does not get into the wrong hands.

Competitiveness: Moving to the cloud gives access to enterprise-class technology, for everyone. It also allows smaller businesses to act faster than big, established competitors do. Pay-as-you-go service and cloud business applications mean small outfits can run with the big boys.

Why do we need cloud computing education?

The market for cloud technology and integrated services has transitioned from early adopters and successful pilots to mainstream use by enterprises. Cloud computing is not just a trend. It is changing the way IT organizations drive business value. As the cloud goes mainstream, it is important for organizations to have experts in cloud computing. It is hard to be an expert without formal education.