Office of the President
University of Maryland, Baltimore County
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July 23, 2019

James D. Fielder, Jr. Ph.D.
Maryland Higher Education Commission
6 North Liberty Street
Baltimore, MD 21201

Dear Secretary Fielder:

UMBC seeks approval to offer its existing Bachelor of Science in Computer Science at the Universities at Shady Grove (USG). The degree is articulated with the Associate of Art in Computer Science at Montgomery College, as described in the agreement attached to the proposal.

The B.S. in Computer Science is one of the largest and most in-demand majors at UMBC. Offering this program at the Montgomery County campus will help to meet the 27% increase in job openings for computer and information research scientists projected for the State of Maryland (2014-2024) by the U.S. Department of Labor. Offering the program at USG is consistent with UMBC's mission and Strategic Plan.

Thank you very much for your review of this proposal for UMBC to offer the B.S. in Computer Science at USG.

Sincerely,

Freeman A. Hrabowski, III
President

C: Dr. Antonio Moreira

UNIVERSITY SYSTEM OF MARYLAND INSTITUTION PROPOSAL FOR

X	Existing Program to be offered at USG
	Substantial Expansion/Major Modification
	Cooperative Degree Program
X	Within Existing Resources, or
	Requiring New Resources

UMBC

Institution Submitting Proposal

Computer Science

Title of Proposed Program

Bachelor of Science	Fall 2020
Award to be Offered	Projected Implementation Date

	11.0701
Proposed HEGIS Code	Proposed CIP Code

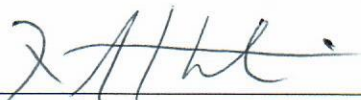| Computer Science & Electrical Engineering	Beth Wells
Department in which program will be located	Department Contact

410-455-8907	bwells@umbc.edu
Contact Phone Number	Contact E-Mail Address

7-31-19

Signature of President or Designee	Date

Cover Sheet for In-State Institutions
New Program or Substantial Modification to Existing Program
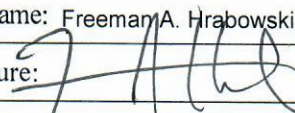
Institution Submitting Proposal	UMBC

*Each **action** below requires a separate proposal and cover sheet.*

○ New Academic Program

○ New Area of Concentration

○ New Degree Level Approval

○ New Stand-Alone Certificate

○ Off Campus Program

○ Substantial Change to a Degree Program

○ Substantial Change to an Area of Concentration

○ Substantial Change to a Certificate Program

○ Cooperative Degree Program

◉ Offer Program at Regional Higher Education Center

Payment Submitted:	○ Yes ◉ No	Payment Type:	○ R*STARS ○ Check	Date Submitted: 08/21/19

Department Proposing Program	Computer Science & Electrical Engineering
Degree Level and Degree Type	Bachelor of Science
Title of Proposed Program	Computer Science (Upper Division)
Total Number of Credits	120
Suggested Codes	HEGIS:	CIP: 11.0701
Program Modality	◉ On-campus　　○ Distance Education (*fully online*)　　○ Both
Program Resources	◉ Using Existing Resources　　○ Requiring New Resources
Projected Implementation Date	◉ Fall　　○ Spring　　○ Summer　　Year: 2020
Provide Link to Most Recent Academic Catalog	URL: https://www.csee.umbc.edu/undergraduate/computer-science-bs/

Preferred Contact for this Proposal	Name:	Beth Wells
	Title:	Assistant Vice Provost for Academic Affairs
	Phone:	(410) 455-8907
	Email:	bwells@umbc.edu

President/Chief Executive	Type Name: Freeman A. Hrabowski, III
	Signature:　　　　　　　　　　　　Date: 08/20/19
	Date of Approval/Endorsement by Governing Board:

Revised 6/13/18

The title of the program and the degree or certificate to be awarded: Bachelor's Degree in Computer Science. The program is already offered at the UMBC main campus.

Centrality to Institutional Mission and Planning Priorities: UMBC's mission statement specifically references the commitment to "contribute to the economic development of the State and the region". Labor market data show Maryland and the Baltimore-Washington metro area have a higher than average demand for jobs in computer science. A report generated by the Labor Insight employer-demand tool shows that for the period from July 2017 through June 2018, the number one most in-demand job in Montgomery County is Software Engineer/Developer[1], a position that typically requires an undergraduate degree in Computer Science. Offering UMBC's highly regarded Bachelor of Science (B.S.) in Computer Science at the USG campus in Montgomery County will allow UMBC to meet current and future workforce demands and address the region's shortage of qualified computer scientists.

The Community and Extended Connections section of the UMBC strategic plan: *A Strategic Plan for Advancing Excellence* specifically highlights a strategic objective to "continue to address novel and important professional development and continuing education needs in Maryland through courses, programs, and services provided by the Division of Professional Studies (DPS)...including UMBC programs offered at Shady Grove." Growing UMBC's presence at USG also contributes to one of the Community and Extended Connections strategic goals to "advance UMBC's regional reputation as a vital stakeholder in Maryland's innovation economy."

UMBC is committed to supporting this program administratively, financially, and technically. The source of funds includes both tuition revenue and funding from the University System of Maryland (USM). UMBC has been offering programs at USG since 2001 and the infrastructure to support new programs is already in place. UMBC at Shady Grove has administrative offices and access to classroom space, as well as an administrative staff of five.

Critical and Compelling Regional or Statewide Need as Identified in the State Plan: Offering the B.S. in Computer Science responds to crucial state needs as identified in the Maryland State Plan for Postsecondary Education (2017 - 2021). One of the overarching themes of the plan is increasing access to higher education. Specifically, the plan references a goal to, "Ensure equitable access to affordable and quality postsecondary education for all Maryland residents." One of USG's core values is to expand access to higher education by providing programs to Montgomery County residents who for family, personal, or financial reasons want to stay in Montgomery County to earn their degree. According to the USG Research and Data Office, 75% of USG undergraduate students transfer from Montgomery College.

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[1] Source: Burning Glass Technologies. http://www.burning-glass.com. 2018.

Currently, there is no way for a student to earn a B.S. in Computer Science at a Maryland public university in Montgomery County, thus limiting their access to this program.

Another goal of the Plan is to "Foster innovation in all aspects of Maryland higher education to improve access and student success." The goal has a specific strategy to, "Develop new partnerships between colleges and businesses to support workforce development and improve workforce readiness." As referenced above, Maryland businesses have a particularly strong need for additional workers in the computer science field as those jobs are in high demand. Montgomery County, in particular, has a large concentration of technology companies. This program will help to educate a technical workforce and strengthen partnerships with Maryland businesses.

The USM Strategic Plan's goals also support the expansion of the B.S. in Computer Science to USG. The USM plan has a goal to "Award 11,000 STEM degrees annually (a 15% increase)." As an in-demand STEM degree, the expansion of the B.S. in Computer Science contributes to meeting this USM goal.

Quantifiable and Reliable Evidence and Documentation of Market Supply and Demand in the Region and State: The B.S. in Computer Science is one of the largest and most in-demand majors at UMBC. It is a highly respected program with over 1500 enrolled students, including both Computer Science and Pre-Computer Science majors. UMBC is proposing to offer the existing Computer Science program at the USG campus beginning in Fall 2019.

Currently, there are no universities that offer a B.S. in Computer Science (CS) at USG, presenting an opportunity for UMBC to launch a much-needed program. Offering this program to the Montgomery County campus will help the citizens of Montgomery County and the state by generating qualified computer science professionals. According to O*NET, an occupational information database sponsored by the U.S. Department of Labor, the number of job openings for Computer and Information Research Scientists in Maryland is expected to increase by 27% during the period 2014 - 2024[2]. Additionally, about 17% of the current UMBC Computer Science majors are residents of Montgomery County.[3] Due to the popularity of the major, upper division CS courses on the main campus quickly fill and it can be challenging for students to register for all their courses. The program at USG gives additional options to students who have a home in Montgomery County.

There is a shortage in the number of qualified information systems/computer science professionals in the state. A query by the Labor Insight employer-demand tool searching for job postings in Maryland during the past 12 months in the broad categories of Computer or Information Systems Analysts or Computer and Information Research Scientist identified 9,744 job postings with these parameters. Labor Insight indicated that this was a much higher demand than average when compared to the national labor market. Of these postings, the largest percentage (22.5%) were located in Montgomery County. Montgomery County employers searching for these employees include Leidos, Booz Allen Hamilton, Marriott, Geico, and Lockheed Martin. With the potential for Amazon HQ2 to be located in Montgomery County or Northern VA, the demand is expected to grow in that region.

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[2] https://www.onetonline.org/
[3] https://rex.umbc.edu

The focus of the USG program will be on offering courses within the existing Cybersecurity and Data Science tracks of the B.S. in Computer Science. The Data Science and Cybersecurity tracks will naturally align with the industry sectors located in Montgomery County and the Washington DC metropolitan area. Montgomery County is home to the National Institute of Standards and Technology's National Cybersecurity Center of Excellence (NCCOE) and National Institute for Cybersecurity Education (NICE). The labor market for Data Science professionals in the Washington DC area has a much higher demand than average when compared to the national average.[4]

Reasonableness of Program Duplication: Upon review of the IPEDS College Navigator tool and other university websites, we found only one Maryland university that offers a face-to-face Bachelor of Science in Computer Science in Montgomery County. That school is Washington Adventist University (WAU). Washington Adventist is a private, religiously affiliated university, while UMBC is a public university. Additionally, there is a significant difference in costs. A semester's tuition for a Maryland resident will cost $4,267 for the UMBC program and $10,900 for the WAU program. The UMBC program will focus on tracks in Data Science and Cybersecurity, which are not focus areas for the WAU program. The five areas of focus for the WAU program are Gaming and Simulation, Graphics and Modeling, Robotics and Computer Learning, Systems Software, and Web Development.

Relevance to High-demand Programs at Historically Black Institutions (HBIs): While four HBIs in Maryland (Bowie State University, Morgan State University, Coppin State University, University of Maryland, Eastern Shore) offer a Bachelor's of Science in Computer Science, none of these programs is offered within 20 miles of USG. Offering the existing Computer Science program to USG should have minimal impact on enrollment at these institutions, as the USG program enrollment will draw from students who want or need to continue their education in Montgomery County and none of the HBIs is located in Montgomery County.

Bowie State University and the University of Maryland, Eastern Shore do offer programs at USG, but not in the IT fields.

Relevance to the support of the uniqueness and identity of Historically Black Institutions (HBIs)

Offering UMBC's program at USG will not have any potential impact on the uniqueness and institutional identities and mission of the HBIs. While the four HBIs do have a B.S. in Computer Science program, UMBC's B.S. in Computer Science is not a new program. This is an existing program that is being proposed to be offered at a new location that is not currently served by a HBI.

Adequacy of Curriculum Design, Program Modality, and Related Learning Outcomes: The B.S. in Computer Science is housed in the College of Engineering and Information Technology (COEIT)'s Department of Computer Science and Electrical Engineering (CSEE). A full-time Program Director will be located at USG and will be responsible for the oversight of Computer Science at USG. The program

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[4] Source: Burning Glass Technologies. http://www.burning-glass.com. 2018.

director will formally report to the Undergraduate Program Director for Computer Science and will work closely with the department chair. The student learning outcomes of the Computer Science program are assessed by methods approved by Accreditation Board for Engineering and Technology (ABET) for the program and are a part of our ABET assessment. CSEE reviews our educational objectives using the following mechanisms:

- The College of Engineering and Information Technology, which houses the CSEE department, has an active Industrial Advisory Board composed of representatives from local industry and government agencies. They are asked to review our educational objectives once every three years.

- The CSEE faculty meets as a group several times each year. Once every three years the chair will use part of one of these meetings to review the objectives.

- The Undergraduate Program Committee for Computer Science is focused on curriculum and assessment. That group meets a minimum of three times each semester with agenda topics including new/modified courses, new assessment plans to meet changing ABET requirements, course scheduling, and other relevant academic topics.

After each of these events the chair and CSEE's ABET/Assessment Committee will convene to determine if any changes are in order and, if so, present them to the Computer Science faculty for discussion and a decision.

The existing B.S. in Computer Science is accredited through ABET. The next round of accreditation is in Fall of 2023 and the program would be reaccredited as of 2024. At that time, we will include the USG site in the application. The new accreditation is retroactive for two years so students graduating from the program at USG after October of 2022 would have an ABET-accredited degree.

UMBC's Division of Professional Studies (DPS) has an existing infrastructure at USG that includes on-site staff who coordinate services to the academic programs. The UMBC at USG staff also provides an essential connecting role to offices and resources on the UMBC campus. The presence of five full-time UMBC staff members who are in place at USG, along with the faculty members associated with the program, will ensure the continuous quality of the Program. The program will be subjected to the same standards that govern the main campus program. In partnership with the Office of Student and Academic Services at USG, UMBC will offer all the necessary services to ensure student success and students will also have access to services on the main campus. Curricular oversight will be maintained at both campuses by the CSEE department. Curricular changes will need to go through a shared governance process. As in the on-campus programs, faculty who have been appropriately vetted by the Program Director and CSEE Undergraduate Program Director and department chair will teach these courses. Any instructors in the program will be eligible for the services provided by UMBC's Faculty Development Center and will receive mentoring from the Program Director.

The educational objectives for the program are:

1. Students will gain both a solid foundation in the fundamental areas of computer science (algorithms, systems, and software) and exposure to multiple sub-disciplines of the field.
2. Students will be proficient in at least one high-level programming language and have the ability to analyze, design, and implement software solutions in a variety of settings.
3. Students will have gained familiarity with state-of-the-art programming techniques, tools, and practices.
4. Students will have practiced and gained proficiency in the written and oral communication skills needed to be effective in the IT industries

At USG, CSEE will offer upper-division (300 and 400 level) courses appropriate for transfer students. Most general education requirements will be met at the community college or other institutions the student attended previously. A copy of an existing articulation agreement between Montgomery College and UMBC is attached. This articulation is currently being updated and we anticipate no changes to the curriculum with the updated articulation. UMBC offers pre-transfer advising at Montgomery College to ensure that MC students are taking the appropriate courses to fit into the 4-year program plan.

The program requires 120 total credit hours. It requires 60 credits taken at UMBC and 60 credits at a community college or other college or university. An associate's degree is not required for transfer admission into the Computer Science program, although some students may complete an associate's degree before transferring. A student who completes an associate's degree before transferring into this program, may have earned more than 120 credits at the time of completing the bachelor's degree. The "Credit When It's Due" program allows students to earn an associate's degree after transferring to UMBC through reverse awarding of credit. Applicable coursework earned at UMBC is transferred back to the community college and allows for the freedom of early transfer and the ability to earn an associate's degree and bachelor's degree in 120 credits. UMBC is committed to advising students about this program.

UMBC is committed to ensuring the students can fulfill the upper division of their degree requirements at USG. Students can also take coursework at other USG intuitions through the Course Sharing initiative. In exceptional cases, USG students may also take courses at UMBC's main campus, and main campus students may do the same at USG. However, this is not the intent of the program.

UMBC offering a B.S. in Computer Science at USG provides an option to students who need or want to complete their degree in Montgomery County due to financial, personal, or family reasons. As mentioned, USG expands access to higher education by providing programs to Montgomery County residents who are unable to travel to USM institutions outside of the County.

UMBC does require that all students complete a foreign language through the intermediate level or demonstrate proficiency at that level.   The coursework for the language sequence typically requires three classes (for example SPAN 101, SPAN 102, and SPAN 201). UMBC's students in a USG program can take these courses at a previous institution can be waived out of the requirements by demonstrating language proficiency through an AP, CLEP, or IB exam or by documenting four years of a language in high school or through the Shady Grove Language Exception, which may permit students attending USG to transfer up to 6 credits of foreign language above the 60 credit limit. The courses can be completed before or after matriculation at Shady Grove. Some students may, required of students is 60

Program requirements for the B.S. in Computer Science at USG include:

- A total of 24 credit hours required in computer science for all CS majors
- A total of 4 credits of statistics for all CS majors. The Department of Computer Science will partner with the Department of Mathematics and Statistics on offering this course.
- A total of 12 credits of required computer science coursework for the cybersecurity track or 12 credits for the data science track
- An additional 11 credits of electives, including 3 credits of technical electives
- 3 credits of social sciences general education requirements. UMBC departments already located at USG that offer courses fulfilling the social science general education requirement include: the Department of Sociology, Anthropology, and Health Administration and Policy, the Department of Psychology, the Department of American Studies, the Department of History, the Department of Political Science, and the Social Work program.
- 6 credits of Arts and Humanities credits. UMBC departments already located at USG that offer courses fulfilling the arts and humanities general education requirement include: the Department of Sociology, Anthropology, and Health Administration and Policy, the Department of American Studies, the Department of History, and the Department of Political Science.

Required Courses for all CS majors (28 credits including a 4 credit STAT course)

CMSC 304 Ethical Issues in Information Technology (3 credits) A survey course that reviews social issues and the ethical impact of information technology throughout the world. The course examines the policy issues that relate to the use of information technology, such as persona, privacy, rights of access, security, transborder information flow and confidentiality.
CMSC 313 Computer Organization and Assembly Language Programming (3 credits) This course introduces the student to the low-level abstraction of a computer system from a programmer's point of view, with an emphasis on low-level programming. Topics include data representation, assembly language programming, C programming, the process of compiling and linking, low-level memory management, exceptional control flow, and basic processor architecture.

CMSC 331 Principles of Programming Languages (3 credits)

This course examines the theory, design and implementation of programming languages and provides students with an introduction to programming languages that are likely to be new to them. Topics include specifications of syntax and semantics, declarations, binding, allocation, data structures, data types, control structures, control and data flow, concurrency, and the implementation and execution of programs. The major language paradigms will be described and explored, including imperative, object-oriented, functional, logic programming, concurrent and others. Programming projects will provide experience in several languages.

CMSC 341 Data Structures (3 credits)

An examination of a range of advanced data structures, with an emphasis on an object-oriented approach. Topics include asymptotic analysis; various binary search trees, including red-black and splay trees; skip lists as alternatives to binary search trees; data structures for multidimensional data such as K-D trees; heaps and priority queues, including binary heaps, binomial heaps, leftist heaps (and/or other mergeable heaps); B-trees for external storage; other commonly used data structures, such as hash tables and disjoint sets. Programming projects in this course will focus on implementation issues for data structures and on empirical analysis of their asymptotic performance.

CMSC 411 Computer Architecture (3 credits)

This course covers the design of complex computer systems making heavy use of the components and techniques discussed in CMSC 313, CMPE 212 and CMPE 310. All parts of the computer system - CPU, memory and input/output - are discussed in detail. Topics include information representation, floating-point arithmetic, instructions set design issues (RISC vs. CISC), microprogrammed control, hardwired control, pipelining, memory cashes, bus control and timing, input/output mechanism and issues in the construction of parallel processors.

CMSC 421 Principles of Operating Systems (3 credits)

An introduction to the fundamentals of operating systems. Topics include interprocess communication, process scheduling, deadlock, memory management, virtual memory, file systems and distributed systems. Formal principles are illustrated with examples and case studies of one or more contemporary operating systems.

CMSC 441 Design and Analysis of Algorithms (3 credits)

This course studies fundamental algorithms, strategies for designing algorithms, and mathematical tools for analyzing algorithms. Fundamental algorithms studied in this course include algorithms for sorting and searching, hashing, and graph algorithms. Mathematical tools include asymptotic notations and methods for solving recurrences. Algorithm design strategies include the greedy method, divide-and-conquer, dynamic programming, and randomization.

CMSC 447 Software Engineering I (3 credits)

This course introduces the basic concepts of software engineering, including software life cycle, requirements analysis and software design methods. Professional ethics in computer science and the social impact of computing are discussed as an integral part of the software development process. Additional topics may include tools for software development, software testing, software metrics and software maintenance.

STAT 355 Probability and Statistics (4 credits)

An introduction to applied statistics designed for science majors and others with demonstrated quantitative ability. Topics include nature of statistical methods, random variables and their distribution functions, general principles of estimation and hypothesis testing. A laboratory introduces students to computer techniques in statistical analysis

Required courses for the Cybersecurity track (12 credits)

CMSC 426 Principles of Computer Security (3 credits)

This course will provide an introduction to computer security, with specific focus on the computing aspects. Topics covered will include: Basics of computer security including an overview of threat, attack, and adversary models; social engineering; essentials of cryptography; traditional computing security models; malicious software; secure programming; Operating system security in practice; trusted operating system design; public policy issues including legal, privacy, and ethical issues; network and database security overview.

CMSC 481 Computer Networks (3 credits)

This course introduces the fundamentals of data communication and computer networking, including circuit and packet switching; network architectures and protocols; local/metropolitan/wide-area networks, OSI and TCP/IP standards; network programming and applications; and network management.

An additional 2 courses (6 credits) from the list of CYBR track courses (See Appendix A)

Required courses for the Data Science track (12 credits)

CMSC 491 Introduction to Data Science (3 credits)

This course gives students hands on experience with all phases of the data science process using real data and modern tools. Topics that will be covered include data formats, loading, and cleaning; data storage in relational and non-relational stores; data analysis using supervised and unsupervised learning, and sound evaluation methods; data visualization; and scaling up with cloud computing, MapReduce, Hadoop, and Spark.

CMSC 436 or CMSC 461 or CMSC 478 (3 credits)

CMSC 436 Data Visualization (3 credits)

This course addresses the theoretical and practical issues in creating visual representations of large amounts of data. It covers the core topics in data visualization: data representation, visualization toolkits, scientific visualization, medical visualization, information visualization, and volume rendering techniques. Additionally, the related topics of applied human perception and advanced display devices are introduced. Open to computer science students with a background in computer graphics or students in data-intensive fields who are familiar with the use of the computer for data collection, storage or analysis.

C**MSC 461 Database Management Systems (3 credits)**

This course covers database management and the different data models used to structure the logical view of databases. The course also covers database design and implementation techniques, including file organization, query processing, concurrency control, recovery, integrity and security.

CMSC 478 Introduction to Machine Learning (3 credits)
This course covers fundamental concepts, methodologies, and algorithms related to machine learning, which is the study of computer programs that improve some task with experience. Topics covered include decision trees, perceptrons, logistic regression, linear discriminant analysis, linear and non-linear regression, basic functions, support vector machines, neural networks, genetic algorithms, reinforcement learning, naive Bayes and Bayesian networks, bias/variance theory, ensemble methods, clustering, evaluation methodologies, and experiment design.

An additional 2 courses (6 credits) from the list of Data Science track courses (See Appendix A)

Additional elective credit may be chosen from the list of Data Science and Cybersecurity track courses listed in Appendix A. We will make sure these electives are regularly offered at USG.

Adequacy of Articulation
An articulation agreement between Montgomery College and UMBC is attached to this proposal. This articulation is in the process of being updated and we expect the updated articulation before the end of 2019. With the updated articulation, we expect the curricula to remain the same as we outlined above. Students will take the majority of their General Education requirements at Montgomery College. UMBC will both brief academic advisors at Montgomery College and hire an academic advisor for the program at USG to ensure a smooth transition for students from Montgomery College to UMBC.

Adequacy of Faculty Resources
Both current faculty and newly hired faculty will teach in the program. A full-time Program Director is located at USG and is responsible for the oversight of Computer Science at USG. The Program Director is Jeanette Kartchner. Ms. Kartchner has a Master's in Computer Science from the University of Southern California and was formally an instructor at University of Maryland, College Park and the Department Chair at Montgomery College. In addition to the Program Director, the five-year hiring plan includes a Professor of the Practice, two Lecturers, and an Assistant Professor. These will be full-time positions and will teach more than 1/3rd of the courses. The Professor of the Practice and Lecturer positions will require a minimum of a Master's degree in Computer Science or a related field. The Assistant Professor position will require a Ph.D. in Computer Science or a related field.

The current chair of CSEE, Dr. Anupam Joshi, will provide the program oversight. Dr. Joshi is full-professor with a Ph.D. in Computer Science from Purdue University.

As with the main campus, the faculty in the program will have access to UMBC's Faculty Development Center, including all professional development training and workshops. Faculty will be eligible for annual conference travel funds.

UMBC uses Blackboard as the Learning Management System. Blackboard support is provided by UMBC's Division of Information Technology.

Adequacy of Library Resources
Students in the program will have access to both the Albin O. Kuhn Library at UMBC and the Priddy Library at USG. Lynda Aldana, UMBC's Associate Director for Technical Services & Library IT Services, affirmed that the amount budgeted for program resources is sufficient to cover any necessary materials. All electronic resources at the Albin O. Kuhn library are available to UMBC students in programs at USG, including close to forty online Computer Science related journal subscriptions and databases.

Adequacy of Physical Facilities, Infrastructure, and Instructional Equipment
UMBC has been offering programs at USG since 2001 and the infrastructure to support new programs is already in place. UMBC at Shady Grove has administrative offices and access to classroom space, as well as an administrative staff of five. The program will be located in the new Biomedical Sciences and Engineering Education Facility at USG. This building is scheduled to open in summer 2019.

UMBC will be licensing virtual desktop services to provide any specialized software needed for the program.

Adequacy of Financial Resources with Documentation
A projected 5-year budget is included in the proposal.

Adequacy of Provisions for Evaluation of Program
The Computer Science program at USG will be subject to the same evaluation requirements as the main campus program. All students complete course evaluations at the end of each course. The results of these evaluations are provided to the department chair.

The existing Computer Science program has educational objectives that are mapped to the courses within the program. Each of the courses have a set of student-learning outcomes (SLO) with specific assignments and associated rubrics to assess students' competency against the course SLO.

Consistency with the State's Minority Student Achievement Goals

Inclusive excellence is a hallmark of UMBC. The University is one of the most diverse public research universities in the nation, with a minority enrollment of 47%. The Computer Science major at UMBC is also diverse with 25% of students identifying as a race other than White or Asian. Additionally, according to the 2017 USG Fact Sheet, USG is a majority minority campus with an ethnic diversity breakdown as follows:

35%	White
22%	African American
18%	Hispanic
14%	Asian

7%	Unknown
4%	Foreign

Bringing the existing B.S. in Computer Science to USG provides the state with a high-demand program at an already diverse university to an even more diverse campus.

Relationship to Low Productivity Programs Identified by the Commission

This is not applicable.

Adequacy of Distance Education Programs

This is not a distance education program.

Appendix A: Cybersecurity and Data Science track courses

Cybersecurity Track Electives

CMSC 442 Information and Coding Theory (3 credits) An introduction to information and coding theory. Topics include error-control coding problems, entropy, channels, Shannon's theorems, error-correcting codes, applications of coding theory, algebraic coding theory, block codes, linear codes, cyclic codes, decoding algorithms, BCH codes, convolutional codes, linear sequential circuits and sequential decoding.
CMSC 443 Cryptology (3 credits) An introduction to cryptology, the science of making and breaking codes and ciphers. Topics include: conventional and public-key cryptosystems, including DES, RSA, shift register systems and selected classical systems; examples of cryptanalytic techniques; digital signatures; pseudo-random number generation; cryptographic protocols and their applications; and an introduction to the theories of cryptographic strength based on information theory and complexity theory.
CMSC 444 Information Assurance (3 credits) Selected recent research topics in information assurance, such as social engineering, buffer overflow, malicious code, spyware, denial of service, information warfare, computer forensics, recovery and response, enterprise security, clandestine channels and emissions security, security analysis, security models and formal techniques, best practices, and national policy for information assurance. Taking a broad, practical view of security - including people, policies and procedures, and technology - this course will help students devise and implement security solutions that meaningfully raise the level of confidence in computer systems. This course will minimize discussion of intrusion detection, firewalls, operating systems security, and mathematical cryptology, which are emphasized in other CMSC security courses.
CMSC 455 Numerical Computations (3 credits) Topics include numerical linear algebra, interpolation, solving non-linear systems and the numerical solution of differential equations. This course also provides some emphasis on numerical algorithms and computation in a parallel environment.
CMSC 487 Introduction to Network Security (3 credits) The objective of this course is to teach the fundamental concepts, architectures, and protocols related to network security. Topics covered include: Overview of network security; Basics of cryptography; Threat models; Authentication and Authorization Mechanisms and Standards; Public Key Infrastructure; Electronic Mail Security; Network Layer Security; Transport layer and web security; Packet filtering; Firewalls; Intrusion Detection, and Virtual Private Networks; Recent topics in Network Security.
CMSC 491 Special Topics courses in Mobile Security, Malware, Reverse Engineering, and Big Data (3 credits)

Data Track Electives

CMSC 427 Wearable Computing (3 credits)
This course covers fundamental concepts, methodologies, and algorithms related to wearable computing, including the following: Emotional Design, Convergent Design Processes, Wearability Considerations, Wearable Sensors Networks, Wearable Networks, Physiological Wearable Sensors, Innovation Processes, Marketing and business considerations, Human Aware Computing, Context Awareness, Wearable Communities, Future Mobility and Wearable Systems Applications.

CMSC 433 Scripting Languages (3 credits)
This course is a study of a class of programming languages and tools known as scripting languages. Topics include: writing scripts to control and connect other programs, strengths and weaknesses of interpreted languages, extending scripting languages to include new functionality, embedding functions of a scripting language in other tools, and the syntax and usage of regular expressions. Programming projects in multiple languages will be required.

CMSC 435 Computer Graphics (3 credits)
An introduction to the fundamentals of interactive computer graphics. Topics include graphics hardware, line drawing, area filling, clipping, two-dimensional and three-dimensional geometrical transforms, three-dimensional perspective viewing, hidden surface removal, illumination, color and shading models.

CMSC 442 Information and Coding Theory (3 credits)
An introduction to information and coding theory. Topics include error-control coding problems, entropy, channels, Shannon's theorems, error-correcting codes, applications of coding theory, algebraic coding theory, block codes, linear codes, cyclic codes, decoding algorithms, BCH codes, convolutional codes, linear sequential circuits and sequential decoding.

CMSC 455 Numerical Computations (3 credits)
Topics include numerical linear algebra, interpolation, solving non-linear systems and the numerical solution of differential equations. This course also provides some emphasis on numerical algorithms and computation in a parallel environment.

CMSC 471 Introduction to Artificial Intelligence (3 credits)
This course provides a broad introduction to artificial intelligence, its sub-fields and their applications. Topics include problem-solving approaches, problem spaces and search, knowledge representation and reasoning, logic and deduction, planning, expert systems, handling uncertainty, learning and natural language understanding.

CMSC 473 Introduction to Natural Language Processing (3 credits)
Natural language processing (NLP), the first non-numerical application of computing, was first studied more than 50 years ago. The ultimate goal of NLP is to enable computers to communicate with people the same way that people communicate among themselves. To do so, the computers must be able to understand and generate text. The course will introduce the students to the problems, methods, and applications of NLP.

CMSC 475 Introduction to Neural Networks (3 credits)
This course is an in-depth introduction to neural networks. Topics include: characteristics of neural network computing; major neural network models and their related algorithms; supervised, unsupervised and reinforcement learning; and neural network application in function approximation, pattern analysis, optimization and associative memories.

CMSC 476 Information Retrieval (3 credits)
This course is an introduction to the theory and implementation of software systems designed to search through large collections of text. The first course objective is to cover the fundamentals of

Information Retrieval (IR): retrieval models, search algorithms and IR evaluation. The second is to give a taste of the implementation issues through the construction and use of a text search engine.

CMSC 478 Introduction to Machine Learning (3 credits)

This course covers fundamental concepts, methodologies, and algorithms related to machine learning, which is the study of computer programs that improve some task with experience. Topics covered include decision trees, perceptrons, logistic regression, linear discriminant analysis, linear and non-linear regression, basic functions, support vector machines, neural networks, genetic algorithms, reinforcement learning, naive Bayes and Bayesian networks, bias/variance theory, ensemble methods, clustering, evaluation methodologies, and experiment design.

CMSC 483 Parallel and Distributed Processing (3 credits)

This course provides a project and applications-oriented approach to parallel and distributed programming. Students will learn a specific parallel language and programming environment and will complete a large programming project. Topics include a selected parallel programming language, a survey of parallel and distributed architectures and associated programming styles, an introduction to parallel and distributed algorithms, and a study of trade-offs between computation and communication in parallel processing.

CMPE 422 Digital Signal Processing (3 credits)

Discrete-time signals and system analysis and the z-transform; sampling of continuous time signals, analog-to- digital and digital-to-analog conversion; design of finite impulse response and infinite impulse response digital filters, direct and computer-aided designs; the discrete Fourier transform and fast Fourier transform; effects of quantization and finite work-length arithmetic.

CMSC 491 Special Topics courses in Computer Vision, Data Driven Signal Processing and Social Media Mining

TABLE 1: RESOURCES					
Resources Categories	(Year 1)	(Year 2)	(Year 3)	(Year 4)	(Year 5)
1.Reallocated Funds	0	0	0	0	0
2. Tuition Revenue[5][6] (c+g below)	192,179[7]	1,087,702[8]	1,940,348	2,369,769	2,611,757
a. #F.T Students[9]	19	103	178	214	235
b. Annual Tuition Rate	8,791	9,055	9,326	9,606	9,894
c. Annual Full Time Tuition Revenue (a x b)	164,832	932,925	1,664,242	2,059,273	2,322,711
d. # Part Time Students[10]	6	34	59	71	78
e. Credit Hour Rate	365	376	387	398	410
f. Annual Credit Hours	75	412	714	857	939
g. Total Part Time Tuition Revenue (e x f)	27,347	154,777	276,106	341,644	385,350

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[5] This assumes a 3% tuition increase annually.
[6] This includes only tuition revenue as fees are treated as a pass through to USG.
[7] Only the Cyber track will be offered in Year 1. Additionally, lower enrollments are expected in Year 1 as there will be a limited time to recruit students.
[8] The increase in tuition revenue is due to the addition of the Data Science track in FY21, as well as an expected increase in students due to a longer student decision cycle.
[9] This includes both new and continuing students.
[10] This includes both new and continuing students.

3. Grants, Contracts, & Other External Sources[11]	310,174	400,610	582,916	785,198	805,071
4. Other Sources	0	0	0	0	0
TOTAL (Add 1 - 4)	494,666	1,651,143	2,502,818	3,154,967	3,466,828

TABLE 2: EXPENDITURES					
Expenditure Categories	(Year 1)	(Year 2)	(Year 3)	(Year 4)	(Year 5)
1. Total Faculty Expenses (b + c below)	396,214 [12]	1,050,138[13]	1,594,858[14]	1,971,965	2,110,358
a. # FTE	2	5	7	8	8
b. Total Salary	268,652	717,390	1,105,894	1,390,304	1,505,612
c. Total Benefits	127,562	332,747	488,964	581,661	604,746
2. Total Administrative Staff Expenses (b + c below)[15]	64,869	66,815	68,820	68,820	70,885
a. # FTE	1	1	1	1	1
b. Total Salary	47,000	48,410	49,862	51,358	52,899
c. Total Benefits	15,980	16,459	16,953	17,462	17,986

[11] The University System of Maryland is providing workforce development funds for this initiative.
[12] Faculty lines for Year 1 include a Program Director, a Lecturer and Teaching Assistants.
[13] In Year 2, two additional Lecturer positions will be added and an Assistant Program Director.
[14] In Year 3, an Assistant Professor position and additional Lecturer will be added.
[15] An academic advisor position will be added in Year 1.

3. Total Support Staff Expenses (b + c below)[16]	0	0	0	0	0
a. # FTE	0	0	0	0	0
b. Total Salary	0	0	0	0	0
c. Total Benefits	0	0	0	0	0
4. Equipment[17]	15,450	28,620	29,329	30,027	30,713
5. Library	3,000	3,180	3,371	3,573	3,787
6. New or Renovated Space[18]	0	0	0	0	0
7. Other Expenses[19]	206,811	537,833	868,671	996,544	1,077,029

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[16] Support staff expense are paid through UMBC's contribution for academic and administrative support at USG. This contribution is included in the line for Other Expenses.
[17] This includes computing needs for faculty and staff.
[18] USG will provide the lab and classroom space.
[19] Other expenses includes start-up costs, indirect costs, funding for honorariums, travel, supplies, fixed charges such as association dues, subscriptions, and rental of classrooms and staff offices at USG.

Articulation Agreement Amendment

Montgomery College
9221 Corporate Blvd
Rockville, Maryland, 20850

University of Maryland, Baltimore County (UMBC)
1000 Hilltop Circle
Baltimore, Maryland 21250

This Amendment is executed this 19th day of February, 2018, between Montgomery College, 9221 Corporate Blvd, Rockville, Maryland, 20850, and the University of Maryland, Baltimore County, a constituent institution of the University System of Maryland, and agency of the State of Maryland.

The parties agree to the following:

Effective Spring 2018, UMBC will cease the practice of considering waivers to the physical education graduation requirement on the basis of age, with the exception of cases involving:

- ☒ *Students who matriculated to UMBC prior to Spring 2018 and have been continuously enrolled (no break in enrollment), who were 30 years of age or older before their first enrolled semester at UMBC;*

- ☒ *Students who matriculate to UMBC prior to Spring 2020 having previously attended a Maryland Community College or another institution prior to Spring 2018 under an established <u>articulation agreement</u> and who were 30 years of age or older before their first enrolled semester at UMBC.*

As of the Execution Date of this Amendment, all the provisions of this Amendment shall be deemed to be incorporated in, and made a part of, the Articulation Agreement with Montgomery College, and shall be read, taken and construed as one and the same instrument. Except as otherwise expressly modified herein, the Articulation Agreement shall remain in full force and effect, in accordance with its terms.

Philip Rous
_____
Philip Rous, Ph.D.
Provost and Senior Vice President for Academic Affairs
University of Maryland, Baltimore County

S N k
_____
Sanjay Rai, Ph.D.
Senior Vice President for Academic Affairs
Montgomery College

<u>Read and Understood</u>

Katharine Cole
_____
Katharine H. Cole, Ph.D.
Vice Provost and Dean of Undergraduate Academic Affairs
University of Maryland, Baltimore County
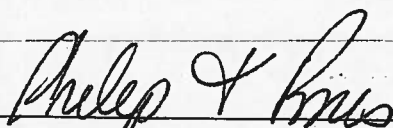
┌─ DocuSigned by:
Christopher Tkacik
_____
└─ Approved for Legal Sufficiency
Office of the General Counsel
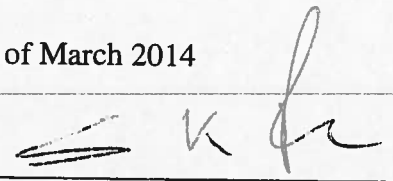University of Maryland, Baltimore County

Articulation Agreement

Montgomery College
Associate of Art in Computer Science
900 Hungerford Drive
Rockville, MD 20850
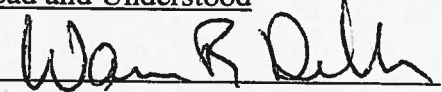
University of Maryland, Baltimore County (UMBC)
Bachelor of Science in Computer Science
1000 Hilltop Circle
Baltimore, Maryland 21250
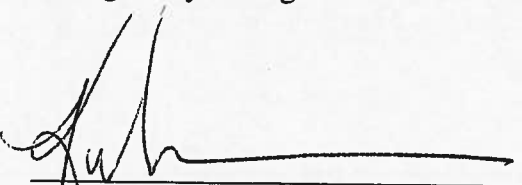
Entered into this 1st day of March 2014
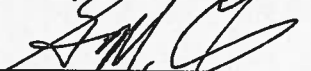
Philip Rous, Ph.D.
Provost and
President for Academic Affairs
University of Maryland, Baltimore County
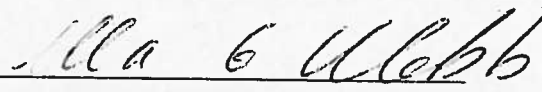
Sanjay Rai, Ph.D.
Interim Senior Vice President for Academic Affairs
Montgomery College

Read and Understood

Warren DeVries, Ph.D.
Dean,
College of Engineerng and Information Technology
University of Maryland, Baltimore County

Kathy Michaelian, M.Ed
College Dean for Information Technology
Montgomery College

Gary Carter, Ph.D.
Chair,
Computer Science and Electrical Engineering
University of Maryland, Baltimore County

Alla Webb, Ph.D.
Computer Science and Information
Systems Program Coordinator
Montgomery College

APPROVED
UMBC
Office of General Counsel

1

This agreement is applicable for students enrolled at Montgomery College (MC) upon the execution date of this agreement. This agreement may be modified by the mutual written consent of both parties. This agreement may be terminated by either party by giving notice six months in advance to the other party. Such termination will not affect the participation in the articulated programs of those MC students who have been fully or conditionally admitted to UMBC.

Any notice to be given hereunder shall be given in writing by U.S. mail or via reputable overnight courier (e.g., Federal Express, DHL, etc.). Notice shall be deemed received upon delivery to the party to whom the notice is directed or to its agent, in the case of UMBC to: UMBC, 1000 Hilltop Circle, Baltimore, Maryland 21250, Attn: Dr. Philip Rous, Provost, with copies to Dr. Diane Lee, Vice Provost and Dean, Undergraduate Education, Dr. Yvette Mozie-Ross, Associate Provost, Enrollment Management, and Mr. Steven Smith, University Registrar, UMBC ; and, in the case of MC to: 900 Hungerford Drive, Rockville Maryland 20850, Attn: Ms. Andrea Milo, Acting Director of Articulation, Transfer and Academic Services. Notwithstanding the foregoing, in the event that this Agreement provides that any notice must be directed to a person other than the person designated for the receipt of notice in the preceding sentence, then notice must be directed to such other person in order to be effective hereunder.

This Agreement embodies the entire agreement and understanding among the parties hereto relating to the subject matter hereof and may not be changed orally, but only by an instrument in writing signed by all parties hereto. No representation, warranty, undertaking or covenant is made by any party hereto except as contained herein and any others are specifically disclaimed. This Agreement shall be governed by and construed in accordance with the internal laws of the State of Maryland (i.e., without regard to its conflicts of law rules). This Agreement shall be binding upon the parties hereto and their respective successors, but shall not inure to the benefit of any third party beneficiary. This Agreement and any rights hereunder may not be assigned by either party without the prior written consent of the other, and any purported assignment without consent shall be null and void and of no effect whatsoever. This Agreement may be executed in any number of counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same Agreement.

This Articulation Agreement continues on the next page.

Articulation Agreement

Montgomery College

Associate of Art in Computer Science

University of Maryland, Baltimore County (UMBC)

Bachelor of Science in Computer Science

This agreement is initiated this day March 1, 2014 between Montgomery College, 900 Hungerford Drive, Rockville, MD 20850, hereafter "MC," and the University of Maryland Baltimore County, a constituent institution of the University System of Maryland, and agency of the State of Maryland, hereafter "UMBC," to facilitate the transfer of students earning the Associate of Art degree in Computer Science at MC to UMBC in pursuit of the Bachelor of Science degree in Computer Science.

I.   PURPOSE

The purpose of this Articulation Agreement (the "Agreement") is to establish collaboration between UMBC and MC in an effort to facilitate the transfer and degree completion of students earning the Associate of Art in Computer Science at MC to the Bachelor of Science in Computer Science at UMBC.

This Agreement also serves as a Memorandum of Understanding between both institutions for the purpose of clarifying roles and responsibilities in this partnership.

II.   GUIDING PRINCIPLES

In consideration of the mutual covenants and conditions expressed herein, the parties agree to the following:

General Requirements

1. All courses meeting general education requirements at MC will transfer and be applied towards the general education requirements at UMBC.
2. A completed general education program shall transfer without further review or approval by UMBC and without the need for a course-by-course match.
3. A maximum of 60 credits will transfer from MC, a 2-year degree-granting institution.
4. Upon matriculation to UMBC, MC students must satisfy all general education, graduation and major requirements as outlined in the UMBC Undergraduate Catalog.
5. MC students must take a minimum of 30 credit hours at UMBC to earn a bachelor's degree.
6. UMBC requires a minimum of 120 credit hours to attain a bachelor's degree

Advising/Academic Planning

1. Students should work closely with their academic advisor at MC to develop an academic plan to ensure a seamless transition.
2. Students and advisors are encouraged to utilize a variety of advising resources including the UMBC Undergraduate Catalog, Suggested Transfer Pathways, departmental websites, as well as ARTSYS (the USM online articulation database), to ascertain transferability of coursework.

3 Following admission to UMBC, students will receive an evaluation of prior college   coursework via myUMBC. The evaluation will include a Transfer Credit Report and a Degree Audit detailing prior coursework, transferability and applicability to UMBC general and university requirements.

4 Prior to matriculation to UMBC, all new students are required to attend the   mandatory new student orientation program. During orientation, students will meet with an academic advisor to review prior coursework, discuss academic interests and goals, and develop an academic plan.

5 Upon matriculation, students will be assigned an advisor in their area of study. Students are strongly encouraged to meet with their advisor periodically. Students are required to meet with their advisor prior to registering for subsequent semesters.

Admissions

1 The UMBC Admissions Committee evaluates transfer applicants on the basis of their academic record at previous institutions. Cumulative grade point average, performance trends, strength of curriculum and performance in courses related to the intended area of study are considered.

2 Applicants successfully completing the articulated program with a 2.0 or better grade point average who have not subsequently matriculated at any other institution of higher education will be guaranteed transfer admission to UMBC. Additional requirements may apply on selective admissions programs (e.g. Engineering, Visual Arts, Performing Arts). A history of acts identified in the Federal Campus Security Act may disqualify a candidate for guaranteed admission.

Scholarships and Financial Aid

Students transferring from MC to UMBC who meet application deadlines, academic and financial qualification that apply to all students, may be eligible for consideration for the following scholarships offered by UMBC:

a) The Academic Achievement Award for Transfers (AAAT) – awarded to community college transfers on the basis of academic accomplishment. Awards of up to $2,500 for each of two academic years of study. May be used for full- or part-time study. Students must have completed 35 or more college level credits at the time of application to be eligible for consideration.

b) Phi Theta Kappa (PTK) Scholarship – awarded to community college transfers on the basis of academic accomplishment. Awards range from $2,000 to $2,500 per year for each of two academic years of study. May be used for full- or part-time study. Students must submit proof of PTK membership to be eligible for consideration.

c) Honors College Scholarship – Transfer students admitted to the Honors College may be eligible for a $1,000 award per year for each of two years of academic study.

d) Transfer Student Alliance (TSA) - awarded Montgomery College transfers who complete the associate's degree and meet all other program requirements. Awards of $1,500 dollars for each of two years of full-time study.

1 To maximize consideration for need-based aid, students are encouraged to complete the free Application for Federal Student Aid (FAFSA) as soon as possible after January 1 but prior to February 14 for fall admission.

Ongoing Collaboration

1. In the spirit of articulation, faculty representatives from both institutions will meet annually to engage in ongoing discussion to enhance and strengthen this collaboration.
2. UMBC Computer Science faculty may serve as a resource as available to MC students and faculty by serving as guest lecturers, workshop/seminar facilitators and other program exchanges.
3. Partner institutions agree to communicate program changes in a timely manner to avoid disruption to student progress toward degree completion.

III. PROGRAM ARTICULATION AGREEMENT

The following details a recommended course of study for students earning the Associate of Art degree in Computer Science at MC transferring to UMBC in pursuit of the Bachelor of Science degree in Computer. Science. Where noted, course equivalencies, general education and major applicability are indicated.

Montgomery College Course Number	Montgomery College Course Title	MC Credits	UMBC Equivalency	UMBC General Education Requirement	Notes
General Requirements					
EN101 or CS elective (ENGL101 or CMSC elective)	Introduction to College Writing	3	LLE		EN101, if needed as EN102 pre-requisite. If not then student will take CS elective
EN102 (ENGL102) or EN109 (ENGL103)	Crit. Read/Write/Research Writing for Business and Technology	3	ENGL 100	EN	
Students will choose one of the two sequences below (Chemistry or Biology)					
CH101 (CHEM131) CH102 (CHEM132)	Principles of Chemistry I Principles of Chemistry II	4 4	CHEM101 CHEM102 +L	SL SL	Student must take CH101 and CH102 in order to receive credit for CHEM101 and CHEM 102+L
BI107 (BIOL150) BI108 (BIOL151)	Principles of Bio I Principles of Bio II	4 4	BIOL141 BIOL142	SL SL	

MA181 (MATH181)	Calculus	4	MATH 151	M	
BSSD	Behavioral and Social Sciences Distribution	3	SS	SS[1]	
BSSD	Behavioral and Social Sciences Distribution	3	SS	SS[1]	
ARTD or HUMD	Arts or Humanities Distribution	3	C	C [1]	Student will be prompted to select Culture designated course
ARTD	Arts Distribution	3	AH	AH[1]	
HUMD	Humanities Distribution	3	AH	AH[1]	
SP108 (COMM108) or SP112 (COMM112)	Introduction to Human Comm Business & Professional Speech Communication	3	SPCH100	AH	
HE 100 or Any HE (HLTH100 or any HLTH)	Health Foundation	1	SS	SS [1]	HE100 Principles of Healthier Living Recommended
Total General Requirements		37			
Program Requirements					
MA182 (MATH182)	Calculus II	4	MATH 152		
MA284 (MATH284)	Linear Algebra	4	MATH 221		
CS103 (CMSC203)	Computer Science I	4	CMSC 201		
CS204 (CMSC204)	Computer Science II	4	CMSC 202		
CS256 (CMSC207)	Intro to Discrete Structures	4	CMSC 203		
CS140 (CMSC140)	Intro to Programming	3	CMSC104		
CS110 (CMSC110)	Computer Concepts	3	IS101		
Total Program Requirements		26			
		63			
Total Number of Credits Required		120			

for *Computer Science* degree					
Maximum Number of Transfer Credits Applied Towards *Computer Science* degree		60			
Minimum Number of Credits Remaining for Completion of 120 Credits Required for *Computer Science* degree		120			

Students will need to complete the Gateway courses CS103 (CMSC 201) and CS204 (CMSC 202) with a grade of B or better and CS256 (CMSC 203) with a grade of C or better. Students are only permitted two attempts in courses for their major; a withdrawal is considered an attempt.

Upon admission, UMBC will determine the transferability of any courses not taken at MC. Students should be prepared to provide syllabi, course descriptions, exams and homework as requested.

[1] These courses satisfy the general categories as indicated. To view specific course equivalency, consult ARTSYS (artweb.usmd.edu).

[2] World Language Requirement - A single language through the 201-level; exemptions based on proof of completion of Level 4 of a language in high school or results of a language proficiency exam. Students may demonstrate foreign language proficiency through other methods, see: www.umbc.edu/mll/gfrs.html. If exempt, take general electives in place of language courses, including six credits of UMBC-designated Culture courses as indicated on ARTSYS (artweb.usmd.edu).

Legend

AH	Arts/Humanities	M	Mathematics
C	Culture	PE	Physical Education
EN	English Composition	S	Science
L	Language	SL	Science (plus lab)
LLE	Lower Level Elective	SS	Social Sciences

Suggested Transfer Pathway
Montgomery College A.A. in Computer Science to
UMBC's B.S. in Computer Science

Year One – Montgomery College

Fall Semester	Cr
CH101 or BI107 (first course in sequence)	4
CS140 Introduction to Programming	3
EN101 Intro to College Writing or CS elective	3
Arts or Humanities Distribution*	3
CS110 Computer Concepts	3
Total Credits	16

Present to Summer 2014

Spring Semester	Cr
CH102 or BI108 (second course in sequence)	4
EN102 or EN109, English Foundation	3
MA181 Calculus I	4
CS103 Computer Science I	4
Total Credits	15

Year Two – Montgomery College

Fall Semester	Cr
CS204 Computer Science II	4
MA182 Calculus II	4
Humanities Distribution	3
Behavioral and Social Sciences Distribution†	3
HE100 Principles of Healthier Living	1
Total Credits	15

Spring Semester	Cr
CS256 Introduction to Discrete Structures	6
MA284 Linear Algebra	4
SP108 or SP112, Speech Foundation	3
Behavioral and Social Sciences Distribution†	3
Arts Distribution	3
Total Credits	17

Apply to graduate from Montgomery College with an Associate of Arts in Computer Science
Students who wish to pursue the Computer Science-Game development track must take PH161 prior to transfer

* All students must meet UMBC's culture requirement and MC's global and cultural perspectives requirement. Students should consult ARTSYS artweb.usmd.edu and the MC catalog to select an art or humanities that meets both requirements.

† Select from two different disciplines

Notes: Unless exempt, all UMBC students are required to meet a language requirement (language course at 201 level) students may begin language prior to transfer.

Students will need to complete the Gateway courses CS103 and CS204 with a grade of B or better and CS256 with a grade of C or better. Students are only permitted two attempts in courses for their major; a withdrawal is considered an attempt.

Upon enrollment, UMBC will determine the transferability of any courses not taken at MC. Students should be prepared to provide syllabi, course descriptions, exams and homework as requested.

Year Three – UMBC

Fall Semester	Cr
CMSC 341 Data Structures	3
CMSC 331 Programming Languages	3
STAT 355 Probability and Statistics	4
Language 101	4
PHED course Ω	0
Total Credits	14

Spring Semester	Cr
CMSC 313 Comp Org & Assembly	3
CMSC 441 Algorithms	3
CMSC 4XX	3
Science III	4
Language 102	4
Total Credits	17

Year Four - UMBC

Fall Semester	Cr
CMSC 304 Social & Ethical Issues	3
CMSC 411 Computer Architecture	3
CMSC 421 Operating Systems Social	3
CMSC 4XX	3
Language 201	4
Total Credits	16

Spring Semester	Cr
CMSC 447 Software Engineering I	3
CMSC 4XX	3
CMSC 4XX	3
CMSC 4XX	3
PHED course Ω	0
3 credits UPLE Elective	3
Total Credits	15

Ω **2 activity courses required by UMBC prior to graduation (unless 30 or older, exempted based on physical disability or a military veteran)**

MC COMPUTER SCIENCE A.A. to UMBC Computer Science B.S.
Total Credits: 63, Catalog Edition 13-14
Present to Summer 2014

Name:		Date:		ID#	
Foundation Courses		**COURSE**	**HRS**	**GRADE**	
English Foundation (EN102 or EN109)		EN	3		
Math Foundation		MA181	4		
Speech Foundation (SP108 or SP112)		SP	3		
Health Foundation		HE100	1		
Distribution Courses		**COURSE**	**HRS**	**GRADE**	
Arts Distribution			3		
Humanities Distribution			3		
Arts or Humanities Distribution *			3		
Behavioral / Social Sciences Distribution †			3		
Behavioral / Social Sciences Distribution †			3		
Natural Sciences Distribution with Lab (BI107 or CH101)			4		
Natural Sciences Distribution without Lab (BI108 or CH102)			4		
Curriculum Requirements		**COURSE**	**HRS**	**GRADE**	
Computer Science I		CS103	4		
Intro to Programming		CS140	3		
Computer Science II		CS204	4		
Intro to Discrete Structures		CS256	4		
Calculus II		MA182	4		
Intro to College Writing or CS elective		EN101	3		
Computer Concepts		CS110	3		
Linear Algebra		MA284	4		
Global & Cultural Perspectives Requirement: *					

Apply to graduate from Montgomery College with an Associate of Art in Computer Science

* All students must meet UMBC's culture requirement and MC's global and cultural perspectives requirement. Students should consult ARTSYS http://artweb.usmd.edu and the MC catalog to select an art or humanities that meets both requirements.

† Select from two different disciplines

Notes: Unless exempt, all UMBC students are required to meet a language requirement (language course at 201 level) some students may want to begin language study prior to transfer www.umbc.edu/mll/gfrs.html.

Students will need to complete the Gateway courses CS103 and CS204 with a grade of B or better and CS256 with a grade of C or better. Students are only permitted two attempts in courses for their major, a withdrawal is considered an attempt.

Upon enrollment, UMBC will determine the transferability of any courses not taken at MC. Students should be prepared to provide syllabi, course descriptions, exams and homework as requested.

Suggested Transfer Pathway
Montgomery College A.A. in Computer Science to
UMBC's B.S. in Computer Science

Year One – Montgomery College

Starting Fall 2014

Fall Semester	Cr
CHEM131 or BIOL150 (first course in sequence)	4
CMSC140 Introduction to Programming	3
ENGL101 Intro to College Writing or CMSC elective	3
Arts or Humanities Distribution*	3
CMSC110 Computer Concepts	3
Total Credits	**16**

Spring Semester	Cr
CHEM132 or BIOL151 (second course in sequence)	4
ENGL102 or ENGL103, English Foundation	3
MATH181 Calculus I	4
CMSC203 Computer Science I	4
Total Credits	**15**

Year Two – Montgomery College

Fall Semester	Cr
CMSC204 Computer Science II	4
MATH182 Calculus II	4
Humanities Distribution	3
Behavioral and Social Sciences Distribution †	3
HLTH100 Principles of Healthier Living	1
Total Credits	**15**

Spring Semester	Cr
CMSC207 Introduction to Discrete Structures	6
MATH284 Linear Algebra	4
COMM108 or COMM112, Speech Foundation	3
Behavioral and Social Sciences Distribution †	3
Arts Distribution	3
Total Credits	**17**

> **Apply to graduate from Montgomery College with an Associate of Art in _Computer Science_**
> **Students who wish to pursue the Computer Science-Game development track must take PH161 prior to transfer**

* All students must meet UMBC's culture requirement and MC's global and cultural perspectives requirement. Students should consult ARTSYS artweb.usmd.edu and the MC catalog to select an art or humanities that meets both requirements.

† Select from two different disciplines

Notes: Unless exempt, all UMBC students are required to meet a language requirement (language course at 201 level) students may begin language prior to transfer www.umbc.edu/mll/gfrs.html.

Students will need to complete the Gateway courses CMSC203 and CMSC204 with a grade of B or better and CMSC207 with a grade of C or better. Students are only permitted two attempts in courses for their major, a withdrawal is considered an attempt.
Upon enrollment, UMBC will determine the transferability of any courses not taken at MC. Students should be prepared to provide syllabi, course descriptions, exams and homework as requested.

Year Three – UMBC

Fall Semester	Cr
CMSC 341 Data Structures	3
CMSC 331 Programming Languages	3
STAT 355 Probability and Statistics	4
Language 101	4
PHED course Ω	0
Total Credits	**14**

Spring Semester	Cr
CMSC 313 Comp Org & Assembly	3
CMSC 441 Algorithms	3
CMSC 4XX	3
Science III	4
Language 102	4
CMSC 313 Comp Org & Assembly	3
Total Credits	**17**

Year Four - UMBC

Fall Semester	Cr
CMSC 304 Social & Ethical Issues	3
CMSC 411 Computer Architecture	3
CMSC 421 Operating Systems Social	3
CMSC 4XX	3
Language 201	4
Total Credits	**16**

Spring Semester	Cr
CMSC 447 Software Engineering I	3
CMSC 4XX	3
CMSC 4XX	3
CMSC 4XX	3
PHED course Ω	0
3 credits UPLE Elective	3
Total Credits	**15**

Ω 2 activity courses required by UMBC prior to graduation (unless 30 or older, exempted based on physical disability or a military veteran)

MC COMPUTER SCIENCE A.A. to UMBC Computer Science B.S.
Total Credits: 63, Catalog Edition 13-14
<u>Starting Fall 2014</u>

Name:		Date:		ID#	
Foundation Courses		**COURSE**	**HRS**	**GRADE**	
English Foundation (ENGL102 or ENGL103)		ENGL	3		
Math Foundation		MATH181	4		
Speech Foundation (COMM108 or COMM112)		COMM	3		
Health Foundation		HLTH100	1		
Distribution Courses		**COURSE**	**HRS**	**GRADE**	
Arts Distribution			3		
Humanities Distribution			3		
Arts or Humanities Distribution *			3		
Behavioral / Social Sciences Distribution †			3		
Behavioral / Social Sciences Distribution †			3		
Natural Sciences Distribution with Lab (BIOL150 or CHEM131)			4		
Natural Sciences Distribution without Lab (BIOL151 or CHEM132)			4		
Curriculum Requirements		**COURSE**	**HRS**	**GRADE**	
Computer Science I		CMSC203	4		
Intro to Programming		CMSC140	3		
Computer Science II		CMSC204	4		
Intro to Discrete Structures		CMSC207	4		
Calculus II		MATH182	4		
Intro to College Writing or CMSC elective		ENGL101	3		
Computer Concepts		CMSC110	3		
Linear Algebra		MATH284	4		
Global & Cultural Perspectives Requirement: *					

Apply to graduate from Montgomery College with an Associate of Art in <u>Computer Science</u>

* All students must meet UMBC's culture requirement and MC's global and cultural perspectives requirement. Students should consult ARTSYS http://artweb.usmd.edu and the MC catalog to select an art or humanities that meets both requirements.

† Select from two different disciplines

Notes: Unless exempt, all UMBC students are required to meet a language requirement (language course at 201 level) some students may want to begin language study prior to transfer www.umbc.edu/mll/gfrs.html.

Students will need to complete the Gateway courses CMSC203 and CMSC204 with a grade of B or better and CMSC207 with a grade of C or better. Students are only permitted two attempts in courses for their major, a withdrawal is considered an attempt.

Upon enrollment, UMBC will determine the transferability of any courses not taken at MC. Students should be prepared to provide syllabi, course descriptions, exams and homework as requested.

Memorandum of Understanding between
University System of Maryland (USM) and
University of Maryland, Baltimore County (UMBC) and
The Universities at Shady Grove (USG)
June 2019

1. **Purpose**

This Memorandum of Understanding ("MOU") constitutes an agreement between the University System of Maryland ("USM"), University of Maryland, Baltimore County ("UMBC") and the Universities at Shady Grove ("USG") to support offering a Bachelor of Science (BS) degree in Computer Science - Cyber Security ("CS-CS"), and a Bachelor of Science (BS) degree in Computer Science - Data Science ("CS-DS") at USG. This MOU was jointly developed and includes the duties and obligations of each party and relevant resource requirements to launch and operate those two programs ("the Programs") at USG.

2. **Rationale for Proposed Programs**

UMBC is proposing to bring three undergraduate programs to USG funded through the FY19 Governor's Workforce Development Initiative (WDI) funding. This MOU between UMBC, USG and USM outlines the arrangements to support these two programs:

- UMBC's B.S. in Computer Science provides students with the knowledge, skills, and awareness of the theory, design, development, and application of computers and computer systems. UMBC will bring two Computer Science track programs to USG: Data Science and Cybersecurity.

  - Computer Science- Data Science track: The state of Maryland has a clear shortage in the number qualified data science professionals. A report generated by the Labor Insights employer-demand tool provides evidence of the labor force demand for IT professionals. A query searching for Bachelor's level job postings in Maryland during the past 12 months needing skills in Data Mining or Data Analysis or Big Data identified 9,982 job postings with these parameters. Labor Insight indicated that this was a higher demand than average, when compared to the national labor market. Of these postings, over 2,700 were located in Montgomery County. Montgomery County employers searching for these employees include Leidos, Booz Allen Hamilton, Marriott, Geico, and Lockheed Martin. Qualitative data from UMBC and USG corporate partners and recruiters supports the quantitative data. This need, coupled with UMBC's long history of success in Computer Science, makes the program a natural fit for USG. Additionally, UMBC is offering their Master of Professional Studies in Data Science at the USG campus, where students with the BS-DS will have the opportunity to continue their education, and earn a graduate degree in this field.

  - Computer Science- Cybersecurity track: The state of Maryland has a clear shortage in the number of qualified cybersecurity professionals. A report generated by the Labor Insights employer-demand tool provides evidence of the labor force demand. A query searching for Bachelor's level job postings in Cybersecurity in Maryland during the past 12 months identified 12,822 job postings with these parameters. Labor Insight indicated that this was a much higher demand than average, when compared to the national labor market. Of these postings, 2,565 were located in Montgomery County. Additionally, UMBC is a collaborator in NIST's National Cybersecurity Center of Excellence, located adjacent to USG in Montgomery County. Additionally, UMBC offers a Master

of Professional Studies in Cybersecurity at USG, where students with the BS-CS will have the opportunity to continue their education, and earn a graduate degree in this field.

3. USM's General Funding Principles for Support of New or Expanded High-Cost Programs at USG

The USM, in concert with USG and its institutional partners, has developed a set of guiding principles to help establish a general framework, by which new, high-cost programs, or expansion of current programs being proposed for USG can be successfully mounted, and sustained to the mutual benefit of the participating institutions and USG (and the citizens and businesses in Montgomery County served by them). This framework is used when the financial and operational model(s), by which USM institutions have traditionally developed and implemented programs at USG, cannot adequately support the development or expansion of key programs, such as high-cost, resource-intensive programs in engineering, technology, and the life/health care sciences.

These principles include:

- The cost of establishing and operating programs will be shared between USG and the institutions.

- Costs will be apportioned according to the details of MOUs, to be negotiated between USG and the individual institutions.

- Each MOU will include (or authorize the development of) appropriate performance metrics, negotiated and agreed upon by both the participating institutions and USG, which will be used to help assess the program's progress, effectiveness, and viability.

- To provide the financial and operational stability, institutions need to plan and build successful programs—and allow USG to maximize the resources available to it, in support of its mission—the MOUs should specify a guaranteed period of funding for each program that will continue on a rolling basis, so long as each program meets the terms and conditions agreed upon by the institutions and USG. In the event that any program funded through the MOU process is required to cease operations at USG, both the institution and USG will work together to plan and implement an orderly and effective phase out of the program, including completion of all teach-out requirements, and the transition of faculty as needed and appropriate, per the requirements of state, Regent, and accreditor policies.

- Faculty staffing and workload decisions/requirements related to programs operating within the Biomedical Sciences and Engineering Education building (BSE) will remain the sole responsibility of the home institution. Both the USG and the USM recognize that campuses require flexibility in how they holistically structure, administer, and support their programs both on campus and at the regional centers, if they are to be successful long term. However, an underlying principle of the MOUs is that funding supplied by USG or USM to the institutions to cover "gap costs" -- those ongoing structural deficits associated with operating high cost programs that cannot be recouped through the revenue models traditionally employed by campuses in support of their operations at USM's regional centers -- should go primarily to build and support the educational quality of the programs, and instruction being offered.

- Institutions and USG are expected to work together to identify and achieve efficiencies in academic programs, support services as appropriate, and practice these general principles.

It is the determination of the USM and USG that, based on the information provided, the Programs meet the definition of high-cost programs, envisioned under this framework. Therefore, the principles outlined above have been used to develop this MOU, which outlines the financial and operational expectations/requirements for the deployment and operation of the Programs at USG.

4. Financial and Operational Expectations/Requirements for the Programs at USG

4.1 Funding

Funding for the Programs under the five years of operations, covered by this MOU will come from a variety of sources, including: tuition and fee revenue generated by students enrolled in the program at USG, internal resource reallocations made at the discretion of UMBC, and FY 2019 enhancement funding provided by the USM and USG to UMBC for the support of the Programs. A breakdown of the revenue and expenses (including those tied to instruction, support, supplies and equipment, marketing, and space) is provided in the attached schedule, developed by UMBC. The enrollment projections from which these revenue/expense estimates are derived are included as well. These enrollments and revenue/expenses may change, and will be reviewed as part of the yearly review by UMBC and USG.

The revenue/expense data provided by UMBC for FY 19 (year zero) through FY 24 (year five) can be broken down into three parts:
1) Projected tuition and fee revenue that will be generated by enrollment within the Programs at USG;
2) Program expenses that will be covered by using tuition and fee revenue. These expenses are split between both instructional personnel costs (lecturers) and operating expenses, and will be covered by UMBC using tuition revenue (this category includes the administrative indirect charge applied by UMBC);
3) Program expenses that USM and USG will cover through use of enhancement funds. These expenses include designated faculty and administrative personnel costs, as laid out in the UMBC schedule, and include their estimated fringe benefit costs and, for the research faculty, a portion of their research start up package.

Under the terms of this MOU, UMBC, using the tuition revenue projected in section 1 of the attached schedule, will cover all Program expenses laid out in section 2 of the schedule (*"Expenses to be supported by tuition revenue"*). Tuition and fee revenue generated by the Programs is projected to range from $0 in FY 19 to $3,495,269 in FY 24. Expenses that UMBC commits to covering using tuition are projected to range from $118,790 in FY 19 to $4,247,049 in FY 24. Importantly, it is the expectation of USM and USG—based on agreements made with the UMBC leadership—that any tuition revenue generated from the Programs at USG that exceeds the expenses identified in section 2 of the schedule, shall be used by UMBC to reinvest in programming at USG, either through new programs, enhanced capacity of existing programs, or other improvements.

In turn, under the terms of this MOU, the USM and USG commit to fully covering all personnel costs identified under Section 3 of the schedule ("*Expenses to be supported by USM"*), including f the expenses identified as "Faculty Startup." Based on the schedule provided by UMBC, faculty start-up costs for the Computer Science degrees are expected to be $26,500 for FY19, $10,000 for FY20, $10,000 for FY21, $485,000 for FY22, $475,000 for FY23 and $125,000 for FY24. Funds used to purchase lab-start-up equipment would be under the direction of USG in order to understand their impact on classrooms, facilities and IT support at USG. The start-up equipment would be USG-owned. USM and USG would provide enhancement funding sufficient to cover

non-tuition supported expenses (including funding up to 25% of under attainment of tuition) ranging from $61,425 in FY 19 to $1,156,661 in FY 24 for the two tracks.

For a breakdown by year of the amount of funding committed by USM/USG to the Programs, see the attached schedule.

4.2 Enrollment and Graduate Production

In return for the funding support outlined above, UMBC estimates headcount enrollment as follows:
1) By FY 20, enroll at least 50 (headcount) students in the Programs.
2) By FY 21, enroll at least 160 (headcount) students in the Programs.
3) By FY 22, enroll at least 238 (headcount) students in the Programs and generate at least 15 graduates per year.
4) By FY 23, enroll at least 286 (headcount) students in the Programs and generate at least 40 graduates per year.
5) By FY 24, enroll at least 313 (headcount) students in the Programs and generate at least 132 graduates annually.

The Programs are anticipated to reach steady-state enrollment in FY26 with projected combined enrollment of approximately 420 (headcount) students and produce approximately 200 graduates annually.

4.3. Funding Start Date, Transfer to USG, and Program Review and Evaluation Requirements

Initial transfer of funds from USM/USG to UMBC, per the terms of this MOU and the schedule provided, is expected to occur in FY 19. This will allow UMBC to begin hiring Program Directors and faculty/staff under the Programs prior to accepting enrollment.

At the beginning of FY 23, UMBC, USG, and USM will undertake a review of the status of the program, including such factors as enrollment in the program (both historical and projected), the annual cost of operating the program against the revenue generated (both historical and projected), the total number of graduates produced (historical and projected), other agreed upon program outcomes, and the need for continued additional operational subsidies (i.e., the "gap" between tuition revenues and identified program costs) going forward. UMBC, USM, and USG will then have the option of negotiating a new MOU or, if deemed appropriate and agreed to by the chancellor, beginning the process for reducing and/or phasing out of the program.

This agreement becomes effective upon signature by authorized representatives of UMBC, USG and USM. It remains in effect unless modified or terminated in writing by executives from all three parties. This MOU may be modified only by mutual written agreement of all parties, subject to final approval by the Chancellor.

5. **Other Key Duties and Obligations Under the MOU**

UMBC will:
- Share data and information necessary to establish and operate the Programs and ensure their success. This includes data and information related to the development of the pathways (e.g., articulation agreements and curriculum changes), recruitment/acceptance of students (e.g., number of qualified

applications, waitlist, acceptance rates), and program enrollments and projections, retention and graduation rates and other metrics as deemed appropriate.

- Share data and information required by USG to maintain campus-wide safety and security as well as the provision of student and academic services, as identified in the current slate of student services provided by USG. In addition, will submit status reports to USG and USM each semester that outline the progress of the Programs, and any additional challenges/opportunities that the Programs have encountered.
- Meet with USG annually to review and discuss progress under the Programs, and any additional challenges/opportunities that the Programs have encountered. This will include reviewing progress toward enrollment projections and other agreed upon performance metrics (e.g., demand for the programs, degree outputs). This annual review is separate from the more comprehensive 3-year review set forth in section 4.3 above.
- Set as enrollment targets the minimum level of enrollment outlined in the schedule provided by UMBC. Differences between estimated and actual FTE projections will be part of the ongoing status reports.
- Partner with USG on mutually beneficial development efforts to support the Programs, including grant funding opportunities as they may arise to enhance the Programs.
- Actively encourage faculty, students, and staff to participate in inter-professional events, curriculum, and experiential opportunities with other programs at USG.
- Recruit, hire, and manage faculty and staff for the Program at USG.
- Honor all previously executed or subsequently executed agreements with USG, including agreements on: counseling services, the delivery of student and academic services, support for students with disabilities, student information, and data sharing.
- Partner with USG to identify and achieve efficiencies in academic programs, support services as appropriate, and practice these general principles.
- Continue to adhere to the current funding policy and fee schedule for all programs at USG, including auxiliary student fees, technology fees, room charges and parking fees for students, faculty and staff, and continue to pay USG for student services provided for UMBC students, per the existing student services agreement. For the students that are fulltime on the home campus and taking one or two classes at the USG campus, UMBC will not charge those students for student fees and pay USG for the student fees that accrue from those students through funding provided in this MOU. The student fees for these students will be supported for FY20 and FY21 only. Under these arrangements, USG will continue to serve all UMBC students enrolled in the classes for these programs.
- Continue to follow existing policy and procedures for establishing a new academic program at USG including timely MHEC filings as well as the required submittals to USG with regard to the academic program proposal. The program proposal must be approved by USG's Shady Grove Governing Council (the "SGGC"). The UMBC program proposals submitted to USG are attached.

USG will:
- Provide funding for the Programs in FY 19-FY 24, per the requirements and expectations identified in Section 4 of this MOU.
- Provide suitable office, classroom, and computer lab space for the Programs
- For the period that begins in FY 25, work with USM and UMBC to ensure the continued adequacy of funds to cover the identified costs of the Program, as identified and agreed upon by the three parties.
- Meet with UMBC annually to review and discuss progress under the Programs, and any additional challenges/opportunities that the Programs have encountered. This will include reviewing progress toward enrollment projections and other agreed upon performance metrics (e.g., demand for the program, degree outputs). This annual review is separate from the more comprehensive 3-year review set forth in section 4.3 above.
- Partner with UMBC on mutually beneficial development efforts to support the Programs, including grant funding opportunities, as they may arise, to enhance the Programs.

- Partner with UMBC to actively encourage faculty, students and staff to participate in inter-professional events, curriculum, and experiential opportunities with other programs at USG.
- Honor all previously executed or subsequently executed agreements with UMBC, including agreements on: counseling services, the delivery of student and academic services, support for students with disabilities, student information, and data sharing.
- Partner with UMBC to identify and achieve efficiencies in academic programs, support services as appropriate, and practice these general principles.
- Continue to provide current funding policy, fee schedules, and invoices to UMBC that include auxiliary student fees, technology fees, room charges, and parking fees for students, faculty and staff, in accordance with standard existing procedures at USG for all home institutions.
- Continue to follow existing policy and procedures for establishing a new academic program at USG, including the required submittals with regard to the academic program proposal. The program proposal must be approved by the SGGC.

USM will:

- Provide the enhancement funds requested by USG for the Programs beginning in FY 19 and continuing through FY 24, as identified in Section 4 above.
- Work with USG to solve any funding needs that may require modification in the FY19-FY24 period.
- For the period that begins in FY 25, work with USG and UMBC to ensure the continued adequacy of funds to cover the costs of the Programs, as identified and agreed upon by the three parties.

6.   Program Contacts

UMBC and USG designate the following individuals as those with the responsibility of coordinating the MOU implementation in general terms:

- UMBC: Dr. Phillip Rous, Provost and Senior Vice President for Academic Affairs and Dr. Christopher Steele, Vice Provost, Division of Professional Studies.
- USG: Dr. Stewart Edelstein, Executive Director and Associate Vice Chancellor for Academic Affairs, USM, Ms. Mary Lang, Chief Strategy Officer, Ms. Nico Washington, Chief Operating and Financial Officer
- USM: Ms. Ellen Herbst, Chief Operating Officer/Vice Chancellor for Administration and Finance, Dr. Joann Boughman, Senior Vice Chancellor for Academic and Student Affairs

7.   Date and Signatures of MOU and Authority to Execute

This MOU shall be effective upon the date of the final signature by the authorized representatives of the parties. The undersigned individuals represent and warrant that they are expressly and duly authorized by their respective institutions to execute the MOU.

8.   Required Signatures

The parties identified below agree to the provisions and terms of this MOU.

APPROVED:

_____
Philip Rous, Ph.D.   Date
Provost and Senior Vice President for Academic Affairs
UMBC

_____
Stewart Edelstein, Ph.D   Date
Executive Director
The Universities at Shady Grove
Associate Vice Chancellor for Academic Affairs
University System of Maryland

_____
Ellen Herbst   Date
Chief Operating Officer
Vice Chancellor for Administration & Finance
University System of Maryland

_____
Dr. Joann Boughman   Date
Senior Vice Chancellor for Academic & Student Affairs
University System of Maryland

Attachment:

Spreadsheet of UMBC Costs submitted by UMBC June 2019
Program Proposal submitted to APAC