Agenda Item: III.C.

DATE: July 23, 2020

SUBJECT: New Academic Program
University of Memphis
Data Science, Master of Science
(CIP 30.7001– Data Science)

ACTION RECOMMENDED: Approval

PROGRAM DESCRIPTION

The University of Memphis proposes a Data Science, Master of Science (MS) which would fill an ever-growing need to produce additional data scientists in the state and region. The proposed program is a multidisciplinary program jointly developed by the departments of Computer Science and Mathematics with close collaboration from other academic units including public health, biology, business and information technology, and economics. The program will be administratively structured under the College of Arts and Sciences.

The proposed program will require 33 credit hours including a three-credit master's project. Graduates of the program will be equipped with the necessary foundation in data science to serve effectively across different industries, while also providing specialties that can be tailored to the industry in which students are hoping to have professional careers. Additionally, the program will prepare students for a Data Science, PhD or related field.

The University of Memphis provided an update regarding the impact of the Coronavirus pandemic on the proposed Data Science MS program (Appendix A). The challenges created by the COVID-19 pandemic have increased the relevance of and need for the proposed program. Data Scientists can provide an understanding of events and predict future patterns of the infection, behavioral responses and the economic impact of the disease. Precise analysis of individual behavior during and after the pandemic will inform consumers, businesses and policy makers for coping, adapting and thriving through the pandemic.

INSTITUTIONAL GOVERNING BOARD APPROVAL

The proposed Data Science MS program was approved by the University of Memphis Board of Trustees on June 19, 2019.

PROPOSED IMPLEMENTATION DATE

Fall 2020

RELEVANCE TO INSTITUTIONAL MISSION AND STRATEGIC PLAN

The proposed program supports the University of Memphis' dedication to preparing students with solid quantitative skills and competencies which apply to a wide variety of fields while preparing them for future endeavors in their career and subsequent studies. The proposed Data Science MS program will bring a strong component of computational and statistical theory and in-depth innovative practical training opportunities, which will result in competitive graduate students who are prepared for high-demand career and research opportunities.

Additionally, the proposed program aligns with the state's goal of greater degree attainment through the establishment of a master's program that has potential for high enrollment and high graduate's rates that produces skilled workers in high wage jobs that are in high demand in Tennessee.

CURRICULUM

The proposed Data Science, MS requires the completion of 33 credit hours which includes 15 credits of core courses; a three-credit master's project; and a thesis option. Students will also be encouraged to choose elective courses related to one of four clusters: Data Science, Biomedical, Economics, or Business Information Technology. Graduates from the proposed program will be able to:

- Demonstrate core competencies in basic programming and data manipulation skills for large, distributed, diverse, structured, and unstructured data (big data);
- Develop skills for statistical model building, data management and analysis of massive data from many domains of application;
- Develop advanced skills for classification and clustering, using statistical machine learning methods;
- Conduct reproducible data analysis with awareness for security, ethical considerations and government regulations; and
- Demonstrate awareness and understanding of key components of the Data Science conceptual framework and process.

PROGRAM PRODUCTIVITY

The proposed Data Science MS program projects an initial enrollment of 40 students with steady increases to 80 students by the fifth year. Enrollment projections for the proposed Data Science MS program are based on existing enrollment in the Data Science graduate certificate program at the University of Memphis and enrollment in the COMP 7/8150 - Fundamentals of Data Science course. Graduate assistantships for six students will be supported.

	2020	2021	2022	2023	2024
Enrollment	40	60	80	80	80
Graduates	--	32	54	74	74

PROGRAM DUPLICATION
There are currently no public graduate programs in Data Science in Tennessee. However, Tennessee State University has recently submitted a Letter of Notification of a proposed Data Science MS program. Lipscomb University and Vanderbilt University both offer Data Science MS programs and UT Chattanooga offers two related concentrations within the Computer Science MS program: Data Science and Data Analytics.

EXTERNAL JUDGEMENT
An external review of the proposed program was conducted during an institutional site visit on February 10, 2020. Dr. Laura E. Brown, Director, Data Science Graduate Program at Michigan Technological University. The site visit included meetings with campus administrators, faculty, prospective students and community partners.

Dr. Brown made a recommendation for approval of the proposed Data Science MS program and stated that "the program will serve a great need to educate a population of students and future employees in data science skills and knowledge. The institution appears highly enthusiastic and supportive of this endeavor at all levels: students excited about the new degree option, faculty keen on the new curriculum and research opportunities, administrative commitment to provide resources and support, and employers ready to hire students with these skills."

STUDENT DEMAND
A survey of over 400 students and alumni from Computer Science, Mathematics, Biology, Public Health, and Economics was conducted that showed 97 percent of respondents in favor of the field, and 71 percent of respondents interested in telling a colleague of the proposed program. In addition to the survey, three letters of support from alumni were included that indicated strong support for the proposed program. Furthermore, enrollment in existing certificates related to the proposed program have been producing graduates. For example, the Certificate in Business Intelligence and Analytics had 45 graduates over the past two years.

OPPORTUNITIES FOR PROGRAM GRADUATES
The Bureau of Labor Statistics estimates employment of Data Science related positions will have an average growth of 33 percent, much higher than the national average of seven percent. Additionally, master's degrees in Data Science have quadrupled from 5000 to 20K between 2016 and 2018.

The need for the proposed Data Science MS program is corroborated by letters of support from the University of Tennessee, Health Science Center's Core Director of Molecular Bioinformatics, AutoZone, St. Jude Children's Research Hospital, Lilly, International Paper, FedEx, Philips, and Audible.

INSTITUTIONAL CAPACITY TO DELIVER THE PROGRAM

The University of Memphis has strong programs in core Data Science areas such as Computer Science and Statistics as well as discipline-specific data analysis expertise and course offerings. In 2019, the inaugural Memphis Data Conference was organized by Dr. Vasile Rus and Dr. David Kemme. The conference attracted nearly 200 attendees and engaged local, regional and global stakeholders with a focus to build a Data Science community of practice and foster research in the area.

With any emerging discipline, there is a need to provide an organizational structure and corresponding resources which is provided in the five-year financial projections. To implement the proposed program in Fall 2020, a program director, administrative assistant and technology resources will be needed. In order to support the expected growth in the proposed Data Science MS program, an additional faculty member will be hired in years 3 and 4 of the program. Funds are also budgeted to renovate the computer lab and provide needed equipment.

Appendix B outlines the five-year financial projections for the proposed Data Science MS program.

ASSESSMENT AND POST-APPROVAL MONITORING

An annual performance review of the proposed program will be conducted for the first five years following program approval. The review will be based on benchmarks established in the approved proposal. At the end of this period, the campus, institutional governing board, and Commission staff will perform a summative evaluation. The benchmarks include, but are not limited to, enrollment and graduation, program cost, progress toward accreditation, and other metrics set by the institution and Commission staff. If benchmarks are not met during the monitoring period, the Commission may recommend that the institutional governing board terminate the program. If additional time is needed and requested by the institutional governing board, the Commission may choose to extend the monitoring period.

Tennessee Higher Education Commission
Coronavirus Impact on New Academic Programs
June 29, 2020

THEC

In light of the current Coronavirus pandemic, THEC is requesting additional information for new academic programs that are slated for the July 23, 2020 Commission meeting agenda. Please submit your response to the questions listed below by July 7, 2020. Any changes to expenditures and/or revenues will require a revised THEC Financial Projections Form.

Institution: University of Memphis
Academic Program, Degree Designation: Data Science, Master of Science
Proposed Implementation Date: Fall 2020

Questions: Coronavirus Impact on New Academic Programs
Overall Program Need ▪ **Is this academic program as relevant as before the pandemic?** The challenges created by the COVID-19 pandemic have *increased* the relevance of and need for the Masters of Science in Data Science program. The Master of Science in Data Science (MS DS) is an academic program designed to enable data-based decision making by individuals and organizations. The skills acquired by graduates provide the tools to enhance problem-solving and increase productivity through interdisciplinary, collaborative engagement of researchers, managers and decision makers. The pandemic has dramatically impacted the operations of many businesses, non- profits, and government agencies. Data Scientists can provide an understanding of events and predict future patterns of the infection, behavioral responses and the economic impact of the disease. Precise analysis of individual behavior during and after the pandemic will inform consumers, businesses and policy makers for coping, adapting and thriving through the pandemic. Data on social distancing collected from phones, changes in shopping preferences and habits, and remote work and schooling effectiveness may be analyzed with modern data science tools. With online databases and data analysis tools, many Data Scientists may work remotely from home so there is little impact on job opportunities for our graduates and in fact there is likely to be greater demand and increased job security for data scientists if new waves of the pandemic resurface in the future. All these should make the program more attractive to prospective graduates. Furthermore, with many people out of work they may think about obtaining advanced degrees and switching careers to areas with much better job prospects such as Data Science, which has been ranked as the top job in the country for a number of years by major job search companies such as Glassdoor. The Federal government decentralization of decision-making and management of the response to the pandemic, also leaves much of the follow-on work of managing the aftermath to local governments and nonprofit partners. The MS DS program will provide graduates with the knowledge and ability to advance understanding of how various organizations and communities may better adjust to a pandemic situation. The combination of training in theory, design, development and application will prepare graduates for careers in the public, nonprofit, private, and education sectors as advanced policy analysts, researchers, managers, administrators, and academics.

The Memphis community faces challenges of persistent poverty, inequity, and barriers to inclusive prosperity. The proposed program is meant to offer recent college graduates and professionals new career opportunities that are in extremely high demand. Local public, nonprofit, and philanthropic organizations also recognize a need for practitioners with advanced skills in research, analytics, and policy/program evaluation to address more effectively the community challenges facing the Memphis region. As evidenced in the letters of support included in Appendix C, local private and non-profit organizations indicate high-demand for Data Scientists. This demand is expected to remain strong, even grow, as businesses reopen and need the skills and tools for data-driven decision making in their daily operations.

- Does this remain the most needed utilization of institutional resources in light of the pandemic? The program curriculum relies solely on existing courses and faculty and does not require significant utilization of institutional resources. The program remains important to the University's mission as an urban-serving university that closely collaborates with its community.

Implementation Date, Admissions, and Enrollment

- **Any projected change in the proposed implementation date for the program?**
  There are no changes to the proposed implementation date.

- **Will there be any adjustments needed in admission standards?**
  We may consider altering the admissions standards according to the general guidance from the Dean of the Graduate School. For instance, some standardized tests may be waived for near term admissions decisions given that taking such tests in Spring 2020 was compromised due to the COVID-19 pandemic.

- **Have enrollment projections shifted for the proposed program? If so, please provide an updated enrollment and graduation table and include an updated financial projections form.**
  The program is scheduled to launch in the Fall semester of 2020. We don't expect a negative impact on enrollment. On the contrary, we anticipate better enrollment than originally projected given the likely increase in Data Scientist job opportunities and the fact that most work tasks may be performed remotely from home if the pandemic situation persists.

Program Delivery

- **What is the current delivery mode of the proposed academic program?**
  The current delivery method is hybrid, with the 4 core courses being offered as online classes. However, the massive shift to online teaching in Spring of 2020 will accelerate the shift to online courses. We anticipate that all courses needed to graduate may be offered online in the next year – much sooner than we anticipated.

- **Are there plans to change the delivery mode for this program in light of the pandemic?**
  The university monitors the pandemic situation as well as student interest and will make decisions regarding online instruction and faculty will adjust course delivery modes accordingly.

- **What percentage of the curriculum is devoted to online delivery?**
  At the moment the curriculum is flexible and will differ for each student. It is not possible to determine what percentage of the curriculum will be delivered online in the Fall 2020 and Spring 2021. Some of the courses are offered online already. All the courses were delivered online for the second half of the Spring 2020 semester, which will make the transition to fully online much easier

in the future. Data Science faculty are among the most proficient at the University in on-line course delivery as well as "flipping" on the ground courses to on-line.

Staffing and Placements

- **What faculty and staff searches are planned prior to implementing the proposed program?**
  We plan to appoint and have in place a Program Director to start the program in August 2020.

- **Are any faculty and staff searches currently being advertised? If so, what is the anticipated hire date for these positions? Any challenges in hiring for these positions?**
  No

- **If applicable, are there any special considerations that will need to be made for student placements in clinical and/or internship settings?**
  NA

Fiscal

- **If applicable, are there any renovation and/or equipment purchases that have been affected by the pandemic?**
  NA

- **How equipped is the proposed program to endure any significant institutional budget cuts?**
  The program curriculum relies largely on existing courses and faculty and does not require a large budget allocation. The program is a high priority of the University and no significant budget cuts are anticipated.

Other

- Are there any additional changes/considerations for the proposed academic program due to the pandemic?
  No

Tennessee Higher Education Commission										
Appendix B: THEC Financial Projections Form										
University of Memphis										
Data Science, Master of Science										

Seven-year projections are required for doctoral programs.

Five-year projections are required for baccalaureate and Master's degree programs

Three-year projections are required for associate degrees and undergraduate certificates.

Projections should include cost of living increases per year.

Planning year projections are not required but should be included when appropriate.

	Year 1		Year 2		Year 3		Year 4		Year 5	
I. Expenditures										
A. One-time Expenditures										
New/Renovated Space[1]	$	-	$	-	$	140,000	$	-	$	-
Equipment	$	40,000	$	-	$	-	$	40,000	$	-
Library	$	-	$	-	$	-	$	-	$	-
Consultants	$	-	$	-	$	-	$	-	$	-
Travel	$	-	$	-	$	-	$	-	$	-
Other (faculty start-up)	$	-	$	-	$	100,000	$	100,000	$	-
Sub-Total One-time	$	**40,000**	$	**-**	$	**240,000**	$	**140,000**	$	**-**
B. Recurring Expenditures										
Personnel										
Administration										
Salary		35,000		36,500		37,132		38,245		39,393
Benefits		12,000		12,360		12,731		13,113		13,506
Sub-Total Administration	$	**47,000**	$	**48,860**	$	**49,863**	$	**51,358**	$	**52,899**
Faculty										
Salary	$	-	$	-	$	110,250	$	231,525	$	243,101
Benefits	$	-	$	-	$	38,918	$	40,864	$	85,814
Sub-Total Faculty	$	**-**	$	**-**	$	**149,168**	$	**272,389**	$	**328,915**
Support Staff										
Salary	$	50,000	$	51,140	$	53,046	$	54,636	$	56,276
Benefits	$	20,000	$	20,600	$	21,218	$	21,854	$	22,510
Sub-Total Support Staff	$	**70,000**	$	**71,740**	$	**74,264**	$	**76,490**	$	**78,786**
Graduate Assistants										
Salary	$	81,000	$	83,430	$	85,933	$	88,511	$	91,166
Benefits	$	1,539	$	1,585	$	1,632	$	1,681	$	1,732
Tuition and Fees* (See Below)	$	44,040	$	44,040	$	44,040	$	44,040	$	44,040
Sub-Total Graduate Assistants	$	**126,579**	$	**129,055**	$	**131,605**	$	**134,232**	$	**136,938**
Operating										
Travel	$	7,500	$	7,725	$	7,957	$	8,195	$	8,441
Printing	$	-	$	-	$	-	$	-	$	-
Equipment	$	-	$	-	$	-	$	-	$	-
Other		45,000		35,000		35,000		30,000		30,000
Sub-Total Operating	$	**52,500**	$	**42,725**	$	**42,957**	$	**38,195**	$	**38,441**
Total Recurring	$	**296,079**	$	**292,380**	$	**447,857**	$	**572,664**	$	**635,979**
TOTAL EXPENDITURES (A + B)	$	**336,079**	$	**292,380**	$	**687,857**	$	**712,664**	$	**635,979**

Base Tuition and Fees Rate	$ 7,340.00	$ 7,340.00	$ 7,340.00	$ 7,340.00	$ 7,340.00
Number of Graduate Assistants	6	6	6	6	6

	Year 1	Year 2	Year 3	Year 4	Year 5
II. Revenue					
Tuition and Fees[2]	440,400	660,600	880,800	880,800	880,800
Institutional Reallocations[3]	$ (159,321)	$ (383,220)	$ (207,943)	$ (223,136)	$ (259,821)
Federal Grants[4]	$ -	$ -	$ -	$ -	$ -
Private Grants or Gifts[5]	55,000	15,000	15,000	55,000	15,000
Other[6]	$ -	$ -	$ -	$ -	$ -
BALANCED BUDGET LINE	$ 336,079	$ 292,380	$ 687,857	$ 712,664	$ 635,979

Notes:

(1) Provide the funding source(s) for the new or renovated space.

Funding from University capital maintenance funds and expected private gifts under discussion.

(2) In what year is tuition and fee revenue expected to be generated? Tuition and fees include maintenance fees, out-of-state tuition, and any applicable earmarked fees for the program. Explain any differential fees.

Tuition will be generated by 20 full-time and 20 part-time students in the first year, 30 full-time and 30 part-time in the second year, and 40 full-time and 40 part-time in the remaining years. There are no additional fees associated with the program.

(3) Identify the source(s) of the institutional reallocations, and grant matching requirements if applicable.

Year 1 reallocations are from College of Arts and Sciences interdepartmental transfers. These reallocations are needed to balance the budget in Year 1. The program is expected to generate net positive revenues in year 2 and later.

(4) Provide the source(s) of the Federal Grant including the granting department and CFDA(Catalog of Federal Domestic Assistance) number.

Not expected at this time for the first 5 years.

(5) Provide the name of the organization(s) or individual(s) providing grant(s) or gift(s).

Based on prior donations, the expectation is to solicit support from advisory board companies to ask computer makers and other local businesses to donate equipment.

(6) Provide information regarding other sources of the funding.

None expected at this time.