From:	Vankeerbergen, Bernadette
To:	Smith, Randy; Reed, Katie
Cc:	Jenkins, Mary Ellen; Crocetta, Alison; Horn, David
Subject:	Proposal to Revise the Biomedical Informatics Specialization in the Data Analytics BS
Date:	Friday, February 14, 2020 3:48:00 PM
Attachments:	BPHAS_Proposal_Feb 14-2020.pdf image001.png ExistingDAMajorAndSpecializations.pdf NMS Panel letter-Revisioin Biomedical Informatics Specialization in the Data Analytics BS.pdf

Dear Randy and Katie,

Please find attached a proposal to revise the Biomedical Informatics Specialization in the Data Analytics BS. The changes were approved this morning by the ASC Curriculum Committee (ASCC).

We are now advancing the proposal for review by CAA. The attached documents are (1) the actual proposal, (2) a copy of the current advising sheets for all specializations in the major for reference, and (3) the Natural and Mathematical Sciences Panel cover letter to ASCC.

Please use this email as a cover letter indicating that the proposal has been duly reviewed and approved by the appropriate ASC curricular bodies (including the full ASC Curriculum Committee).

Please let me know if you have any questions.

Best regards,
Bernadette

THE OHIO STATE UNIVERSITY

Bernadette Vankeerbergen, Ph.D.
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THE OHIO STATE UNIVERSITY

Data Analytics Major
College of Arts and Sciences

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January 17, 2020
(rev. February 3, 2020)

College of Arts and Sciences Curriculum Committee

Dear Committee Members:

We request that the College of Arts and Sciences Curriculum Committee approve a revision to an existing specialization in the undergraduate Data Analytics major.

We propose to change the name of the *Biomedical Informatics* specialization to *Biomedical and Public Health Analytics*, to revise the learning outcomes for the specialization to be inclusive of analytics concepts, knowledge and skills from a broader range of perspectives than exists currently in the specialization, and to revise the curriculum to enable students to meet the revised objectives. The proposed revision will reduce the number of required credit hours in the specialization to provide a closer match to other existing specializations, which should make the specialization more attractive to students. Finally, the revised curriculum will introduce the College of Public Health as a new partner in the undergraduate Data Analytics major program.

As part of our regular assessment efforts, the Management Committee of the undergraduate Data Analytics major reviews the major's core curriculum as well as the curricula for our five existing specializations. This assessment process revealed that students were facing challenges navigating some aspects of the existing curriculum. This was due to both a limited number of course options in the specialization and limited availability to offer all courses on a regular schedule. The proposed revisions to the specialization will remove these challenges and at the same time expand the range of health-related analytics concepts to which students in the specialization are exposed.

The following documents are enclosed under this cover:

1. *Proposed Modified Specialization for the Existing BS Degree – Data Analytics Major: Biomedical and Public Health Analytics Specialization*
    a. Rationale for proposed revisions
    b. Specialization educational objectives
    c. Proposed specialization curriculum
    d. Curriculum maps
2. *Curriculum sheet* (for students)
    a. Information about pre-requisite, core, specialization and general education requirements for students under the revised specialization
3. *Suggested four-year sample plan* (for students)
    a. Outline of a four-year pathway to graduation for students under the revised specialization
4. *Transition plan for students currently in the BMI specialization*
5. *Curriculum sheet and suggested four-year sample plan for **current** Biomedical Informatics Specialization*

Details about the proposed revisions can be found in the documents referenced above. A summary of the impact of the changes on the number of required credit hours for students completing the specialization are as follows:

- **Prerequisite credit hours:** The current specialization requires **13** credit hours of specialization-specific prerequisites. The revised specialization will require only **9** such credit hours. All prerequisites, with the exception of CSE 1223, satisfy General Education requirements.

- **Specialization credit hours:** The current specialization requires students to complete **21** credit hours in the specialization. Students will be able to complete the revised specialization with as few as **15** required credit hours.

Under the revised curriculum, students will be able to complete the specialization by taking as few as **131** credit hours, compared with **138** credit hours under the existing specialization, while at the same time being exposed to a wider range of ideas and concepts. We believe these changes will make the specialization more attractive to and beneficial for students.

The College of Public Health and the Department of Biomedical Informatics plan to design jointly a new course to satisfy the major's capstone requirement for students in the revised specialization. This course is labeled as "BMI 5899 / PUBH 5899: Capstone in Biomedical and Public Health Analytics" in the proposal and accompanying advising sheets. Until that course has been developed and approved, students in the specialization will continue to take "Stat 4911: Data Analytics Capstone" to satisfy the requirement.

No changes to the major's assessment plan will be required as a result of this proposal, though its implementation will be adapted to reflect the revised outcomes and the new courses. Our assessment plan calls for the use of direct and indirect measures to assess both the core educational outcomes and the outcomes that are specific to each specialization. We currently use the University's exit survey and a focus group consisting of our Academic Path Peers to obtain indirect measures; this process will remain unchanged under the revised curriculum. Direct measures are sourced from course embedded testing using goal-specific rubrics and evaluation of capstone projects, reports and presentations. The assessment plan calls for annual assessment of the core outcomes and a year-by-year assessment rotation through the specialization outcomes. While an ongoing review of the BMI specialization led to these proposed curricular revisions, we not yet formally reported assessment data on the existing specialization outcomes due to both small initial enrollments and the limited number of offerings of existing specialization courses. Following implementation of the proposed revisions, we will begin to collect direct measurements on the revised outcomes according to our existing protocol. Assessment data will be reported per the rotating schedule after students have started to graduate under the revised specialization curriculum.

Our transition plan for students who are already in the existing specialization is to allow them to complete the specialization under the revised (smaller) number of required credit hours while using the courses they have already completed toward this end. Details for this plan can be found in the attached documents.

The proposed revisions were developed jointly by the Data Analytics major's Management Committee, the Department of Biomedical Informatics in the College of Medicine, and the College of Public Health, and were presented to and discussed with the major's Steering Committee on September 26, 2019.

Please feel free to contact us with any questions or concerns about this proposed revision to the major.

Sincerely,

THE OHIO STATE UNIVERSITY

Dr. Christopher Hans
Associate Professor, Statistics
Co-director of the Data Analytics Major

Dr. Srinivasan Parthasarathy
Professor of Computer Science and Engineering
Co-director of the Data Analytics Major

Proposed Modified Specialization for the Existing BS Degree - Data Analytics Major:
Biomedical and Public Health Analytics
Modified Submission – December 6, 2019

Introduction

There is interest and demand for integrating more health-related content into the curriculum for the BS degree Data Analytics major. Currently, the most compatible specialization is *Biomedical Informatics*. Representatives from the College of Public Health and the College of Medicine – Department of Biomedical Informatics met with representatives from the respective curriculum committees for the interdisciplinary BS degree Data Analytics major. Discussions focused on combining relevant public health content/courses with a select subset of courses under the current *Biomedical Informatics* specialization to develop the modified specialization in *Biomedical and Public Health Analytics*.

The curriculum for the proposed modified and hybridized specialization in *Biomedical and Public Health Analytics* was established in alignment with educational objectives established for the specialization. These educational objectives represent competencies, or what students are expected to know and be able to do upon completion of the BS degree Data Analytics specialization in *Biomedical and Public Health Analytics*. The curriculum consists of a combination of courses that include foundational content (9-10 credits) delivered via three courses. Additional basic and applied content is attained via an additional selected elective (2-3 credits) plus a capstone experience (4 credits).

This is a unique combination of content area. Indeed, students completing the major with this specialization will be able to gather, review, organize, calculate and interpret more comprehensive complementary and compatible data applicable to both clinical health care and population-based public health practice. They will be qualified for applicable data analytics positions at agencies and organizations engaged in health care delivery, insurance, public health, and human resources.

The modified specialization will require a preferred 15-17 credits compared with the current 21 credit BMI specialization. The existing core educational objectives for the Data Analytics major plus the educational objectives (competencies) for the proposed modified specialization follow.

Core Educational Objectives for the BS Degree Major in Data Analytics

(https://data-analytics.osu.edu/major/core-curriculum)

A student graduating with a Bachelor of Science degree with a major in Data Analytics will demonstrate:

1. an understanding of and ability to apply computer science principles relating to data representation, retrieval, programming, and analysis.
2. an understanding of and ability to apply mathematical and statistical models and concepts to detect patterns in data, and to draw inferences and conclusions supported by data.
3. critical thinking skills associated with problem identification, problem solving and decision making, assessing value propositions supported by data, and generating a logical synthesis of information from data.
4. the ability to apply knowledge gained from one area to problems and data in another.
5. the ability to communicate findings and their implications, and to apply them effectively in organizational settings.

Specialization Educational Objectives (Competencies) Proposed for *Biomedical and Public Health Analytics*

In addition to the Core Educational Objectives for the BS degree – Data Analytics major, students graduating with a specialization in *Biomedical and Public Health Analytics* will be able to:

1. demonstrate an understanding of the core sub-disciplines of biomedical informatics and public health that play a role in the design, implementation, and management of clinical, research, and translational information systems.
2. describe the contributing theoretical frameworks that are conventionally used to inform the design and use of biological data, medical information systems, and integrative data discovery and analysis tools.
3. apply critical evaluation skills that allow for the analysis of system design, interpretation and utilization of biomedical and public health information systems and data.

Proposed Curriculum for the *Biomedical and Public Health Analytics* Specialization (15-17 Credits)

Required Courses (9 to 10 Credits):

- **MolGen 4500** General Genetics (3 cr) or **4606** Molecular Genetics (4 cr)
- **BMI 5710** Introduction to Biomedical Informatics (3 cr)
- **PUBHLTH 5015** Public Health Data Analytics I (3 cr)

Elective Courses (Select One; 2 to 3 Credits):

- **BMI 5720** Introduction Imaging Informatics (3 cr)
- **BMI 5730** Introduction Bioinformatics (3 cr)
- **BMI 5740** Introduction Research Informatics (3 cr)
- **BMI 5750** Methods in Biomedical Informatics (3 cr)
- **BMI 5760** Public Health Informatics (3 cr)
- **BMI 5770** Health Analytics: Data to Discovery to Dissemination (3 cr)
- **PUBHEPI 5420** Infectious Disease Modeling in Humans and Animals (3 cr)
- **PUBHBIO 5280** Introduction to Genomic Data Analysis (2 cr)
- **PUBHEPI 5421** Mathematics of Infectious Disease Dynamics(3 cr)
- **GEOG 5226** Spatial Simulation and Modeling in GIS (3 cr)

Capstone Experience (4 Credits):

- **BMI 5899/PUBH 5899** Capstone in Biomedical and Public Health Analytics (4 cr)*

* BMI 5899/PUBH 5899 is expected to be designed in the near future. Until this course has been designed and approved, students in the specialization will continue to take STAT 4911 Data Analytics Capstone to satisfy the major's capstone requirement.

(Please Continue to Next Page)

Table 1. Map of Proposed Curriculum (15-17 credits) for the *Biomedical and Public Health Analytics* Specialization vs. the Major Competencies:

BS Degree *Data Analytics* Major Competencies	Foundation Courses (9-10 credits)			Elective Courses (select one) (2-3 credits)								Capstone (4 credits)
	MolGen 4500 or 4606	BMI 5710	PUBHLTH 5015	BMI 5720	BMI 5730	BMI 5740	BMI 5760	PUBHEPI 5420	PUBHBIO 5280	PUBHEPI 5421	GEOG 5226	BMI 5899/ PUBH 5899
1. an understanding of and ability to apply computer science principles relating to data representation, retrieval, programming, and analysis.		X	X	X	X	X	X					X
2. an understanding of and ability to apply mathematical and statistical models and concepts to detect patterns in data, and to draw inferences and conclusions supported by data.		X	X	X	X	X	X	X	X	X		X
3. critical thinking skills associated with problem identification, problem solving and decision making, assessing value propositions supported by data, and generating a logical synthesis of information from data.		X	X	X	X	X	X	X	X	X		X
4. the ability to apply knowledge gained from one area to problems and data in another.		X	X	X	X	X	X	X	X	X	X	X
5. the ability to communicate findings and their implications, and to apply them effectively in organizational settings.		X	X	X	X	X	X	X	X	X	X	X

Table 2. Map of Proposed Curriculum (15-17 credits) for the *Biomedical and Public Health Analytics* Specialization vs. the Specialization Competencies:

Biomedical and Public Health Analytics **Specialization Competencies**	**Foundation Courses (9-10 credits)**			**Elective Courses (select one) (2-3 credits)**								**Capstone (4 credits)**
	MolGen 4500 or 4606	**BMI 5710**	**PUBHLTH 5015**	**BMI 5720**	**BMI 5730**	**BMI 5740**	**BMI 5760**	**PUBHEPI 5420**	**PUBHBIO 5280**	**PUBHEPI 5421**	**GEOG 5226**	**BMI 5899/ PUBH 5899**
1. Demonstrate an understanding of the core sub-disciplines of biomedical informatics and public health that play a role in the design, implementation, and management of clinical, research, and translational information systems.		**X**	**X**									
2. Describe the contributing theoretical frameworks that are conventionally used to inform the design and use of biological data, medical information systems, and integrative data discovery and analysis tools.	**X**	**X**	**X**									
3. Apply critical evaluation skills that allow for the analysis of system design, interpretation and utilization of biomedical and public health information systems and data.				**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**

BACHELOR OF SCIENCE (BS) DATA ANALYTICS:
BIOMEDICAL AND PUBLIC HEALTH ANALYTICS SPECIALIZATION

Major Prerequisites (22 hours)

These courses may overlap with the General Education curriculum where appropriate. Courses in **BOLD** should be completed before submitting an application to the Data Analytics major. Online options may be available for courses marked ●. Please refer to the ASC General Education course list for GE online courses.

Department	Course	Hours	Term Offered
Math	**Math 1151** ● (1161 or 1181H) – Calculus I	5	AU/SP/SU
	Math 1152 ● (1172, 2162 or 2182H) – Calculus II	5	AU/SP/SU
Computer Science & Engineering	***CSE 1223** – Computer Programming in Java	3	AU/SP/SU
Chemistry	CHEM 1110 ●/1210/1250/1610 – Chemistry I	5	AU/SP/SU
Biology	BIO 1113 – Energy Transfer and Development	4	AU/SP/SU

*CSE 1222 or CSE placement level A can also fulfill this prerequisite; however, 1223 is *strongly* preferred.

Core Requirements (51 hours)

The Data Analytics Core courses follow a strict pre-requisite structure. Some courses are only offered once per year. Failure to successfully enroll in and complete these courses will delay graduation.

Department	Course	Hours	Terms Offered
Math	Math 2568 ● – Linear Algebra	3	AU/SP/SU
Industrial & Systems Engineering	ISE 3230 – Systems Modeling and Optimization	3	AU
Computer Science & Engineering	**CSE 2221** – Software I: Software Components	4	AU/SP/SU
	CSE 2231 – Software II: Development & Design	4	AU/SP/SU
	CSE 2321 – Foundations I: Discrete Structures	3	AU/SP/SU
	CSE 2421 or 3430 – Systems I: Computer Systems	4	AU/SP/SU
	CSE 3241 – Databases I: Computer Architecture	3	AU/SP/SU
	CSE 3244 or 5242 – Adv. DB & Cloud Computing	3	AU/SP
	CSE 5243 – Data Mining	3	AU/SP
	CSE 5544 or ISE 5760 – Data Visualization	3	AU/SP
Statistics	STAT 3201 – Probability for Data Analytics	3	AU/SP
	STAT 3202 – Statistical Inference for Data Analytics	4	AU/SP
	STAT 3301 – Statistical Modeling for Discovery I	3	AU
	STAT 3302 – Statistical Modeling for Discovery II	3	SP
	STAT 4620 – Statistical Learning	2	AU
	STAT 3303 – Statistical Decision Making	3	SP

Biomedical and Public Health Analytics Specialization (15-17 hours)

MolGen 4500 or 4606 – Molecular Genetics	3-4	AU/SP/SU
BMI 5710 ● – Introduction to Biomedical Informatics	3	AU
PUBHLTH 5015 – Public Health Data Analytics	3	AU
Biomedical and Public Health elective – Choose one course from back of sheet	2-3	AU/SP
BMI 5899/PUBHLTH 5899/STAT 4911 – Capstone in Data Analytics **(SP Senior year)**	4	SP

GENERAL EDUCATION

Please visit http://artsandsciences.osu.edu/academics/current-students/advising/ge for a list of the General Education curriculum requirements.

BACHELOR OF SCIENCE (BS) DATA ANALYTICS:
BIOMEDICAL AND PUBLIC HEALTH ANALYTICS SPECIALIZATION

ELECTIVES: BIOMEDICAL INFORMATICS AND PUBLIC HEALTH ANALYTICS			
COURSE	**TITLE**	**HOURS**	**PREREQUISITES**
Choose **one** of the following:			
BMI 5720	Intro to Imaging Informatics	3	None
BMI 5730	Intro to Bioinformatics	3	None
BMI 5740	Intro to Research Informatics	3	None
BMI 5750 ●	Methods in Biomedical Informatics	3	Basic knowledge of computer science principles, statistical methods, and medical terminology
BMI 5760 ●	Public Health Informatics	3	None
BMI 5770	Health Analytics: Data to Discovery to Dissemination	3	None
PUBHEPI 5420	Modeling Infectious Disease in Humans and Animals	3	Junior standing or above
PUBHBIO 5280	Intro to Genomic Data Analysis	2	Junior standing or above, Math 1151 or 1156, Stat 2450 or higher, Biology 1113 or MolGen 5660
PUBHEPI 5421	Mathematics of Infectious Disease Dynamics	3	Math 1152 or 1172
GEOG 5226	Spatial Simulation and Modeling	3	None

BACHELOR OF SCIENCE (BS) DATA ANALYTICS:
BIOMEDICAL AND PUBLIC HEALTH ANALYTICS SPECIALIZATION

Suggested Curriculum – 4 Year Degree Plan

This should be used as a **guide** only. Semester offerings are subject to change. Students should meet with the Data Analytics academic advisor every semester to ensure an on time graduation.

Year	Autumn		Spring	
	Course	**Hrs.**	**Course**	**Hrs.**
1	ASC 1100.xx	1	Math 1152 or 2162 or 1172 or 2182H**	5
	Math 1151 or 1161 or 1181H	5	CSE 2221	4
	CSE 1223 or equiv	3	GE Foreign Language 1	4
	CHEM 1110 or 1210 (GE Phys Sci)	5	BIO 1113 (GE Bio Sci)	4
	GE Writing Level I	3		
	Total:	**17**	**Total:**	**17**
2	CSE 2231	4	Math 2568	3
	CSE 2321	3	CSE 2421 or 3430	4
	STAT 3201	3	STAT 3202	4
	GE Foreign Language 2	4	GE Writing Level 2	3
	MOLGEN 4500 or 4606	3-4	GE Foreign Language 3	4
	Total:	**17-18**	**Total:**	**18**
3	ISE 3230	3	CSE 5544 **or** ISE 5760	3
	CSE 3241	3	STAT 3302	3
	STAT 3301	3	GE Historical Study	3
	BMI 5710***	3	GE Open Option*	3
	GE Literature	3	GE Visual and Performing Arts	3
	Total:	**15**	**Total:**	**15**
4	CSE 5243	3	CSE 3244	3
	STAT 4620	2	STAT 3303	3
	PubHlth 5015***	3	BMI/PubHlth elective***	2-3
	GE Cult. & Ideas or 2nd Historical Study	3	STAT 4911 Capstone	4
	GE Social Science	3	GE Social Science	3
	GE Natural Science	3		
	Total:	**17**	**Total:**	**15-16**

*Stat 2450 can be utilized as a GE Open Option course for students who do not have previous experience in Statistics; however, this course is not required. If a student has EM or dual enrollment K credit for Math 1151, it is recommended for them to enroll in STAT 2450 during their first semester.

**Math courses above the 1151 and 1161 levels complete one of the two GE Open Option courses for a B.S. degree in the College of the Arts and Sciences. Data Analytics students must take Math 1152 or 1172 or 2162 or 2182H as a prerequisite to Math 2568.

*** Most BMI and Public Health courses are offered only one semester per year. Careful planning is needed.

****This curriculum plan assumes overlap for the Social Diversity and Global Studies GE categories.

Total hours to complete the degree program = 131

Revised: 02/2020

Biomedical and Public Health Analytics Specialization
Transition Plan

Students who have already declared BMI as their specialization sub-plan ("transitioning students" below) will be allowed to complete the major under the revised (smaller) number of required credit hours while using any courses they have already completed in the existing specialization toward this end. Students who declare BPHA as their specialization sub-plan after the revisions are approved will take courses under the revised curriculum.

Transitioning students may count toward the MolGen requirement any MolGen course that was previously approved as part of the student's plan of study. Otherwise, students should take MolGen 4500 or 4606 under the new curriculum.

Transitioning students are required to take BMI 5710 and to fulfill the capstone requirement, as these are required under the both the existing and proposed curricula.

The proposed curriculum requires students to take PBHLTH 5015 plus one elective. Because PBHLTH 5015 is not required under the existing curriculum, transitioning students should instead take two elective courses from the list below. Students may opt to take PBHLTH 5015 as one of the elective courses. This will allow transitioning students to count all 5000-level BMI courses they have already taken toward the specialization requirements.

Biomedical and Public Health Analytics Specialization (15-17 hours)
Transition Curriculum

Any previously approved MolGen course, or MolGen 4500 or 4606 – Molecular Genetics	3-4	AU/SP/SU
BMI 5710 ● – Introduction to Biomedical Informatics	3	AU
Biomedical and Public Health electives – Choose two courses from the elective list below*.	5-6	AU/SP
BMI 5899/PUBHLTH 5899/STAT 4911 – Capstone in Data Analytics **(SP Senior year)**	4	SP

TRANSITION PLAN ELECTIVES: BIOMEDICAL INFORMATICS AND PUBLIC HEALTH ANALYTICS			
COURSE	**TITLE**	**HOURS**	**PREREQUISITES**
Choose **two** of the following:			
BMI 5720	Intro to Imaging Informatics	3	None
BMI 5730	Intro to Bioinformatics	3	None
BMI 5740	Intro to Research Informatics	3	None
BMI 5750 ●	Methods in Biomedical Informatics	3	Basic knowledge of computer science principles, statistical methods, and medical terminology
BMI 5760 ●	Public Health Informatics	3	None
BMI 5770	Health Analytics: Data to Discovery to Dissemination	3	None
PBHLTH 5015*	Public Health Data Analytics	3	PUBHBIO 2210 or 6210 or STAT 3202, 3470 or STAT 5301 or permission of instructor.
PUBHEPI 5420	Modeling Infectious Disease in Humans and Animals	3	Junior standing or above
PUBHBIO 5280	Intro to Genomic Data Analysis	2	Junior standing or above, Math 1151 or 1156, Stat 2450 or higher, Biology 1113 or MolGen 5660
PUBHEPI 5421	Mathematics of Infectious Disease Dynamics	3	Math 1152 or 1172
GEOG 5226	Spatial Simulation and Modeling	3	None

*Transitioning students may elect to take PBHLTH 5015, but it is not required.

Current BMI Specialization

BACHELOR OF SCIENCE (BS) DATA ANALYTICS: BIOMEDICAL INFORMATICS SPECIALIZATION

Major Prerequisites (26 hours)

These courses may overlap with the General Education curriculum where appropriate. Courses in **BOLD** should be completed before submitting an application to the Data Analytics major.

Department	Course	Hours	Term Offered
Math	**Math 1151** (1161 or 1181H) – Calculus I	5	AU/SP/SU
	Math 1152 (1172, 2162 or 2182H) – Calculus II	5	AU/SP/SU
Computer Science & Engineering	***CSE 1223** – Computer Programming in Java	3	AU/SP/SU
Chemistry	CHEM 1110/1210/1250/1610 – Chemistry I	5	AU/SP/SU
Biology	BIO 1113 – Energy Transfer and Development	4	AU/SP/SU
	BIO 1114 – Form, Function, Diversity, and Ecology	4	AU/SP/SU

*CSE 1222 or CSE placement level A can also fulfill this prerequisite; however, 1223 is *strongly* preferred.

Core Requirements (51 hours)

The Data Analytics Core courses follow a strict pre-requisite structure. Some courses are only offered once per year. Failure to successfully enroll in and complete these courses will delay graduation.

Department	Course	Hours	Terms Offered
Math	Math 2568 – Linear Algebra	3	AU/SP/SU
Industrial & Systems Engineering	ISE 3230 – Systems Modeling and Optimization	3	AU
Computer Science & Engineering	**CSE 2221** – Software I: Software Components	4	AU/SP/SU
	CSE 2231 – Software II: Development & Design	4	AU/SP/SU
	CSE 2321 – Foundations I: Discrete Structures	3	AU/SP/SU
	CSE 2421 or 3430 – Systems I: Computer Systems	4	AU/SP/SU
	CSE 3241 – Databases I: Computer Architecture	3	AU/SP/SU
	CSE 3244 or 5242 – Adv. DB & Cloud Computing	3	AU/SP
	CSE 5243 – Data Mining	3	AU/SP
	CSE 5544 or ISE 5760 – Data Visualization	3	AU/SP
Statistics	STAT 3201 – Probability for Data Analytics	3	AU/SP
	STAT 3202 – Statistical Inference for Data Analytics	4	AU/SP
	STAT 3301 – Statistical Modeling for Discovery I	3	AU
	STAT 3302 – Statistical Modeling for Discovery II	3	SP
	STAT 4620 – Statistical Learning	2	AU
	STAT 3303 – Statistical Decision Making	3	SP

Biomedical Informatics Specialization (21 hours)

MOLGEN 5660 – Molecular and Cellular Biology (MOLGEN 5650 & 4500 approved as alternates)	5
BMI 5710 – Intro to Biomedical Informatics	3
BMI 5720 – Intro to Imaging Informatics (any BMI 5000-level approved as alternate)	3
BMI 5730 – Intro to Bioinformatics	3
BMI 5740 – Intro to Research Informatics	3
STAT 4911 – Capstone in Data Analytics **(SP Senior year)**	4

GENERAL EDUCATION

Please visit http://artsandsciences.osu.edu/academics/current-students/advising/ge for a list of your General Education curriculum requirements.

Revised 03/2019

Current BMI Specialization

BACHELOR OF SCIENCE (BS) DATA ANALYTICS: BIOMEDICAL INFORMATICS SPECIALIZATION

Suggested Curriculum – 4 Year Degree Plan

This should be used as a **guide** only. Semester offerings are subject to change. Students should meet with the Data Analytics academic advisor every semester to ensure an on time graduation.

Year	Autumn		Spring	
	Course	**Hrs.**	**Course**	**Hrs.**
1	ASC 1100.xx	1	Math 1152 or 2162 or 1172 or 2182H**	5
	Math 1151 or 1161 or 1181H	5	CSE 2221	4
	CSE 1223 or equiv	3	GE Foreign Language 1	4
	Chemistry 1110 or 1210 (GE Phys Sci)	5	Biology 1113 (GE Bio Sci)	4
	GE Writing Level I	3		
	Total:	**17**	**Total:**	**17**
2	CSE 2231	4	Math 2568	3
	CSE 2321	3	CSE 2421 or 3430	4
	Stat 3201	3	Stat 3202	4
	GE Foreign Language 2	4	GE Writing Level 2	3
	Biology 1114 (GE Bio Sci)	4	GE Foreign Language 3	4
	Total:	**18**	**Total:**	**18**
3	ISE 3230	3	CSE 5544 **or** ISE 5760	3
	CSE 3241	3	Stat 3302	3
	Stat 3301	3	BMI 5730***	3
	BMI 5710***	3	GE Open Option*	3
	BMI 5720***	3	GE Visual and Performing Arts	3
	GE Historical Study	3	GE Literature	3
	Total:	**18**	**Total:**	**18**
4	CSE 5243	3	CSE 3244	3
	Stat 4620	2	Stat 3303	3
	MOLGEN 5660***	5	BMI 5740***	3
	GE Cult. & Ideas or 2nd Historical Study	3	STAT 4911 Capstone	4
	GE Social Science	3	GE Social Science	3
	Total:	**16**	**Total:**	**16**

*Stat 2450 can be utilized as a GE Open Option course for students who do not have previous experience in Statistics; however, this course is not required. If a student has EM or dual enrollment K credit for Math 1151, it is required for them to enroll in STAT 2450 during their first semester.

**Math courses above the 1151 and 1161 levels complete one of the two GE Open Option courses for a B.S. degree in the College of the Arts and Sciences. Data Analytics students must take Math 1152 or 1172 or 2162 or 2182H as a prerequisite to Math 2568.

*** Most BMI specialization courses are offered only one semester per year. Careful planning is needed.

****This curriculum plan assumes overlap for the Social Diversity and Global Studies GE categories.

Total hours to complete the degree program = 138

Version: 03/18/2019

BACHELOR OF SCIENCE (BS) DATA ANALYTICS: GENERIC SPECIALIZATION

Major Prerequisites (13-26 hours)

These courses may overlap with the General Education curriculum where appropriate. Courses in **BOLD** must be completed before submitting an application to the Data Analytics major.

Department	Course	Hours	Term
Math	**Math 1151** (1161 or 1181H) – Calculus I	5	AU/SP/SU
	Math 1152 (1172, 2162 or 2182H) – Calculus II	5	AU/SP/SU
Computer Science & Engineering	***CSE 1223** – Computer Programming in Java	3	AU/SP/SU
Specialization-specific prereqs	(See data-analytics.osu.edu for specific prereqs)	0-13	AU/SP/SU

*CSE 1222 or CSE placement level A can also fulfill this prerequisite; however, 1223 is *strongly* preferred.

Core Requirements (51 hours)

The Data Analytics Core courses follow a strict pre-requisite structure. Some courses are only offered once per year. Failure to successfully enroll in and complete these courses will delay graduation.

Department	Course	Hours	Term
Math	Math 2568 – Linear Algebra	3	AU/SP/SU
Industrial & Systems Engineering	ISE 3230 – Systems Modeling and Optimization	3	AU
Computer Science & Engineering	**CSE 2221** – Software I: Software Components	4	AU/SP/SU
	CSE 2231 – Software II: Development & Design	4	AU/SP/SU
	CSE 2321 – Foundations I: Discrete Structures	3	AU/SP/SU
	CSE 2421 or 3430 – Systems I: Computer Systems	4	AU/SP/SU
	CSE 3241 – Databases I: Computer Architecture	3	AU/SP/SU
	CSE 3244 or 5242 – Adv. DB & Cloud Computing	3	AU/SP
	CSE 5243 – Data Mining	3	AU/SP
	CSE 5544 or ISE 5760 – Data Visualization	3	AU/SP
Statistics	STAT 3201 – Probability for Data Analytics	3	AU/SP
	STAT 3202 – Statistical Inference for Data Analytics	4	AU/SP
	STAT 3301 – Statistical Modeling for Discovery I	3	AU
	STAT 3302 – Statistical Modeling for Discovery II	3	SP
	STAT 4620 – Statistical Learning	2	AU
	STAT 3303 – Statistical Decision Making	3	SP

Data Analytics Specialization (14-19 hours)

Specialization electives (See data-analytics.osu.edu for specialization specific requirements)	10-13
CSE 59xx/STAT 5xxx – Capstone in Data Analytics (Senior year)	4-6

GENERAL EDUCATION

Please visit http://artsandsciences.osu.edu/academics/current-students/advising/ge for a list of your GE curriculum requirements.

Revised 05/2018

BACHELOR OF SCIENCE (BS) DATA ANALYTICS: SAMPLE FOUR-YEAR DEGREE PLAN

This should be used as a **guide** only. Semester offerings are subject to change. Students should meet with the Data Analytics academic advisor every semester to ensure an on time graduation.

Year	Autumn		Spring	
	Course	**Hrs.**	**Course**	**Hrs.**
1	ASC 1100.xx	1	Math 1152 or 2162 or 1172 or 2182H**	5
	Math 1151 or 1161 or 1181H	5	CSE 2221	4
	CSE 1223 or equiv	3	GE Foreign Language 2	4
	GE Foreign Language 1	4	GE Open Option*	3
	GE Writing Level I	3		
	Total:	**16**	**Total:**	**16**
2	CSE 2231	4	Math 2568	3
	CSE 2321	3	CSE 2421 or 3430	4
	Stat 3201	3	Stat 3202	4
	GE Foreign Language 3	4	GE Writing Level 2	3
	GE Social Science	3	GE Cultures & Ideas	3
	Total:	**17**	**Total:**	**17**
3	ISE 3230	3	CSE 5544 **or** ISE 5760	3
	CSE 3241	3	Stat 3302	3
	Stat 3301	3	Specialization Elective***	4
	GE Natural Science	3	GE Historical Study	3
	GE Visual and Performing Arts	3	GE Biological Science (lab)	4
	Total:	**15**	**Total:**	**17**
4	CSE 5243	3	CSE 3244	3
	Stat 4620	2	Stat 3303	3
	Specialization Elective***	3	Specialization Elective***	3
	Specialization Elective***	3	CSE 59xx/Stat 5xxx Capstone course	4
	GE Social Science	3	GE Literature	3
	GE Physical Science (lab)	4		
	Total:	**18**	**Total:**	**16**

*Stat 2450 can be utilized as a GE Open Option course for students who do not have previous experience in Statistics; however, this course is not required. If a student has EM or dual enrollment K credit for Math 1151, it is required for them to enroll in STAT 2450 during their first semester.

**Math courses above the 1151 and 1161 levels complete one of the two GE Open Option courses for a B.S. degree in the College of the Arts and Sciences. Data Analytics students must take Math 1152 or 1172 or 2162 or 2182H as a prerequisite to Math 2568.

*** From approved list of major specialization elective courses

****This curriculum plan assumes overlap for the Social Diversity and Global Studies GE categories.

Total hours to complete the degree program = 132

BACHELOR OF SCIENCE (BS) DATA ANALYTICS: BIOMEDICAL INFORMATICS SPECIALIZATION

Major Prerequisites (26 hours)

These courses may overlap with the General Education curriculum where appropriate. Courses in **BOLD** should be completed before submitting an application to the Data Analytics major.

Department	Course	Hours	Term Offered
Math	**Math 1151** (1161 or 1181H) – Calculus I	5	AU/SP/SU
	Math 1152 (1172, 2162 or 2182H) – Calculus II	5	AU/SP/SU
Computer Science & Engineering	***CSE 1223** – Computer Programming in Java	3	AU/SP/SU
Chemistry	CHEM 1110/1210/1250/1610 – Chemistry I	5	AU/SP/SU
Biology	BIO 1113 – Energy Transfer and Development	4	AU/SP/SU
	BIO 1114 – Form, Function, Diversity, and Ecology	4	AU/SP/SU

*CSE 1222 or CSE placement level A can also fulfill this prerequisite; however, 1223 is *strongly* preferred.

Core Requirements (51 hours)

The Data Analytics Core courses follow a strict pre-requisite structure. Some courses are only offered once per year. Failure to successfully enroll in and complete these courses will delay graduation.

Department	Course	Hours	Terms Offered
Math	Math 2568 – Linear Algebra	3	AU/SP/SU
Industrial & Systems Engineering	ISE 3230 – Systems Modeling and Optimization	3	AU
Computer Science & Engineering	**CSE 2221** – Software I: Software Components	4	AU/SP/SU
	CSE 2231 – Software II: Development & Design	4	AU/SP/SU
	CSE 2321 – Foundations I: Discrete Structures	3	AU/SP/SU
	CSE 2421 or 3430 – Systems I: Computer Systems	4	AU/SP/SU
	CSE 3241 – Databases I: Computer Architecture	3	AU/SP/SU
	CSE 3244 or 5242 – Adv. DB & Cloud Computing	3	AU/SP
	CSE 5243 – Data Mining	3	AU/SP
	CSE 5544 or ISE 5760 – Data Visualization	3	AU/SP
Statistics	STAT 3201 – Probability for Data Analytics	3	AU/SP
	STAT 3202 – Statistical Inference for Data Analytics	4	AU/SP
	STAT 3301 – Statistical Modeling for Discovery I	3	AU
	STAT 3302 – Statistical Modeling for Discovery II	3	SP
	STAT 4620 – Statistical Learning	2	AU
	STAT 3303 – Statistical Decision Making	3	SP

Biomedical Informatics Specialization (21 hours)

MOLGEN 5660 – Molecular and Cellular Biology (MOLGEN 5650 & 4500 approved as alternates)	5
BMI 5710 – Intro to Biomedical Informatics	3
BMI 5720 – Intro to Imaging Informatics (any BMI 5000-level approved as alternate)	3
BMI 5730 – Intro to Bioinformatics	3
BMI 5740 – Intro to Research Informatics	3
STAT 4911 – Capstone in Data Analytics **(SP Senior year)**	4

GENERAL EDUCATION

Please visit http://artsandsciences.osu.edu/academics/current-students/advising/ge for a list of your General Education curriculum requirements.

BACHELOR OF SCIENCE (BS) DATA ANALYTICS: BIOMEDICAL INFORMATICS SPECIALIZATION

Suggested Curriculum – 4 Year Degree Plan

This should be used as a **guide** only. Semester offerings are subject to change. Students should meet with the Data Analytics academic advisor every semester to ensure an on time graduation.

Year	Autumn		Spring	
	Course	**Hrs.**	**Course**	**Hrs.**
1	ASC 1100.xx	1	Math 1152 or 2162 or 1172 or 2182H**	5
	Math 1151 or 1161 or 1181H	5	CSE 2221	4
	CSE 1223 or equiv	3	GE Foreign Language 1	4
	Chemistry 1110 or 1210 (GE Phys Sci)	5	Biology 1113 (GE Bio Sci)	4
	GE Writing Level I	3		
	Total:	**17**	**Total:**	**17**
2	CSE 2231	4	Math 2568	3
	CSE 2321	3	CSE 2421 or 3430	4
	Stat 3201	3	Stat 3202	4
	GE Foreign Language 2	4	GE Writing Level 2	3
	Biology 1114 (GE Bio Sci)	4	GE Foreign Language 3	4
	Total:	**18**	**Total:**	**18**
3	ISE 3230	3	CSE 5544 **or** ISE 5760	3
	CSE 3241	3	Stat 3302	3
	Stat 3301	3	BMI 5730***	3
	BMI 5710***	3	GE Open Option*	3
	BMI 5720***	3	GE Visual and Performing Arts	3
	GE Historical Study	3	GE Literature	3
	Total:	**18**	**Total:**	**18**
4	CSE 5243	3	CSE 3244	3
	Stat 4620	2	Stat 3303	3
	MOLGEN 5660***	5	BMI 5740***	3
	GE Cult. & Ideas or 2nd Historical Study	3	STAT 4911 Capstone	4
	GE Social Science	3	GE Social Science	3
	Total:	**16**	**Total:**	**16**

*Stat 2450 can be utilized as a GE Open Option course for students who do not have previous experience in Statistics; however, this course is not required. If a student has EM or dual enrollment K credit for Math 1151, it is required for them to enroll in STAT 2450 during their first semester.

**Math courses above the 1151 and 1161 levels complete one of the two GE Open Option courses for a B.S. degree in the College of the Arts and Sciences. Data Analytics students must take Math 1152 or 1172 or 2162 or 2182H as a prerequisite to Math 2568.

*** Most BMI specialization courses are offered only one semester per year. Careful planning is needed.

****This curriculum plan assumes overlap for the Social Diversity and Global Studies GE categories.

Total hours to complete the degree program = 138

Version: 03/18/2019

BACHELOR OF SCIENCE (BS) DATA ANALYTICS: BUSINESS ANALYTICS SPECIALIZATION

Major Prerequisites (19 hours)

These courses may overlap with the General Education curriculum where appropriate. Courses in **BOLD** should be completed before submitting an application to the Data Analytics major.

Department	Course	Hours	Term Offered
Math	**Math 1151** (1161 or 1181H) – Calculus I	5	AU/SP/SU
	Math 1152 (1172, 2162 or 2182H) – Calculus II	5	AU/SP/SU
Computer Science & Engineering	***CSE 1223** – Computer Programming in Java	3	AU/SP/SU
Economics	ECON 2001.xx – Principles of Microeconomics	3	AU/SP/SU
	ECON 2002.xx – Principles of Macroeconomics	3	AU/SP/SU

*CSE 1222 or CSE placement level A can also fulfill this prerequisite; however, 1223 is *strongly* preferred.

Core Requirements (51 hours)

The Data Analytics Core courses follow a strict pre-requisite structure. Some courses are only offered once per year. Failure to successfully enroll in and complete these courses will delay graduation.

Department	Course	Hours	Terms Offered
Math	Math 2568 – Linear Algebra	3	AU/SP/SU
Industrial & Systems Engineering	ISE 3230 – Systems Modeling and Optimization	3	AU
Computer Science & Engineering	**CSE 2221** – Software I: Software Components	4	AU/SP/SU
	CSE 2231 – Software II: Development & Design	4	AU/SP/SU
	CSE 2321 – Foundations I: Discrete Structures	3	AU/SP/SU
	CSE 2421 or 3430 – Systems I: Computer Systems	4	AU/SP/SU
	CSE 3241 – Databases I: Computer Architecture	3	AU/SP/SU
	CSE 3244 or 5242 – Adv. DB & Cloud Computing	3	AU/SP
	CSE 5243 – Data Mining	3	AU/SP
	CSE 5544 or ISE 5760 – Data Visualization	3	AU/SP
Statistics	STAT 3201 – Probability for Data Analytics	3	AU/SP
	STAT 3202 – Statistical Inference for Data Analytics	4	AU/SP
	STAT 3301 – Statistical Modeling for Discovery I	3	AU
	STAT 3302 – Statistical Modeling for Discovery II	3	SP
	STAT 4620 – Statistical Learning	2	AU
	STAT 3303 – Statistical Decision Making	3	SP

Business Analytics Specialization (15 hours)

BUSADM 3630.05 – Business Analytics Immersion Course **(Taken AU of Junior year)**	3
BUSADM 3632.05 – Business Analytics Immersion Project Experience **(Taken SP of Junior year)**	3
Business electives – Choose 9 hours from back of sheet	9

GENERAL EDUCATION

Please visit http://artsandsciences.osu.edu/academics/current-students/advising/ge for a list of your General Education curriculum requirements.

BACHELOR OF SCIENCE (BS) DATA ANALYTICS: BUSINESS ANALYTICS SPECIALIZATION

Students in the Business Analytics Track must take an **additional 9 credit hours** of coursework from the electives listed below. Courses are grouped to show possible focus areas, but students may select any combination of courses to meet the 9 credit hour requirement. Some courses require extensive pre-requisites for enrollment. **The prerequisite structure for the Data Analytics Major is strictly enforced.**

ELECTIVES: FINANCE FOCUS			
COURSE	**TITLE**	**HOURS**	**PREREQUISITES**
BUSFIN 3120	Foundations of Finance	3	ACCT 2000 & ECON 2001 & MATH 1130 or higher & CSE 1100 or higher; not open to students with credit for 3220
BUSFIN 3220	Business Finance	3	ECON 2001 & 2002 & ACCT 2300 (prereq or concur); not open to students with credit for 3120
BUSFIN 3222	Foundations of Investments	3	BUSFIN 3120 or 3220 & ACCT 2000
BUSFIN 3250	International Finance	3	BUSFIN 3120 or 3220 & ACCT 2000
BUSFIN 4201	Financial Data	1.5	BUSFIN 3220 & ACCT 2300 & STAT 3201 & 3202

ELECTIVES: ACCOUNTING FOCUS			
COURSE	**TITLE**	**HOURS**	**PREREQUISITES**
ACCTMIS 2000	Foundations of Accounting	3	None
ACCTMIS 3600	Intro to Accounting Information Systems	3	ACCT 3200 (Which requires ECON 2001 & ACCT 2300 & STAT 3201 & 3202)
ACCTMIS 4210	Financial Accounting	3	ACCT 3201 (Which requires ACCT 3200)
ACCTMIS 4310	Management Accounting	3	ACCT 3300 (Which requires ECON 2001 & ACCT 2300 & STAT 3201 & 3202)
ACCTMIS 4650	Decision Support and Expert Systems	3	CSE 3232 & STAT 3201 & 3202
ACCTMIS 5000	Accounting and Cost Analysis	3	ISE 2000 & 2040

ELECTIVES: CUSTOMER INSIGHT FOCUS			
COURSE	**TITLE**	**HOURS**	**PREREQUISITES**
BUSML 3150	Foundations of Marketing	3	ECON 2001; not open to students with credit for 3250
BUSML 3250	Principles of Marketing	3	ECON 2001 & 2002; not open to students with credit for 3150
BUSML 4202	Marketing Research	3	BUSML 3250 & STAT 3201 & 3202
BUSML 4210	Advanced Market Research	1.5	BUSML 4201 & 4202
BUSML 4211	Market Analysis, Development, and Forecasting	1.5	BUSML 4201 & 4202
BUSML 4212	Customer Relationship Mgmt	1.5	BUSML 4201 & 4202

ELECTIVES: OPERATIONS MANAGEMENT AND LOGISTICS FOCUS			
COURSE	**TITLE**	**HOURS**	**PREREQUISITES**
BUSMGT 3230	Intro to Operations Mgmt	3	ECON 2001 & 2002 & STAT 1430 or higher
BUSMGT 4250	Six Sigma Principles	3	ACCT 2000 & BUSMGT 3230 & STAT 3201 & 3202
BUSMGT 4251	Six Sigma Projects	3	BUSMGT 4250
BUSML 3380	Logistics Management	1.5	ECON 2001 & 2002
BUSML 4382	Logistics Analytics	3	BUSML 4380 & STAT 3201 & 3202
BUSML 4386	Logistics Tech and Application	1.5	BUSML 3380 & STAT 3201 & 3202

BACHELOR OF SCIENCE (BS) DATA ANALYTICS: BUSINESS ANALYTICS SPECIALIZATION

Suggested Curriculum – 4 Year Degree Plan

This should be used as a **guide** only. Semester offerings are subject to change. Students should meet with the Data Analytics academic advisor every semester to ensure an on time graduation.

Year	Autumn		Spring	
	Course	**Hrs.**	**Course**	**Hrs.**
1	ASC 1100.xx	1	Math 1152 or 2162 or 1172 or 2182H**	5
	Math 1151 or 1161 or 1181H	5	CSE 2221	4
	CSE 1223 or equiv	3	GE Foreign Language 2	4
	GE Foreign Language 1	4	GE Open Option*	3
	GE Writing Level I	3		
	Total:	**16**	**Total:**	**16**
2	CSE 2231	4	Math 2568	3
	CSE 2321	3	CSE 2421 or 3430	4
	Stat 3201	3	Stat 3202	4
	GE Foreign Language 3	4	GE Writing Level 2	3
	Econ 2001.xx (GE Social Science)	3	Econ 2002.xx (GE Social Science)	3
	Total:	**17**	**Total:**	**17**
3	ISE 3230	3	CSE 5544 **or** ISE 5760	3
	CSE 3241	3	Stat 3302	3
	Stat 3301	3	BUSADM 3632.05	3
	BUSADM 3630.05	3	Business Analytics Elective***	3
	GE Historical Study	3	GE Biological Science (lab)	4
	GE Visual and Performing Arts	3		
	Total:	**18**	**Total:**	**16**
4	CSE 5243	3	CSE 3244	3
	Stat 4620	2	Stat 3303	3
	Business Analytics Elective***	3	Business Analytics Elective***	3
	GE Cult. & Ideas or 2nd Historical Study	3	GE Literature	3
	GE Physical Science (lab)	4	GE Natural Science	3
	Total:	**15**	**Total:**	**15**

*Stat 2450 can be utilized as a GE Open Option course for students who do not have previous experience in Statistics; however, this course is not required. If a student has EM or dual enrollment K credit for Math 1151, it is required for them to enroll in STAT 2450 during their first semester.

**Math courses above the 1151 and 1161 levels complete one of the two GE Open Option courses for a B.S. degree in the College of the Arts and Sciences. Data Analytics students must take Math 1152 or 1172 or 2162 or 2182H as a prerequisite to Math 2568.

*** From approved list of business elective courses

****This curriculum plan assumes overlap for the Social Diversity and Global Studies GE categories.

Total hours to complete the degree program = 130

Version: 04/12/2017

BACHELOR OF SCIENCE (BS) DATA ANALYTICS: COMPUTATIONAL ANALYTICS SPECIALIZATION

Major Prerequisites (16 hours)

These courses may overlap with the General Education curriculum where appropriate. Courses in **BOLD** should be completed before submitting an application to the Data Analytics major.

Department	Course	Hours	Term Offered
Math	**Math 1151** (1161 or 1181H) – Calculus I	5	AU/SP/SU
	Math 1152 (1172, 2162 or 2182H) – Calculus II	5	AU/SP/SU
Computer Science & Engineering	***CSE 1223** – Computer Programming in Java	3	AU/SP/SU
Linguistics	**LING 2000 – Intro to Language in the Humanities	3	AU/SP

*CSE 1222 or CSE placement level A can also fulfill this prerequisite; however, 1223 is *strongly* preferred.

*LING 2000 is only required for students pursuing the Linguistics and Text Analytics Focus, but it can fulfill the Cultures & Ideas GE for any Data Analytics major, regardless of specialization or focus.

Core Requirements (51 hours)

The Data Analytics Core courses follow a strict pre-requisite structure. Some courses are only offered once per year. Failure to successfully enroll in and complete these courses will delay graduation.

Department	Course	Hours	Term Offered
Math	Math 2568 – Linear Algebra	3	AU/SP/SU
Industrial & Systems Engineering	ISE 3230 – Systems Modeling and Optimization	3	AU
Computer Science & Engineering	**CSE 2221** – Software I: Software Components	4	AU/SP/SU
	CSE 2231 – Software II: Development & Design	4	AU/SP/SU
	CSE 2321 – Foundations I: Discrete Structures	3	AU/SP/SU
	CSE 2421 or 3430 – Systems I: Computer Systems	4	AU/SP/SU
	CSE 3241 – Databases I: Computer Architecture	3	AU/SP/SU
	CSE 3244 or 5242 – Adv. DB & Cloud Computing	3	AU/SP
	CSE 5243 – Data Mining	3	AU/SP
	CSE 5544 or ISE 5760 – Data Visualization	3	AU/SP
Statistics	STAT 3201 – Probability for Data Analytics	3	AU/SP
	STAT 3202 – Statistical Inference for Data Analytics	4	AU/SP
	STAT 3301 – Statistical Modeling for Discovery I	3	AU
	STAT 3302 – Statistical Modeling for Discovery II	3	SP
	STAT 4620 – Statistical Learning	2	AU
	STAT 3303 – Statistical Decision Making	3	SP

Computational Analytics Specialization (14 hours)

Course	Hours	Term Offered
CSE and LING Electives – Choose 10 hours from back of sheet	10	varies
CSE 59xx/STAT 4911 – Capstone in CSE or Data Analytics **(Senior year)**	4	AU/SP

General Education

Please visit http://artsandsciences.osu.edu/academics/current-students/advising/ge to download a PDF document of your General Education curriculum requirements.

BACHELOR OF SCIENCE (BS) DATA ANALYTICS: COMPUTATIONAL ANALYTICS SPECIALIZATION

Students majoring in Computational Analytics must take **10 credit hours** of coursework from the electives listed below. Courses are grouped to show possible focus areas but **students may select any combination of** courses (assuming pre-requisites have been met).

ELECTIVES: CYBER-SECURITY FOCUS			
COURSE	**TITLE**	**HOURS**	**PREREQUISITES**
CSE 3461	Computer Networking and Internet Technologies	3	CSE 2421. Concur: CSE 2431
CSE 4471	Information Security	3	CSE 2231 & 2321
CSE 5472 OR 5473	Info Security Projects OR Network Security	3	CSE 3901 or 3902 or 3903 OR 3461

ELECTIVES: MACHINE INTELLIGENCE FOCUS			
COURSE	**TITLE**	**HOURS**	**PREREQUISITES**
CSE 2331	Foundations II	3	CSE 2231 & 2321 & STAT 3202
CSE 3521	Survey of Artificial Intelligence I	3	CSE 2331
Choose ***two*** of the following:			
CSE 5245	Intro to Network Science	3	CSE 2331
CSE 5523	Machine Learning and Statistical Pattern Recognition	3	CSE 3521 & STAT 3202
CSE 5524	Computer Vision for Human-Computer Interaction	3	CSE 2331
CSE 5526	Intro to Neural Networks	3	CSE 3521 or 5521

ELECTIVES: CORE (SYSTEMS OR THEORY) FOCUS			
COURSE	**TITLE**	**HOURS**	**PREREQUISITES**
CSE 2331	Foundations II: Structures & Algorithms	3	CSE 2231 & 2321 & STAT 3202
CSE 2431	Systems II: Operating Systems	3	CSE 2421
CSE 3901/ 3902/3903	CSE Junior Project Choice	4	CSE 2231 & 2321 & 2421 or 3430
Choose ***one*** of the following:			
CSE 5245	Intro to Network Science	3	CSE 2331
CSE 5361	Numerical Methods	3	CSE 2231 & MATH 2568
CSE 5441	Intro to Parallel Computing	3	CSE 2231 & 2321 & 2421 or 3430 & MATH 2568

ELECTIVES: LINGUISTICS AND TEXT ANALYTICS FOCUS			
COURSE	**TITLE**	**HOURS**	**PREREQUISITES**
LING 5801	Computational Linguistics I	3	LING 3802 & 5000 & CSE 3321 & 3521 or 5052
LING 5802	Computational Linguistics II	3	LING 5801
CSE 5525	Foundations of Speech and Language Processing	3	CSE 3521 & STAT 3202
Choose ***one*** of the following:			
LING 4100	Phonetics	3	LING 2000
LING 4200	Syntax	3	LING 2000
LING 4300	Phonology	3	LING 2000
LING 4400	Linguistic Meaning	3	LING 2000

BACHELOR OF SCIENCE (BS) DATA ANALYTICS: COMPUTATIONAL ANALYTICS SPECIALIZATION

Suggested Curriculum – 4 Year Degree Plan

This should be used as a **guide** only. Semester offerings are subject to change. Students should meet with the Data Analytics academic advisor every semester to ensure an on time graduation.

Year	Autumn		Spring	
	Course	**Hrs.**	**Course**	**Hrs.**
1	ASC 1100.xx	1	Math 1152 or 2162 or 1172 or 2182H**	5
	Math 1151 or 1161 or 1181H	5	CSE 2221	4
	CSE 1223 or equiv	3	GE Foreign Language 2	4
	GE Foreign Language 1	4	GE Open Option*	3
	GE Writing Level I	3		
	Total:	**16**	**Total:**	**16**
2	CSE 2231	4	Math 2568	3
	CSE 2321	3	CSE 2421 or 3430	4
	Stat 3201	3	Stat 3202	4
	GE Foreign Language 3	4	GE Writing Level 2	3
	GE Social Science	3	Linguistics 2000 (GE Cultures & Ideas)	3
	Total:	**17**	**Total:**	**17**
3	ISE 3230	3	CSE 5544 **or** ISE 5760	3
	CSE 3241	3	Stat 3302	3
	Stat 3301	3	Computational Elective***	4
	GE Natural Science	3	GE Historical Study	3
	GE Visual and Performing Arts	3	GE Biological Science (lab)	4
	Total:	**15**	**Total:**	**17**
4	CSE 5243	3	CSE 3244	3
	Stat 4620	2	Stat 3303	3
	Computational Elective***	3	Computational Elective***	3
	GE Social Science	3	CSE 59xx/Stat 4911 Capstone	4
	GE Physical Science (lab)	4	GE Literature	3
	Total:	**15**		**16**

*Stat 2450 can be utilized as a GE Open Option course for students who do not have previous experience in Statistics; however, this course is not required. If a student has EM or dual enrollment K credit for Math 1151, it is required for them to enroll in STAT 2450 during their first semester.

**Math courses above the 1151 and 1161 levels complete one of the two GE Open Option courses for a B.S. degree in the College of the Arts and Sciences. Data Analytics students must take Math 1152 or 1172 or 2162 or 2182H as a prerequisite to Math 2568.

*** From approved list of computational analytics elective courses

****This curriculum plan assumes overlap for the Social Diversity and Global Studies GE categories.

Total hours to complete the degree program = 129

Version: 03/18/2019

BACHELOR OF SCIENCE (BS) DATA ANALYTICS: DATA VISUALIZATION SPECIALIZATION

Major Prerequisites (13 hours)

These courses may overlap with the General Education curriculum where appropriate. Courses in **BOLD** should be completed before submitting an application to the Data Analytics major.

Department	Course	Hours	Term Offered
Math	**Math 1151** (1161 or 1181H) – Calculus I	5	AU/SP/SU
	Math 1152 (1172, 2162 or 2182H) – Calculus II	5	AU/SP/SU
Computer Science & Engineering	***CSE 1223** – Computer Programming in Java	3	AU/SP/SU

*CSE 1222 or CSE placement level A can also fulfill this prerequisite; however, 1223 is *strongly* preferred.

Core Requirements (51 hours)

The Data Analytics Core courses follow a strict pre-requisite structure. Some courses are only offered once per year. Failure to successfully enroll in and complete these courses will delay graduation.

Department	Course	Hours	Terms Offered
Math	Math 2568 – Linear Algebra	3	AU/SP/SU
Industrial & Systems Engineering	ISE 3230 – Systems Modeling and Optimization	3	AU
	ISE 5760 – Data Visualization	3	SP
Computer Science & Engineering	**CSE 2221** – Software I: Software Components	4	AU/SP/SU
	CSE 2231 – Software II: Development & Design	4	AU/SP/SU
	CSE 2321 – Foundations I: Discrete Structures	3	AU/SP/SU
	CSE 2421 or 3430 – Systems I: Computer Systems	4	AU/SP/SU
	CSE 3241 – Databases I: Computer Architecture	3	AU/SP/SU
	CSE 3244 or 5242 – Adv. DB & Cloud Computing	3	AU/SP
	CSE 5243 – Data Mining	3	AU/SP
Statistics	STAT 3201 – Probability for Data Analytics	3	AU/SP
	STAT 3202 – Statistical Inference for Data Analytics	4	AU/SP
	STAT 3301 – Statistical Modeling for Discovery I	3	AU
	STAT 3302 – Statistical Modeling for Discovery II	3	SP
	STAT 4620 – Statistical Learning	2	AU
	STAT 3303 – Statistical Decision Making	3	SP

Data Visualization Specialization (15 hours)

DESIGN 5505 – Information Design	3	AU
CSE 5544 – Introduction to Data Visualization	3	AU/SP
ACCAD 5141 – Interactive Arts Media	3	SP
ACCAD 5150 – Emerging Trends in Data Visualization	3	SP
STAT 4911 – Capstone in Data Analytics	3	SP

GENERAL EDUCATION

Please visit http://artsandsciences.osu.edu/academics/current-students/advising/ge for a list of your General Education curriculum requirements.

Revised 3/2019

BACHELOR OF SCIENCE (BS) DATA ANALYTICS: DATA VISUALIZATION SPECIALIZATION

Suggested Curriculum – 4 Year Degree Plan

This should be used as a **guide** only. Semester offerings are subject to change. Students should meet with the Data Analytics academic advisor every semester to ensure an on time graduation.

Year	Autumn		Spring	
	Course	**Hrs.**	**Course**	**Hrs.**
1	ASC 1100.xx	1	Math 1152 or 2162 or 1172 or 2182H**	5
	Math 1151 or 1161 or 1181H	5	CSE 2221	4
	CSE 1223 or equiv	3	GE Foreign Language 2	4
	GE Foreign Language 1	4	GE Open Option*	3
	GE Writing Level I	3		
	Total:	**16**	**Total:**	**16**
2	CSE 2231	4	Math 2568	3
	CSE 2321	3	CSE 2421 or 3430	4
	Stat 3201	3	Stat 3202	4
	GE Foreign Language 3	4	GE Writing Level 2	3
	GE Social Science	3	GE Cult. & Ideas or Hist. Study	3
	Total:	**17**	**Total:**	**17**
3	ISE 3230	3	ISE 5760	3
	CSE 3241	3	ACCAD 5141	3
	Stat 3301	3	Stat 3302	3
	DESIGN 5505	3	GE Historical Study	3
	GE Natural Science	3	GE Biological Science (lab)	4
	GE Visual and Performing Arts	3		
	Total:	**18**	**Total:**	**16**
4	CSE 5243	3	CSE 3244	3
	Stat 4620	2	Stat 3303	3
	CSE 5544	3	ACCAD 5150	3
	GE Social Science	3	STAT 4911 Capstone	4
	GE Physical Science (lab)	4	GE Literature	3
	Total:	**15**		**16**

*Stat 2450 can be utilized as a GE Open Option course for students who do not have previous experience in Statistics; however, this course is not required. If a student has EM or dual enrollment K credit for Math 1151, it is required for them to enroll in STAT 2450 during their first semester.

**Math courses above the 1151 and 1161 levels complete one of the two GE Open Option courses for a B.S. degree in the College of the Arts and Sciences. Data Analytics students must take Math 1152 or 1172 or 2162 or 2182H as a prerequisite to Math 2568.

***This curriculum plan assumes overlap for the Social Diversity and Global Studies GE categories.

Total hours to complete the degree program = 131

Version: 03/18/2019

BACHELOR OF SCIENCE (BS) DATA ANALYTICS: SOCIAL SCIENCE ANALYTICS SPECIALIZATION

Major Prerequisites (13 hours)

These courses may overlap with the General Education curriculum where appropriate. Courses in **BOLD** should be completed before submitting an application to the Data Analytics major.

Department	Course	Hours	Term Offered
Math	**Math 1151** (1161 or 1181H) – Calculus I	5	AU/SP/SU
	Math 1152 (1172, 2162 or 2182H) – Calculus II	5	AU/SP/SU
Computer Science & Engineering	***CSE 1223** – Computer Programming in Java	3	AU/SP/SU

*CSE 1222 or CSE placement level A can also fulfill this prerequisite; however, 1223 is *strongly* preferred.

Core Requirements (51 hours)

The Data Analytics Core courses follow a strict pre-requisite structure. Some courses are only offered once per year. Failure to successfully enroll in and complete these courses will delay graduation.

Department	Course	Hours	Terms Offered
Math	Math 2568 – Linear Algebra	3	AU/SP/SU
Industrial & Systems Engineering	ISE 3230 – Systems Modeling and Optimization	3	AU
Computer Science & Engineering	**CSE 2221** – Software I: Software Components	4	AU/SP/SU
	CSE 2231 – Software II: Development & Design	4	AU/SP/SU
	CSE 2321 – Foundations I: Discrete Structures	3	AU/SP/SU
	CSE 2421 or 3430 – Systems I: Computer Systems	4	AU/SP/SU
	CSE 3241 – Databases I: Computer Architecture	3	AU/SP/SU
	CSE 3244 or 5242 – Adv. DB & Cloud Computing	3	AU/SP
	CSE 5243 – Data Mining	3	AU/SP
	CSE 5544 or ISE 5760 – Data Visualization	3	AU/SP
Statistics	STAT 3201 – Probability for Data Analytics	3	AU/SP
	STAT 3202 – Statistical Inference for Data Analytics	4	AU/SP
	STAT 3301 – Statistical Modeling for Discovery I	3	AU
	STAT 3302 – Statistical Modeling for Discovery II	3	SP
	STAT 4620 – Statistical Learning	2	AU
	STAT 3303 – Statistical Decision Making	3	SP

Social Science Analytics Specialization (19 hours)

Overview of Research Methods – Choose one research methods course from back of sheet	3
Social Science electives – Choose 9 hours of electives from back of sheet	9
STAT 4911 – Capstone in Data Analytics **(SP Senior year)**	4
*Independent research in the Social Sciences – DEPT 4998/4999	3

*Meet with a Data Analytics advisor early in your third year to discuss options for fulfilling this research requirement.

GENERAL EDUCATION

Please visit http://artsandsciences.osu.edu/academics/current-students/advising/ge for a list of your General Education curriculum requirements.

BACHELOR OF SCIENCE (BS) DATA ANALYTICS: SOCIAL SCIENCE ANALYTICS SPECIALIZATION

In addition to coursework within the specialization, students completing the Social Science Analytics specialization will be required to complete an independent research project of their choosing under the guidance of a faculty member. In order to prepare for this independent research project, students are encouraged to complete GE courses by strategically selecting relevant coursework that meets their research interests. There are several GE courses that might be of interest to students depending on the area of research they wish to pursue. Students can strategically coordinate a number of GE courses in a way that could be helpful in preparing for their required research project. Recommended GE courses are listed at https://data-analytics.osu.edu/social-science-specialization-gen-eds.

OVERVIEW OF RESEARCH METHODS			
COURSE	**TITLE**	**HOURS**	**PREREQUISITES**
Choose **one** of the following:			
COMM 3160	Communications Research Methods	4	STAT 1450 or higher
POLISCI 4781	Data Analysis in Political Science I	3	MATH 1151 & one POLISCI course at 3000-level or higher
PSYCH 2300	Research Methods in Psychology	3	PSYCH 1100 or 1100H
SOCIOL 3487	Research Methods in Sociology	3	None

ELECTIVES: FOCUSED RESEARCH METHODS AND VISUALIZATION AND SPATIAL ANALYSES			
COURSE	**TITLE**	**HOURS**	**PREREQUISITES**
Choose **three** of the following:			
ANTHRO 5650	Research Design and Ethnographic Methods	3	ANTHROP 2202
ANTHRO 5651	Spatial Analysis for Anthropologists	3	GEOG 5210
COMM 3163	Communication Industry Research Methods	4	STAT 1450 or higher
ECON 4050	Experimental Economics	3	ECON 2001.xx or equiv.
ECON 5420	Econometrics II	3	ECON 5410 & 4002.xx
GEOG 5200	Cartography and Map Design	3	None
GEOG 5201	GeoVisualization	3	GEOG 5200
GEOG 5210	Fundamentals of Geographic Information Systems	3	None
GEOG 5222	GIS Algorithms & Programming	3	GEOG 5210 & 5212 & CSE 1114
GEOG 5223	Design & Implementation of GIS	3	GEOG 5222
GEOG 5225	Geographic Applications of Remote Sensing	3	None
GEOG 5226	Spatial Simulation and Modeling	3	None
POLISCI 3780	Data Literacy and Data Visualization	3	None
PSYCH 4511	Psychological Testing	3	PSYCH 2220 & 2300
SOCIOL 4650	Seminar in Social Networks	3	GE Data Analysis or GE Mathematical and Logical Analysis course
STAT 5510	Statistical Foundations of Survey Research	3	STAT 1450 or higher & MATH 1075 or higher

BACHELOR OF SCIENCE (BS) DATA ANALYTICS: SOCIAL SCIENCE ANALYTICS SPECIALIZATION

Suggested Curriculum – 4 Year Degree Plan

This should be used as a **guide** only. Semester offerings are subject to change. Students should meet with the Data Analytics academic advisor every semester to ensure an on time graduation.

Year	Autumn		Spring	
	Course	**Hrs.**	**Course**	**Hrs.**
1	ASC 1100.xx	1	Math 1152 or 2162 or 1172 or 2182H**	5
	Math 1151 or 1161 or 1181H	5	CSE 2221	4
	CSE 1223 or equiv	3	GE Foreign Language 2	4
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	GE Writing Level I	3		
	Total:	**16**	**Total:**	**16**
2	CSE 2231	4	Math 2568	3
	CSE 2321	3	CSE 2421 or 3430	4
	Stat 3201	3	Stat 3202	4
	GE Foreign Language 3	4	GE Writing Level 2	3
	GE Social Science	3	GE Social Science	3
	Total:	**17**	**Total:**	**17**
3	ISE 3230	3	CSE 5544 **or** ISE 5760	3
	CSE 3241	3	Stat 3302	3
	Stat 3301	3	Research Methods Elective***	3
	Social Science Analytics Elective***	3	Social Science Analytics Elective***	3
	GE Historical Study	3	GE Biological Science (lab)	4
	GE Visual and Performing Arts	3		
	Total:	**18**	**Total:**	**16**
4	CSE 5243	3	CSE 3244	3
	Stat 4620	2	Stat 3303	3
	Ind. Research in the Social Sciences	3	Stat 4911 Capstone	4
	GE Cult. & Ideas or 2nd Historical Study	3	Social Science Analytics Elective***	3
	GE Physical Science (lab)	4	GE Natural Science	3
	GE Literature	3		
	Total:	**18**	**Total:**	**16**

*Stat 2450 can be utilized as a GE Open Option course for students who do not have previous experience in Statistics; however, this course is not required. If a student has EM or dual enrollment K credit for Math 1151, it is required for them to enroll in STAT 2450 during their first semester.

**Math courses above the 1151 and 1161 levels complete one of the two GE Open Option courses for a B.S. degree in the College of the Arts and Sciences. Data Analytics students must take Math 1152 or 1172 or 2162 or 2182H as a prerequisite to Math 2568.

*** From approved list of social science courses

****This curriculum plan assumes overlap for the Social Diversity and Global Studies GE categories.

Total hours to complete the degree program = 134

Version: 03/18/2019

Department of Molecular Genetics

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February 13, 2020

Alison Crocetta
Chair, ASCC

Dear Alison,

The NMS Panel of the Arts and Sciences Curriculum Committee (ASCC) reviewed and discussed the proposed revisions to the Biomedical Informatics Specialization in the Data Analytics BS at the regular NMS panel meeting on January 27, 2020.

The proposed revisions consist of (i) a change of the name of the Biomedical Informatics specialization to *Biomedical and Public Health Analytics*, (ii) revised learning outcomes to reflect the analytics concepts, as well as knowledge and skills from a broader range of perspectives, (iii) a reduced number of required credit hours in the specialization to better match the credit hour requirements of the other specializations in the Data Analytics BS, and (iv) the inclusion of the College of Public Health as a new partner in the undergraduate Data Analytics program.

The proposed revisions are the result of the Data Analytics major Management Committee's regular assessment efforts of the Data Analytics major core curriculum and the curricula of the presently existing five specializations. The proposed revisions address identified challenges that students face in navigating the present Biomedical Informatics specialization. In addition, an expansion of health-related analytics concepts is proposed.

The proposed revisions are well rationalized and compelling in their justifications. The NMS panel unanimously approved the proposed revisions with several minor recommendations that have been addressed.

The NMS Panel forwards the proposed revisions to the Biomedical Informatics Specialization in the Data Analytics BS to ASCC with a motion to approve.

Sincerely,

Dr. Harald Vaessin
Chair, NMS Panel of ASCC
Professor and Chair, Molecular Genetics