Table of Contents

Statistics MS Program Revision

Background

The MS program in statistics is designed to serve students who obtain an MS degree en route to a PhD in statistics or biostatistics as well as those who complete their education at the master's level. Because of this dual purpose, the MS program and PhD program overlap in the first year required courses and some second-year courses.

After several years of review and consideration of various curricular changes in the PhD program, the Department of Statistics is proposing a curricular revision to the PhD program with the desired implementation term of Fall 2024. Detailed information on the revised PhD program and the rationale for the revision can be found in the "Statistics PhD Program Revision" document that accompanies this proposal. The proposed course changes in the PhD program will affect those courses in the MS program shared with the PhD program. This proposal describes the corresponding changes to the MS program. The implementation term for this revised MS program is Fall 2024. The last major changes to the MS program in statistics were made during the semester conversion in 2011-2012. See the MS curriculum (p. 6) approved at the semester conversion.

Outline of the Proposed Changes

Course changes

Revisions to the PhD curriculum include changes to the following 8 courses, among which three are new courses and five are revisions of the existing courses. The course changes in blue only apply to the PhD program.

- 6111 (3 credits) & 6112 (3 credits): a new sequence for reviewing and introducing mathematical foundations necessary for the coursework in PhD and MS programs. This sequence with 6 credits total will replace MATH 4545 (4 credits) and STAT 6860 (2 credits).
- 6910 (4 credits) & 6950 (4 credits): resequencing of 6910 and 6950 changing their order.
- 7301 (3 credits): reduce redundancy with 6802 (first-year theory course) and introduce topics in high dimensional estimation which are relevant to contemporary applications.
- 7302 (3 credits): add more computational and modeling elements of Bayesian analysis to 7303 since 6570 (2 credits) Applied Bayesian Analysis is no longer required for the PhD program. The change will better prepare students for research in Bayesian analysis.
- 7410 (3 credits): refocus course content to cover more applied statistical modeling techniques.
- 7541 (3 credits): a new course on stochastic processes with more emphasis on applications and simulation replacing 7540 (Theory of Stochastic Processes)

In the revised MS program, students will take the new mathematical foundations sequence (6111 & 6112), revised applied statistics sequence (6910 & 6950) and revised course on linear modeling (7410).

See the table below for comparison between the proposed and current curricula in core required courses and change in elective courses.

Math Prerequisite

Current			**Proposed**			
Code	Credits	Title	Code	Credits	Title	Notes
MATH 4545**	4	Analysis Overview				Removed
			6111	3	Foundations of Statistical Theory I	New course*
			6112	3	Foundations of Statistical Theory II	New course*

*6111-6112 replace MATH 4545 and STAT 6860. Math prerequisites do not count toward the credit hours required for the degree.
**MATH 4545 is not required but considered as math prerequisites for 6801-6802 in the current MS program

Core Required Courses

Current			**Proposed**			
Code	Credits	Title	Code	Credits	Title	Notes
6801	4	Statistical Theory I	6801	4		
6802	4	Statistical Theory II	6802	4		
6860	2	Foundations of the Linear Model				Removed*
6910	4	Applied Statistics I	6910	4	Applied Statistics II	Resequenced and revised
6950	4	Applied Statistics II	6950	4	Applied Statistics I	Resequenced and revised
7410	3	Theory of the Linear Model	7410	3	Linear Models	Revised

Pick one of the following:

Current			**Proposed**		
Code	Credits	Title	Code	Credits	Notes
6570	2	Applied Bayesian Analysis	6570	2	Changed to elective
6615 (PUBHBIO 7215)	2	Design and Analysis of Clinical Trials	6615	2	Changed to elective

Pick one of the following:

Current			**Proposed**		
Code	Credits	Title	Code	Credits	Notes
6750	2	Statistical Consulting and Collaboration	6750	2	
7755* (PUBHBIO 7245)	2	Biostatistical Collaboration	PUBHBIO 7245	2	Typically taken by students pursuing a PhD in Biostatistics, who often also earn an MS in Statistics en route to their PhD.

*This course stopped being cross-listed in May 2022.

Elective Courses

There is no change in the required credit hours for elective courses (11 hours of approved electives). 6570 and 6615 (PUBHBIO 7215) will be added to elective courses.

The percent change of the revision:
The proposed program revision adds 6111 (3 cr) and 6112 (3 cr) as new courses although they can be viewed as replacements of the existing courses (MATH 4545 and STAT 6860) covering similar course contents. Note again that MATH 4545 is not a required course in the current program, but it is considered as math prerequisites for 6801-6802. The rest of the revised courses (6910, 6950, and 7410) have about 15% of change on average in the course content. In addition, as pick one of the two options, 6570 (2 cr) and 6615 (2 cr) are removed from the MS requirements. This leads to a change of 11.65 (=10 + 11*0.15) credits total out of 36 credits representing 32.36% of change to the program.

The revised MS program requires a minimum of 32 credit hours. As 6860 (2 cr) is removed from the curriculum and 6111-6112 (6 cr total are added) as math prerequisites but they don't count toward the degree, we propose to reduce the total credit hours from 36 in the current program to 32.

Transition Plan

We will enact this program change for students entering the program in the academic year 2024-2025. Students currently in the existing program will continue with the current program and will not be impacted by this redesign either in terms of progress towards their degree or their expected date of graduation, though they may take some courses with revised content. We do not anticipate any students will have taken only part of the applied statistics sequence (STAT 6910/6950) and thus be 'out of sequence' due to the course sequence change starting in Autumn 2024. In the unlikely event that this sequencing issue would arise, the Graduate Studies Chair will work individually with the student and appropriate instructors. We expect that STAT 6570 will be offered every year for the foreseeable future, since this is a required course for the Master of Applied Statistics.

Learning Goals and Assessment Plan

There is no proposed change in the learning goals for the MS program and the assessment plan. For information, the learning goals are listed below, and the current assessment plan is included in Appendix.

Learning Goals

A student graduating with a MS in Statistics should meet the following learning goals:

1. Display proficient understanding of probabilistic theory
2. Display proficient understanding of the theory of statistical inference
3. Display proficient understanding of statistical models, and the use of such models in analyzing data

Appendix

- Current Program Guide (See p. 4 of the Program Guide to Graduate Studies in Statistics)
- Revised Program Guide
- Plan of Study Form (revised version)
- Assessment Plan (current version)
- Syllabi of new and revised courses (see those included in the Statistics PhD program revision proposal)

MASTER OF SCIENCE IN STATISTICS PROGRAM

The Master of Science (M.S.) degree program can provide preparation for a career in applied statistics or it can be composed primarily of the first two years of course work for either the Statistics Ph.D. program or the methodology specialization of the Biostatistics Ph.D. program. The M.S. degree may be awarded by one of two different routes: Thesis or Non-thesis. Under either route, the M.S. may be a terminal degree. The Non-thesis route may serve as a steppingstone to the Ph.D. degree if later admitted to the Ph.D. program. The M.S. requires a minimum of 32 credit hours and students in the M.S. program will generally be in residence for two academic years.

Students in the M.S. program are subject to the policies set forth by the Graduate School. See the Graduate School Handbook for details.

Course Requirements (32 credit hours)

Mathematics		Program coursework requires Advanced Calculus, Linear Algebra, and some Real Analysis. Stat 6111 and Stat 6112 are recommended; previous coursework or courses in the Math department could also be used to meet this requirement.
Core (21 hours)	6801 (4), 6802 (4) 6950 (4), 6910 (4) 7410 (3)	Statistical Theory I & II Applied Statistics I & II Linear Models
one of	6750 (2) PUBHBIO 7245 (2)	Statistical Consulting and Collaboration or Biostatistical Collaboration
Electives (11 hours)		11 hours of **approved** elective courses appropriate to the Thesis or Non-Thesis option as described in (2a) or (2b) below

Sample M.S. in Statistics Course Program

(Courses are typically only offered in the terms in which they are listed in the sample program below. Individual electives are not offered on a regular basis. See Buckeyelink for details on previous/current offerings and enrollment requirements, including prerequisites. Note that offerings are subject to change. Refer to the Courses page on our department website for additional information.)

Basic Sample Program

First Year	**Autumn**	**Spring**
	6801 (4)	6802 (4)
	6950 (4)	6910 (4)
	6111 (3)	6112 (3)
Second Year	**Autumn**	**Spring**
	7410 (3)	Elective
	6750 (2)	Elective
	Elective	Elective

Sample Program for a Terminal Master's Degree

First Year	**Autumn**	**Spring**
	6801 (4)	6802 (4)
	6950 (4)	6910 (4)
	6111 (3)	6112 (3)
Second Year	**Autumn**	**Spring**
	7410 (3)	6500 (3)
	6750 (2)	6550 (2) or 6530 (2)
	6730 (2)	SP1 6650 (2)
	6510 (3) or 6520 (3) or 6560 (3)	SP2 6570 (2)

Sample Program for a Master's Degree for Students Planning to Pursue a Ph.D.

First Year	**Autumn**	**Spring**
	6801 (4)	6802 (4)
	6950 (4)	6910 (4)
	6111 (3)	6112 (3)
Second Year	**Autumn**	**Spring**
	7201 (3)	7302 (3)
	7301 (3)	7541 (3)
	7410 (3)	7730 (3)
	6750 (2)	

Notes on the Program Requirements

1. Course Grades – All courses used towards the degree requirements must be taken and passed with a grade of B- or above in a letter-graded course and with a grade of S in a S/U course. Note that all graduate students are required to maintain a cumulative GPA of at least 3.0 both overall and in their statistics courses in order to remain in good standing.
2. Thesis or Examination – The department views either the thesis or non-thesis option as acceptable. However, the department does not view either option as an alternative once the other option has resulted in failure. Most students in recent years have elected to choose the non-thesis option. A student wishing to learn more about the thesis option should talk with the Graduate Studies Chair, who serves as the advisor for all M.S. students unless the student chooses to pursue a thesis with another faculty member. Students planning to do the thesis option must notify the Graduate Studies Chair via email by the beginning of the second year of study.

   2a. Thesis Option – Write a thesis and pass an oral examination in defense of this thesis.
   (Note: Some professors have problems that are suitable for masters' theses. These topics can range from the very mathematical to applications in other fields.)

   Electives* (11 hours): Letter graded Statistics courses at the 6000-level or above (including their cross-listed equivalents), excluding STAT 6030, 6040, 6111, 6112, 6193, 6194, 6201, 6301, 6302, 6410, 6450, 6740, 7193, 7194, 8010, 8193, 8194, 8895, 8999. Up to four hours of thesis preparation under STAT 7998 or STAT 7999 may be counted among the 11 hours of electives. Up to four hours of STAT 8750.xx may be counted.

2b. Non-thesis Option – Pass the M.S. Examination, a written examination that is offered in May, with a second offering in August if at least one student who failed the first offering of the M.S. Exam wishes to retake the exam. M.S. students opting for the non-thesis graduation requirement are expected to take the May offering of the M.S. Exam and are also expected to take the next offering in the event of a failure on the May exam. The examination will cover material from the first year of the M.S. course work. A student is permitted a maximum of two attempts at successful completion of the examination.

Electives* (11 hours): Letter graded Statistics courses at the 6000-level or above (including their cross-listed equivalents), excluding STAT 6030, 6040, 6111, 6112, 6193, 6194, 6201, 6301, 6302, 6410, 6450, 6740, 7193, 7194, 7998, 7999, 8010, 8193, 8194, 8895, 8999. Up to four hours of STAT 8750.xx may be counted. STAT 7998 and STAT 7999 may not be counted as elective hours for a non-thesis option degree.

*Students may, with approval of the Graduate Studies Committee, count one course (up to 3 hours) from another department as an elective. The course must have appropriate content for a statistics degree, and must not duplicate the material covered in any course available from the Department of Statistics.

Forms

Any student who anticipates obtaining the M.S. degree in the course of his/her academic career should file the departmental M.S. Plan of Study form prior to the student's last term of enrollment. Any subsequent modifications in this Plan of Study will require approval of the Graduate Studies Committee. The student must also submit the online Graduate School Application to Graduate form via GRADFORMS.OSU.EDU by the published deadline of the Graduate School. Please consult the Graduate School website for details. The Plan of Study form must be submitted prior to the Application to Graduate.

Assessment Plan for the Statistics M.S.

Learning Goals for the Statistics M.S.: A student graduating with a M.S. in Statistics should meet the following learning goals:

1. Display proficient understanding of probabilistic theory [as studied in Stat 6801, for example]
2. Display proficient understanding of the theory of statistical inference [e.g. Stat 6802]
3. Display proficient understanding of statistical models, and the use of such models in analyzing data [e.g. Stat 6910, 6950, etc.]

Assessment of Learning Goal 1: Display proficient understanding of probabilistic theory

Assessment Rubric: The program will directly assess students' achievement of this learning goal by scoring the comprehensive M.S. Examination. The M.S. Examination Committee will assess each student on the ordinal scale: "High Proficiency," "Satisfactory Proficiency," "Some Proficiency," or "Low Proficiency." This will be done separately from the committee's determination of who passes the exam on an overall basis, and the committee will decide which questions on the M.S. Examination are appropriate for assessing this learning goal. (Note that some questions on the M.S. Examination could be appropriate for assessing more than one learning goal.) The chair of the M.S. Examination Committee will be responsible for communicating the rating summaries and remarks to the assessment program coordinator, to the chair of the curriculum committee, and to the Graduate Program Coordinator.

Criterion: The students assessed will be placed in three categories: "Already Completed the M.S.," "Currently Pursuing the M.S.," and "Other (Not Completing or Currently Pursuing the M.S.)." If at least 80% of the assessment ratings of students who have completed the M.S. are in the "High Proficiency" or "Satisfactory Proficiency" categories, we will consider this as evidence of success in achieving Learning Goal 1 for our M.S. graduates. We will also monitor the overall percentage of "High Proficiency" or "Satisfactory Proficiency" ratings for all students, not just those completing the M.S.

Use of Data: Aggregated data for each learning outcome will be examined by the Graduate Studies Committee and/or by the Curriculum Committee on an annual basis. If the data do not meet our criteria or are otherwise disappointing, the committee will bring this to the attention of the Statistics faculty to discuss possible remedies, including: meeting with students directly to discuss their performance, making improvements in course content, and making improvements in course delivery and learning activities within courses.

Assessment of Learning Goal 2: Display proficient understanding of the theory of statistical inference

Assessment Rubric: [same as for Learning Goal 1]

Criterion: [same as for Learning Goal 1]

Use of Data: [same as for Learning Goal 1]

<u>Assessment of Learning Goal 3</u>: Display proficient understanding of statistical models, and the use of such models in analyzing data

Assessment Rubric: [same as for Learning Goal 1]

Criterion: [same as for Learning Goal 1]

Use of Data: [same as for Learning Goal 1]

DEPARTMENT OF
STATISTICS

THE OHIO STATE UNIVERSITY

MS Plan of Study Form

Submit this form to the Graduate Studies Chair prior to your last term of enrollment. Any subsequent modifications in this Plan of Study will require approval of the Graduate Studies Committee. Note that you must also submit the online Graduate School Application to Graduate form via GRADFORMS.OSU.EDU by the published deadline of the Graduate School. The Plan of Study form must be submitted prior to the Application to Graduate.

Student Name: _____ **OSU. #**_____

Core Course Requirements (21 hours)

Fill in your grade for each course completed. For courses yet to be completed, indicate the term/year you plan to take the course. If you have received approval to substitute a course, cross off the required course and fill in the substituted course information and corresponding grade.

Course	Course Title	Grade	Course	Course Title	Grade
6801 (4)	Statistical Theory I	_____	7410 (3)	Linear Models	_____
6802 (4)	Statistical Theory II	_____	6750 (2) –or–	Statistical Consulting	_____
6950 (4)	Applied Statistics I	_____	PubHBio 7245 (2)	Biostat Collaboration	_____
6910 (4)	Applied Statistics II	_____			

Elective Course Requirements (11 hours)*

Course	Course Title	Hours	Grade
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
	TOTAL ELECTIVE HOURS	_____	

* Letter graded STAT courses at the 6000-level or above, excluding STAT 6030, 6040, 6060, 6111, 6112, 6193, 6194, 6201, 6301, 6302, 6410, 6450, 6740, 7193, 7194, 7998, 7999, 8010, 8193, 8194, 8895 and 8999. Up to 4 hours of STAT 8750.xx may be counted. At most 4 hours of STAT 7998 and 7999 may be counted by thesis students only. Special approval is required to substitute one course (no more than 3 credit hours) from another department.

Plan (circle): Thesis Examination **Exam/ Defense Date:** _____ **Result** (circle): Pass Fail N/A

Proposed Term/Year of Graduation (circle): SU AU SP 20 ____

Student's Signature: _____ Date: _____

Advisor: _____ _____ Date: _____
Print Sign

FOR DEPARTMENT USE ONLY

All degree requirements met: _____ Yes _____ No _____ Pending _____

Approval: _____ _____ Date:_____
Print Sign

rev 3/2023