

DEPARTMENT OF STATISTICS GRADUATE HANDBOOK

A Guide to Survival in the Statistics Department

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Contents

I	What to Pack – The Essentials	1
1	Welcome	1
2	Who’s Who in the Statistics Department	2
3	Before You Arrive	3
3.1	Health Insurance	3
3.2	Tuition Bill	3
3.3	Registration	3
3.4	Where to Live	4
3.5	Football Tickets	4
3.6	Additional References	4
4	Orientation and First Week	5
4.1	Advisors	5
4.2	Course Load	5
4.3	Assistantship Responsibilities	5
4.4	Office and Key Assignments	6
4.5	Copier Code	6
4.6	Student ID	7
4.7	Computer Accounts	7
4.8	First Paycheck	7
4.9	Instructional Development Program (IDP)	7
II	Where to Hike – Graduate Degrees	9
5	Admission Requirements	9
6	Master of Applied Statistics	10
6.1	Course Requirements	10
6.2	Program Examples	11
7	Master of Arts and Master of Science Degrees	13
7.1	Course Requirements	13
7.2	Examination Requirements	13
7.3	Thesis or Paper Requirements	14
7.4	Program Examples	14
8	Doctorate Degrees	17
8.1	Course Requirements	17
8.2	Qualifying Examination	17

8.3	Options	17
8.4	Graduate Colloquium	18
8.5	Ph.D. Committee	18
8.6	Foreign Language Requirement	18
8.7	Residency Requirement	18
8.8	Graduate School Comprehensive Examination (and Proposal)	19
8.9	Thesis Guidelines	19
8.10	Final Oral Examination (Thesis Defense)	19
8.11	Exceptions	20
8.12	Program Examples	20
 III Preventing Forest Fires – Other Stuff to Know		21
 9 Academic Policies		22
9.1	Normal Academic Progress	22
9.2	Independent Study and Thesis Research Credits	22
9.3	Summer Registration	23
9.4	Travel Funds	23
 10 Miscellaneous		24
10.1	Departmental Activities	24
10.2	Assistantship Opportunities	25
10.3	Pre-Doctoral Lecturers	26
10.4	Taxes	26
10.5	Career Resources	26

Part I

What to Pack – The Essentials

1 Welcome

Welcome to the Department of Statistics at Penn State!

As an incoming graduate student you probably have a lot of questions about the program and what you will need to do before you arrive, the first week you get here, and for the next few years. This handbook was written by graduate students, faculty, and staff in the department to answer your immediate questions and to address questions and issues that may arise as you progress through the statistics program. Please keep this guide handy because it will serve as a valuable and current reference throughout your career as a graduate student in the Department of Statistics.

In addition to this handbook, we suggest that you obtain *The Guide to Graduate Life* and the *Graduate Degree Programs Bulletin*, both available from the Kern Building Information Desk. These two booklets provide general information for graduate students at Penn State.

The Department of Statistics is committed to providing a friendly and helpful environment for all students, with facilities that will benefit everyone. If you have additional questions or need more information, please do not hesitate to contact us. A list of “Who’s Who in the Department of Statistics” on page 2 provides the titles, names, and phone numbers of students, faculty, and staff who will be able to address your questions.

We look forward to meeting you!

2 Who's Who in the Statistics Department

Title	Name	Office Address	Office Phone	Email Address
Department Head	Jim Rosenberger	326A	5-1348	jlr
Graduate Studies Chair	Bing Li	410	5-1952	bing
Graduate Admissions & Recruitment Committee Chair	Steven Thompson	314	5-3235	skt
Statistical Consulting Center	Andrea Piccinin	323E	5-3541	piccinin
Administrative Assistant	Kathleen DiFlaviana	323G	5-1348	kmd
Graduate Secretary	Kellie Karaky	326	5-1348	kellie
Staff Assistants	Laurie Roan	326	5-1348	laurie
	Bonnie Cain	326	5-1348	bonnie
Information Technology Associates				
Unix System Administrator	James Lockwood	331C	5-2544	lockwood
PC	Robin Hill	424	5-5623	rhill
Student Advisory Committee	Steve Bai	330A	5-3193	bai
01/02	Shu-Chuan Chen	422C	3-8677	shu
	Eliza Geier	301	3-2314	egeier
	Jenny Hellman	301	3-2314	jhellman
	Melinda Moyer	301	3-2314	mmoyer
	SAC email alias			sac
Graduate Student Association	Ryan Elmore	330B	3-0692	elmore
Representatives 01/02	Ryan Vraney	301	3-2314	rvraney

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- All offices listed are in Thomas Building.
 - All office phone numbers are (814) 86X-XXXX.
 - All email addresses are xxx@stat.psu.edu (unless otherwise listed).

3 Before You Arrive

3.1 Health Insurance

According to *The Guide to Graduate Life*, Penn State University requires that all graduate assistants, students, fellows and international students have acceptable health insurance. There are two health insurance options available through the University for graduate students: MEGA and Blue Cross/Blue Shield. There is also a vision plan option with MEGA. Forms are available in Grange building, and the process takes approximately two weeks. The department pays 80% of the premiums for graduate assistants or fellows enrolled in MEGA's Basic Plan. The remaining 20% is taken out of your paycheck in three installments: September, February and April. This ends up being approximately \$40-50 each of those three times. It is very important to realize that you will be automatically enrolled in MEGA's Basic Plan unless you submit a waiver and can demonstrate that you have an acceptable alternative plan. The department does not subsidize Blue Cross/Blue Shield or any other health insurance plan. More detailed information is available in the *The Guide to Graduate Life* or from the Health Insurance Office in 320 Grange Building (814-865-7467). After your graduation from Penn State, you will be eligible for short-term Blue Cross/Blue Shield plans which are offered by the Alumni Association (1-800-922-1245).

3.2 Tuition Bill

About six weeks before the beginning of each semester, you should receive your tuition bill. If you are a graduate assistant (or fellow) write "Graduate Assistant (or Graduate Fellow) in the Statistics Department" on your bill, put balance due of 0, and *return* it by the due date. If you prefer, you may file your 0 bill by phone by calling the Bursar's Office Voice Response System (814-863-2777). Zero bills can also be filed online through the elion system. Note that if the Registrar's office does not receive your tuition bill before the deadline, your account will be charged \$25 (which you are responsible for paying). If you are not on a graduate assistantship, follow the directions on the bill for calculating your tuition, computer fee and activity fee (all adjusted for the number of credits for which you are enrolled). If you need further assistance, call the Graduate Secretary.

3.3 Registration

During orientation you will be given an opportunity to meet with an advisor regarding course selection. After this meeting, you should register before the first day of classes in order to avoid "late registration fees." Courses may be added or dropped during the first ten calendar days of the fifteen week semester. Note that you are permitted to add or drop classes without penalty only during the first week of classes. Then starting with the seventh day, a \$6 fee is charged each day an add/drop transaction is processed. See Section 4.2 for the appropriate number of credits to take.

3.4 Where to Live

Graduate students and their families can choose between on and off campus housing. If you are planning on living off campus, we suggest making a trip to State College in the spring or early summer (at the latest). There are numerous ways to find places to live including websites such as statecollege.com and rent.net, looking in the Centre Daily Times (the State College regional newspaper) and the Collegian (the Penn State campus newspaper). Discussing housing options with current graduate students to learn from their experiences is also helpful. The Office of Off Campus Living also posts lists of people looking for roommates. Also, the Department of Town Affairs in 203 Hetzel Union Building (814-865-6851) publishes The Apartment Guide. Here you can find a listing of all State College realtors and descriptions of the many apartment complexes in the area. In addition, you may wish to contact the Graduate Secretary to see if other incoming or current graduate students in our department are looking for roommates. If you wish to live on campus, contact the Assignment Office for Campus Residences in 101 Shields at 814-865-7501.

3.5 Football Tickets

Penn State has a nationally recognized football team, and a lot of the fall activities center around football games. If you don't know who Joe Paterno is now, you will soon. You will receive an application for football tickets in May. If you wish to purchase season tickets send in the form with your check as soon as possible because the tickets usually sell out during the summer on a first-come, first-serve basis. The seats are not pre-assigned and since there is always a group of graduate students in the department who regularly attend the home games together, you won't have to worry about sitting alone.

3.6 Additional References

The Guide to Graduate Life and *The GSA Tax Guide* may be obtained at 111B Kern Graduate Building. More information on taxes is discussed in Section 10.4. Each incoming graduate student will receive a card allowing them to pick up (free of charge) one copy of *The Graduate Degree Programs Bulletin* from the Kern Information Desk. The Graduate Student Association has a home page at <http://cac.psu.edu/~gsa> which has *The Guide to Graduate Life* online, as well as various other topics.

4 Orientation and First Week

The fall semester usually begins during the third week of August. On the day before classes begin, there will be an important all-day orientation meeting for all Department of Statistics incoming graduate students as well as current students. If you are unable to attend this meeting, please notify the department and make arrangements to get your keys and necessary paperwork completed. If you are an international student, you will receive information about an important and fun orientation for international students which takes place about two weeks prior to the beginning of classes. Outlined below are the topics which will be addressed during this meeting and items to which you should attend during your first week here.

4.1 Advisors

As a first year graduate student, an advisor will be assigned to you by the Graduate Studies Chair. During orientation, you will be given the opportunity to visit with your assigned advisor to decide upon first semester courses and to begin planning your program of study. As the year progresses, you are strongly encouraged to visit with faculty members concerning opportunities for thesis research activities. One suggestion for meeting faculty and gaining insight into possible research areas is to attend department-sponsored colloquiums and SAC sponsored SOS talks. After you decide on a research area, you should choose a faculty member in that field of research to be your advisor. You are responsible for informing the Graduate Studies Chair of advisor changes.

4.2 Course Load

Students supported by assistantships are required to be registered as full-time students. Full-time status is defined to be:

	Credits per semester Fall/Spring
1/4-time assistantship	9-14
1/2-time assistantship	8-11
3/4-time assistantship	6-8
Fellows and Trainees	at least 9

If you audit a course, it doesn't count towards the minimum, but it does count against the maximum. If you go over the maximum courseload, a memo must be sent to the graduate school! See Kellie for any details. Also see Section 7.4 of this guide for an example of a first year program.

4.3 Assistantship Responsibilities

Most first year graduate students are given a 1/2-time assistantship and are assigned the responsibility of being either a teaching assistant (TA) or a grader for one or more undergraduate statistics classes. Both positions may require up to 20 hours of work per week,

but typically amount to less. As a teaching assistant or grader, you will be responsible for grading homework and/or exams, holding office hours, and maintaining grade files. Several teaching assistants are assigned to Stat 200, an elementary statistics course that involves using Minitab in class computer lab sessions. These TA's assist students as they work on lab activities and hold tutorial sessions as well as office hours. A 1/4-time assistantship may require up to 10 hours of work per week either as a teaching assistant or research assistant. After the fall semester, assistantship assignments are based upon your interests and the needs of the department.

All graduate assistants, domestic or international, may accept concurrent employment outside the university only after obtaining permission from the head of the department providing the assistantship and from your advisor. All fellowship and scholarship students may not accept employment of any kind. See the *Graduate Degree Programs* in the Employment Section for more information.

4.4 Office and Key Assignments

When you arrive, you will be assigned to an office. Priority on assignments will be based on semester standing and funded versus nonfunded status. Due to a lack of space, some unfunded students may be asked to share desks. Each student will also be assigned a mailbox in Room 325 where department mailings and information should be checked for daily.

You will need to obtain several keys to the building because many of the commonly used rooms will be locked after 5 P.M. and on weekends.

- Thomas Building
- Assigned Office
- Rm 330 (Unix Computer Lab)
- Rm 424 (PC Computer Lab)
- Mailroom/Conference Rooms/Clifford C. Clogg Memorial Library

Keys are authorized by Laurie Roan, Secretary, and then can be picked up in 512 Thomas Building (Eberly College of Science Facilities Office) with a \$10.00 deposit for each key. This deposit is refunded when you return your keys. In addition, a key for your assigned desk can be obtained from Laurie Roan in the main office.

4.5 Copier Code

You should obtain a copier code from Laurie Roan in the main office. This is a four number code which is necessary to use the copiers located in the mailroom. The copiers should only be used for department business, such as assistantship duties.

4.6 Student ID

You *must* get a student identification card during the first week (orientation) of the fall semester. The ID can be obtained by going to Room 103 in HUB.

4.7 Computer Accounts

There are two types of computer accounts available to statistics graduate students.

1. **UNIX account:** The UNIX system is the main operating environment in the department. Important departmental communication is done through electronic mail on this system. Instructions on the initial accessing of the account will be given during orientation. In addition, a UNIX class is held in the fall semester to help you learn about this computer environment.

When you leave the department, e.g. due to graduating, your UNIX account will be deleted after 60 days unless prior arrangements have been made with the system administrator. You can have the contents of your account copied to a CD-ROM disk. You will need to make arrangements with the system administrator for this.

2. **Center for Academic Computing(CAC) Access Account:** This account is assigned to all incoming Penn State students and allows access to the Penn State network. There are several PCs in 424 Thomas Building that are networked to the CAC system. To get your Access Account, take your current Penn State photo ID card to an automatic signature station and follow the instructions there. Stations are located at 103 Boucke Building, 6 Findlay Commons, W111 Pattee Library, 112 Redifer Commons, 107 Waring Commons, 108 Warnock Commons, and 2 Willard Building. Your userid and password should be active within 24 hours and will remain active until you graduate.

You can set your CAC account email to be sent to your Stat department account. To do this, use a web browser and go to <http://www.work.psu.edu> and click on the link to change your forwarding address.

4.8 First Paycheck

If you will be receiving financial support from the department, you will receive a monthly payment on the last working day of the month via direct deposit to your bank account. You will need to bring a canceled check and two forms of identification to the graduate secretary to set up direct deposit of paycheck. **However, expect to receive double pay in September and no paycheck in August.** Information about banking is available in the *The Guide to Graduate Life*. Many graduate students like to use the Penn State Federal Credit Union.

4.9 Instructional Development Program (IDP)

The Instructional Development Program throughout the graduate school offers workshops during the week before classes for first-time teaching assistants and instructors. By attending

February 5, 2002

the workshops you will learn about some creative and effective teaching techniques, as well as what it will be like to teach at a large university such as Penn State. It is also a great way to meet incoming graduate students from other departments.

Part II

Where to Hike – Graduate Degrees

5 Admission Requirements

The admission requirements for the department include the following:

- Completion of an undergraduate degree is required for admission to the graduate program of Statistics. You will need at least a 3.0 junior-senior average to be considered for admission.
- *Graduate Record Examination* (GRE). Students must submit scores on the general aptitude test of the GRE prior to admission. (Combined score of 1900 minimum).
- *Test of English as a Foreign Language* (TOEFL). All international applicants whose first language is not English or who have not received baccalaureate or master's degree from a United States institution must take the TOEFL. A minimum score, of 550 on the paper test or a score of 213 on the computer-based test is required for admission.

6 Master of Applied Statistics

6.1 Course Requirements

For the M.A.S.¹ degree, a minimum of 30 credits and a minimum grade point average of 3.0 are required for graduation. Of the 30 credits, 24 must be courses from the Statistics department and 21 must be at the 500 level.

Required Courses

There will be five core courses (The number of credits is in parentheses)[the prerequisites are in brackets]:

- STAT 414. Introduction to Probability Theory (3). [Multidimensional calculus]
- STAT 415. Introduction to Mathematical Statistics (3). [STAT 414]
- STAT 501. Regression Methods (3). [6 credits of Statistics or STAT 500 plus matrix algebra]
- STAT 502. Analysis of Variance and Design of Experiments (3). [STAT 501]
- STAT 580. Statistical Consulting Practicum (3)².

The frequency of offerings of the core courses every year are:

Spring	Summer	Fall
414, 415, 501, 502, 580	501, 502, 580	414, 415, 501, 580

Elective Courses

To complete the remaining credit requirements, a candidate can select 9-15 credits from the following elective courses (number of credits in parentheses) [prerequisites in brackets]:

- STAT 464. Applied Nonparametric Statistics (3). [3 credits of statistics or STAT 500]
- STAT 480. Introduction to Statistical Program Packages (1). [3 credits of statistics or STAT 500]
- STAT 500. Applied Statistics (3). [3 credits of Mathematics]
- STAT 503. Design of Experiments (3). [STAT 501 and 502]
- STAT 504. Analysis of Discrete Data (3). [STAT 502 and matrix algebra]

¹The MAS program is a separate non-funded program in the Statistics department.

²The Stat 580 course should be taken in the last year or last semester of enrollment. Each student in the MAS program must submit a written comprehensive final project report derived from his or her completed work in STAT 580. (Stat 580 is variable credit and is offered as a 2 credit course in the Fall, 1 credit course in the Spring and will be a 3 credit course in the Summer.) For all MAS students, the Stat 580 course will have a comprehensive written project report required as part of the course, which serves as the culminating experience.

- STAT 505. Applied Multivariate Statistical Analysis (3). [STAT 501 and 502]
- STAT 506. Sampling Theory and Methods (3). [3 credits of statistics or STAT 500]
- STAT 508. Applied Statistical Distribution Theory (3). [STAT 414]
- STAT 509. Biostatistical Methods (3). [3 credits of statistics or STAT 500]
- STAT 510. Applied Time Series Analysis (3). [STAT 501]
- STAT 597C Data Base Management using SAS (1). [STAT 480]
- STAT 597D Advanced Statistical Methods using SAS (1). [STAT 480]

In addition, students with suitable backgrounds may choose up to 6 credits from a departmental list of additional courses with approval from their advisor.

6.2 Program Examples

Sample program for the Fall, Spring, Fall, Spring sequence for the residence program:

Fall	Spring	Fall	Spring
414, 501, 509	415, 502, 506	503, 505, 580 (2 credits)	504, 580 (1 credit)

Sample program for the Summer, Fall, Spring, Summer sequence for the residence program:

Summer	Fall	Spring	Summer
501, 502 ¹	414, 503, 505, 509	415, 504, 506	580 (3 credits)

¹Note that Stat 501 is offered in the first session of the summer and Stat 502 is offered in the second session of the summer.

Master of Applied Statistics Degree Checklist

Required Courses

- _____ Stat 414 (3 credits)
 - _____ Stat 415 (3 credits)
 - _____ Stat 501 (3 credits)
 - _____ Stat 502 (3 credits)
 - _____ Stat 580 (3 credits)
-

Elective Courses

- _____ Stat 464 (3 credits)
- _____ Stat 480 (1 credits)
- _____ Stat 500 (3 credits)
- _____ Stat 503 (3 credits)
- _____ Stat 504 (3 credits)
- _____ Stat 505 (3 credits)
- _____ Stat 506 (3 credits)
- _____ Stat 508 (3 credits)
- _____ Stat 509 (3 credits)
- _____ Stat 510 (3 credits)
- _____ Stat 597C (1 credits)
- _____ Stat 597D (1 credits)

_____ **Total Statistic Elective Credits** (must be at least 9 credits)

_____ _____ (other courses)

_____ _____

_____ **Total Credits** (must be at least 30 credits)

7 Master of Arts and Master of Science Degrees

7.1 Course Requirements

A minimum of 30 graduate credits and a minimum grade point average of 3.0 are required for graduation. Of the 30 credits, 27 must be at the 500 level and 21 of the 27 must be courses from the Statistics department. The remaining credits must be courses at the 400 level or higher with approval by your advisor. You are expected to have knowledge of matrix algebra (Math 441, for example) and a computer programming language prior to entering the program, or you must register for appropriate courses in your first year of study. For a full-time terminal Master's student, you are expected to complete the Master's degree requirements by the end of the summer following the second year of study. If you have not completed your degree requirements at this time, you may be unable to receive departmental funding. All requirements for a Master's degree must be met within five years from the first semester of graduate study.

Each Master's program of study should meet the following requirements:

- 9 credits in probability and mathematical statistics (Stat 513, 514, 515)
- 6 credits in applied statistics (Stat 511, 512)
- 3 credits in Statistical Consulting Practicum (Stat 580)

In the Fall semester of their second year, the consulting course consists of a two credit course. As such, it will have two fifty-minute periods scheduled per week. One credit covers in class instruction and projects relating to the art of consulting. The other credit involves client contacts (about three per student).

In the Spring semester of the second year, Master's students continue with one credit of STAT 580 which will consist entirely of client contacts (about four per student). In addition, the course will have a single fifty-minute period scheduled per week. This time will be used to discuss client contacts with the class.

In the back of this section is a checklist sheet for you to keep track of your progress towards your Master's degree.

7.2 Examination Requirements

A qualifying exam which is based on material contained in Stat 511-515 is given after the completion of your first year. There are three possible outcomes from the exam which you could receive: (1) Pass with distinction, (2) Pass, or (3) Fail. This exam will first be given in May. For those who do not receive a pass on the May exam, there will be another test given in December or January. Students have three chances to pass it. Incoming students with a Master's degree in Statistics do not take the first year exam (see Section 8.2). All other students, including those entering with a Master's degree in another field, *will* be required

to take the first year exam. Old qualifying exams are on file in the department office, and they are extremely helpful as a studying aid.

7.3 Thesis or Paper Requirements

You may earn either a Master of Arts or a Master of Science degree.

Master of Arts In addition to satisfying the course requirements, you will need to submit a Master's paper on a topic approved by your advisor. While working on this paper, you may register for individual studies (Stat 596) or thesis research (Stat 600) *during regular semesters* in lieu of other courses. More can be taken during the summer with the understanding that according to Graduate School requirements, at most 3 credits of Stat 596 will be counted toward the 30 required credits. Master's of Arts students who go on internships can use a report on their internship project to fulfill the Master's paper requirement.

Master of Science In addition to satisfying the course requirements, you will need to submit a Master's thesis on a topic approved by your advisor. While working on your thesis, you must register for 6 graded credits of thesis research (Stat 600). The six credits may be distributed among several semesters. This is a general requirement made by the Graduate School for any student to obtain a Master of Science. Note that a Master's thesis must meet all the requirements established by the Graduate School's thesis office. A complete guideline can be obtained from the Thesis Office in Kern Building by calling 865-5448.

The paper or thesis advisor need not be the advisor assigned to you during the orientation meeting. If you select a new advisor, you must inform the Graduate Studies Chair of the change.

There are several Graduate School deadlines that you should be aware of as you plan to graduate. There is a deadline for declaring your intent to graduate, a deadline for submitting a draft of your thesis, and a deadline for final thesis submission. You will be notified of these deadlines by the department. You can also obtain a thesis calendar from the Thesis Office. (They can even email the calendar to you).

There is a collection of computer files to help with conforming to the with style guidelines from the Thesis Office. Contact a SAC representative for more details. The web site <http://cac.psu.edu/infotech/theses.html> contains more details.

7.4 Program Examples

First Year

Fall Semester: Most incoming students take Stat 511, 513, and 597C, a one-credit course entitled Introduction to Computing Environments. In addition, you may choose another statistics course, such as Applied Nonparametric Statistics (Stat 464), or a course from the following table:

If you're interested in ...	You should look into ...
Ecology	Stat 524 (Ecometrics)
Operations Research	Micrb 400 (Environmental Microbiology)
	MSIS 527
	CSE/Math 455 (Numerical Analysis I)
	Math 484 (Linear Programming)
	IE 505 (Linear Programming)
Biostatistics	IE 521 (Nonlinear Programming)
	IE 578 (Simulation)
	Stat 509
Computer Science	Biol 428 (Population Genetics)
	CSE/Math 451 (Numerical Computations)
	CSE/Math 455 (Numerical Analysis I)

Spring Semester: If you took Stat 511 and 513 in the Fall, you should continue with Stat 512, 514, and 515 and begin preparing for the qualifying exam offered in May.

Summer Session: Most students use this period to take a topics course in statistics and perhaps a course outside the department in an area of interest that complements the area of emphasis. Some students use this time to gain practical experience by obtaining an internship.

Second Year

If you will be staying to complete your doctoral degree, please see Section 8 for an example of the second year for a Ph.D. student.

If you are a terminal Master's student, you will generally take a total of three courses plus the required Stat 580 (Statistical Consulting Practicum). The consulting sequence consists of two credits of Stat 580 in the Fall and an additional one credit of Stat 580 in the Spring. Your second year courses can be a mixture of statistics courses and electives from other areas of your interest. Statistics courses in the second year are typically selected from the following: Stat 503, 504, 505, 506, 510, 524, 525, 527, 528, 540, 544, 551 and 597 (Special Topics). Descriptions of these course are available in the *Department of Statistics Graduate Program* booklet and *Graduate Degree Programs Bulletin*.

In addition, you should begin writing your Master's paper or thesis in the second year, as described in Section 7.3. You should attempt to complete this requirement in the spring semester or your second summer.

Master's Degree Checklist

	Stat 511 (3 credits)	
	Stat 512 (3 credits)	
	Stat 513 (3 credits)	
	Stat 514 (3 credits)	
	Stat 515 (3 credits)	
	Stat 580 (2 credits - Fall)	
	Stat 580 (1 credit - Spring/Summer)	
		(500 level Stat)
		(500 level Stat)
		(500 level Stat)
		(500 level Stat)
		(500 level Stat)
	Stat 600 (6 credits)	(MS students only)
	Subtotal (must be at least 21 credits)	

		(500 level - Non Stat)
		(500 level - Non Stat)
		(500 level - Non Stat)
	Subtotal (at most 6 credits)	

		(400 level)
	Subtotal (at most 3 credits)	

	Pass 1st year exam (on Stat 511-515)	
	Submit in Master's Thesis to Thesis office	(MS students)
	or Submit in Master's Paper to the department	(MA students)

Total Credits (must be at least 30)

8 Doctorate Degrees

8.1 Course Requirements

In addition to the core course requirements (Stat 511-515), the following courses are required in order to graduate with a Ph.D. (see also options section 8.3)

- 3 credits in Mathematical Analysis (Math 403) — students who demonstrate completion of an equivalent course may have this requirement waived.
- 3 credits in Probability Theory (Stat 517)
- 6 credits in Statistical Inference and Asymptotic Theory (Stat 561 and 562)
- 3 credits in Linear Models (Stat 551)
- 3 credits in Asymptotic Tools (Stat 553)
- 2 credits of Colloquium (Stat 590)
- 15 credits of electives taken from Stat 544, 545, 552, 564, 565, and 572, or other courses suggested by your committee.
- 3 credits of Statistical Consulting (Stat 580)

Note that it is possible for incoming students with a master's degree from another university to petition to have first-year courses waived. This is handled on a case by case basis in consultation with your advisor and the Graduate Studies Chair. See the checklist of doctoral degree coursework and examination requirements at the end of this section.

8.2 Qualifying Examination

The PhD qualifying exam based on material contained in Stat 551 and Stat 553 is given after the completion of your Fall semester of the second year. There are three grades (outcomes) from the exam which you could receive: (1) Fail. (2) Conditional Ph.D. Pass. (3) Ph.D. Pass. In order to be admitted to the Ph.D. program, you must achieve a Ph.D. level pass. Students have the opportunity to retake the qualifying exam once in the following May. The conditional Ph.D. Pass becomes a Ph.D. Pass if a student satisfies an additional requirement such as completing a master's thesis.

Students entering the program without a master's degree who want to pursue a Ph.D must take the first year required courses and first year exam before taking Stat 551 and 553.

8.3 Options

The Ph.D. in Statistics offers options in Biometrics, Biostatistics, Environmental Statistics, and Management Science and Information Systems. The course and examination requirements remain the same under these options. The different elective courses suggested for each

option are described in detail in the Department of Statistics Graduate Program booklet. Section 8.12 of this guide provides sample programs.

It is also possible for students to pursue a dual degree in Statistics and Operations Research. If you are interested in this degree, visit with the chair of the Operations Research Committee and the Department of Statistics representative (currently Dr. Arnold) early in your program of study for more details.

Some additional required courses for the dual degree in Statistics and Operations Research are:

- a minimum of 12 credits from linear programming I and II, mathematical programming, and dynamic programming.
- a minimum of 9 credits from inventory models, scheduling models, and waiting-line models.
- a minimum of 6 credits from computer science, including numerical methods and digital simulation techniques.
- a minimum of 15 credits in applications and/or specialization. These credits may all be in statistics.

8.4 Graduate Colloquium

As a Ph.D. student, you are required to register for 2 credits (1 credit per semester) of Stat 590, colloquium, during your program. This course is usually taken in the third year. The specific guidelines will be set up by the faculty instructor of the course. In the past, students have been required to attend all of the department colloquiums and to present one colloquium each semester.

8.5 Ph.D. Committee

During your third year, you should begin to form your Ph.D. committee in consultation with your advisor, who will be the chair of your committee. Your committee must have at least four members; at least three of these members (including your chair) must have faculty appointments in the Department of Statistics, and at least one member must be from outside the Department of Statistics and represent an area related to your research.

8.6 Foreign Language Requirement

There is no foreign language requirement for a Ph.D. in Statistics.

8.7 Residency Requirement

There is no required minimum number of credits or semesters of study to meet residency requirements. However, during some twelve month period between admissions to candidacy

and completion of the Ph.D. degree, the candidate must spend at least two semesters (including the semester in which the candidacy examination is taken) as a registered, full-time student engaged in academic work at University Park.

8.8 Graduate School Comprehensive Examination (and Proposal)

After forming your Ph.D. committee, you will need to schedule the Graduate School Comprehensive Exam. The comprehensive exam, as described in the *Graduate Degree Programs Bulletin*, will have both a written and an oral component. The content of the written component will be determined by your committee. The oral component of the exam consists of presenting your thesis research proposal to your committee. You will need to inform the Graduate Secretary of the date of your comprehensive exam at least two weeks in advance so the necessary paperwork can be filed. Note also that the Graduate School Comprehensive Examination should be taken at least three months before the final oral examination.

8.9 Thesis Guidelines

As a degree candidate, you must demonstrate ability to do independent research and competence in scholarly exposition through the preparation of a thesis topic related to your major subject. Your thesis should represent a significant contribution to knowledge, be presented in a scholarly manner, reveal an ability to do independent research of high quality, and indicate considerable experience in using a variety of research techniques. The thesis is to be developed under supervision of your advisor. You will be required to provide at least 3 bound copies of your thesis to the department (one for the Graduate School, one for the Department, and one for your advisor). Further information about preparing a thesis is available in *Thesis Guide: Requirements for the Preparation of Master's and Doctoral Theses*, which can be purchased in the Thesis Office in Kern Building.

There is a collection of computer files to help with conforming to the style guidelines from the Thesis Office. Contact a SAC representative for more details. Recently, the Graduate School has implemented a plan which will eventually require all dissertations to be submitted electronically. For more information about this requirement, please see the report posted at <http://cac.psu.edu/etd>, see also <http://www.gradsch.psu.edu/etd>.

8.10 Final Oral Examination (Thesis Defense)

Once you have satisfied all other requirements for your degree, you will need to arrange with your committee a suitable date for your final oral examination. You will need to inform the Graduate Secretary of the date of your final oral examination at least two weeks in advance so the necessary paperwork can be filed. The examination is related largely to your thesis, but it may cover your entire field of study. A passing vote from at least two-thirds of your committee is required to pass the final oral examination. If you fail, your committee will determine what changes you will need to make and when another examination, if any, may be taken.

8.11 Exceptions

For an exception to any of these requirements, you will need to submit a request in writing to the Graduate Studies Chair for consideration by the faculty. If you are granted an exception, you will receive a written statement of the exception terms.

8.12 Program Examples

First Year

This is similar to the first year of the master's program (see Section 7.4). Most students take Math 403 during the Fall semester of the first year. If you enter with a master's degree in statistics, you may want to petition to have first-year courses waived. This is handled on a "case by case" basis in consultation with your advisor and the Graduate Studies Chair.

Second Year

Fall Semester: Provided that you have been successful in obtaining a pass on the first year qualifying examination (or believe that you will when you next take it), you should begin taking the required courses of the Ph.D. program. In the fall of your second year, the courses you should take are Stat 551 (Linear Models), 553 (Asymptotic Tools) and two credits of Stat 580 (Consulting Practicum).

Spring Semester: In the Spring semester, You will need to take one more credit of Stat 580. Your remaining credits can be selected from electives or independent study. Remember that the Ph.D requires 15 credits of electives. Also, keep in mind that several courses, such as Stat 545, are offered every other year. Finally, you may want to consider writing a master's paper or thesis during this semester and/or the summer.

Remaining Years

In the third year, you will finish your required courses and begin to formulate a thesis topic. In the fall, you will need to take Stat 517 (Probability Theory), Stat 561 (Statistical Inference) and Stat 590 (Colloquim), which is a great way to hear about current research in statistics. In the spring, you will need to take Stat 562 (Asymptotic Theory) and Stat 590 (Colloquim). You should fill out your schedule with independent study or elective courses as needed. During this year, you should also form a graduate committee and consider a time to schedule your Graduate School Comprehensive Examination. After the required coursework is complete, most students focus on their research and may sit in on courses in which they are interested (rather than registering for these for credit). Depending upon what point you are at in the program, the "independent study" courses for which you need to register differ. See Section 9.2 for a detailed description of these courses.

Doctoral Degree Checklist

Required Courses

- _____ Math 403¹ (3 credits)
- _____ Stat 517 (3 credits)
- _____ Stat 561 (3 credits)
- _____ Stat 562 (3 credits)
- _____ Stat 551 (3 credits)
- _____ Stat 553 (3 credits)
- _____ Stat 590 (2 credits - Fall & Spring)
- _____ Stat 580 (2 credits - Fall)
- _____ Stat 580 (1 credit - Spring/Summer)
- _____ OR Stat 585 (1 credit - Spring/Summer)

Electives

- _____ Stat 544 (3 credits)
- _____ Stat 545 (3 credits)
- _____ Stat 552 (3 credits)
- _____ Stat 564 (3 credits)
- _____ Stat 565 (3 credits)
- _____ Stat 572 (3 credits)
- _____ _____ (other course(s) suggested by committee)
- _____ _____

_____ Total elective credits
(must be at least 15)

Examination Requirements

- _____ Ph.D. pass on 2nd year exam
- _____ pass comprehensive exam
- _____ pass final oral exam

¹may be waived if student demonstrates completion of an equivalent Mathematical Analysis course

Part III

Preventing Forest Fires – Other Stuff to Know

9 Academic Policies

9.1 Normal Academic Progress

You are expected to complete the minimum credit requirement each semester as specified in Section 4.2 and to maintain a grade point average of 3.00. If your GPA should fall and remain below this standard for two consecutive semesters, you are placed on academic probation. You should be aware that this situation may be grounds for removal from the program.

9.2 Independent Study and Thesis Research Credits

The following courses have been designed for doing independent study or working toward the completion of a thesis. These are useful as summer courses, as courses for meeting the continuous registration requirements, and after completion of coursework.

1. Stat 596 - Independent Studies. This course is suitable for studying a particular subject under the direction of a faculty member. It can be taken for 1-9 credits. This course is also suitable for meeting the registration requirements of Pre-Doctoral lecturers – those Ph.D. students who are TA's or RA's and have completed all course work, but have not yet passed the Graduate School Comprehensive Examination. See Section 10.3 for important information about the Pre-Doctoral lecturer status.
2. Stat 600 - Thesis Research. This course has been designed for Master's students working on their thesis who do not need to maintain full-time status. One credit is usually recommended for students not on assistantships. The Graduate Council has established limits on the total number of research credits that can be assigned letter grades in a student's program: 6 graded credits for master's candidates and 12 for doctoral candidates. You are required to write a brief memo describing the objectives for the course and identifying the faculty member who will be responsible for evaluating your progress. Note: M.S. candidates must register for 6 graded credits of Stat 600 to complete the degree requirements.
3. Stat 601 - Ph.D. Dissertation Full Time. This course is only for Ph.D. students who have completed their course work and have passed the Graduate School Comprehensive Examination. It can only be taken for 0 credits and is used to keep your student record active. Students should only register for 601 if all of their time is being devoted to thesis research/writing.
4. Stat 610 - Thesis Research Off Campus. This course is suitable for Ph.D. students who decide to finish their dissertation off-campus.

These are summarized in the following table:

Independent Study Courses

Stat 596	MA or MS topics Pre-Doctoral Lecturer Summer credits
Stat 600	MA or MS thesis research
Stat 601	Ph.D. students who have passed the comprehensive exam and reside at University Park
Stat 610	Ph.D. students who have passed the comprehensive exam and reside outside University Park

9.3 Summer Registration

If you are on a teaching or research assistantship for both the Fall and Spring semesters, you are eligible for a summer tuition grant-in-aid which allows you to take courses the following summer. The department encourages you to utilize this by registering for elective courses and completing your schedule with Stat 596 to reflect the efforts on your paper or thesis research. This also maintains your full-time student status if you register for at least 6 credits.

9.4 Travel Funds

The department encourages you to attend professional meetings and become acquainted with the statistical societies: ASA, IMS and ENAR. Funds are allocated when possible to provide travel grants to cover part of the cost of travel, housing, and registration at those meetings. An announcement is made during the Fall semester. Priority is given to students who will present a paper or poster, Ph.D. students nearing the end of their studies, and students who receive matching funds from other organizations and sources. To apply for travel funds, you will need to submit a memo stating your purpose and a proposed budget to the Department Head. A supporting statement from your advisor is also helpful. The decision on awarding funding is made by the Graduate Studies Chair and the Department Head usually by December for meetings during the next calendar year.

10 Miscellaneous

10.1 Departmental Activities

Colloquiums

Every Thursday and occasional Tuesdays, the graduate students and faculty from the Statistics Department gather in the department conference room (327 Thomas) at 3:30 p.m. to eat cookies and drink coffee or tea. Then at 4pm, the group attends a departmental colloquium. Usually, the colloquium talk is given by someone from another university who has been invited to present and discuss their current research. There are always a wide variety of topics and applications. Notification is made by an email sent a few days before the scheduled day of the talk which contains the speaker's name as well as the title and abstract of their talk. As a graduate student, you are strongly encouraged to attend the department colloquia. It is a great way to meet faculty, other graduate students, and be exposed to the "hot" (and sometimes controversial!) topics in statistics.

Student Organized Seminars (SOS)

Every Friday at lunchtime there is a brownbag student organized seminar (SOS). These seminars are organized by the SAC (see below) and are geared to the graduate students in the department. Topics of the talks include: summer internship experiences, current masters and PhD students' research, and presentations by industry representatives or alumni about employment opportunities. All graduate students are encouraged to attend these weekly seminars — bring your lunch and we'll provide the cookies!

Committees

Students are also encouraged to become involved with committees within the department and the graduate school as a whole. Some examples of committees are:

- Student Advisory Committee (SAC)
In the fall, students from each year in the program elect one or two people from their year to be on the SAC. The SAC has a wide range of functions which serve the graduate students and faculty within the department. The SAC organizes social activities, such as department tailgates and happy hours, as well as the SOS brownbags. The SAC also works hard to maintain this "Guide to Survival in the Statistics Department!"
- Graduate Student Association (GSA)
The GSA is a great organization to join if you are interested in meeting graduate students from other departments and seeing some of the political side of graduate school life. Each year the Department of Statistics elects two graduate students to serve as representatives at the GSA meetings. The GSA does a lot on campus to serve the graduate student community. For example, it shows foreign and alternative films for free every weekend, holds blood drives, and provides garden plots. The GSA has two meetings every month (usually Tuesday evenings), and the meetings last about an hour. It's a fun way to get involved and does not require a huge time commitment.

Other Activities

There are several other department-sponsored events that you will be invited to attend: the Fall picnic in September, the Holiday party in December, and the Ice Cream Social in April. These events are a lot of fun and are a good way to get to know the other members of the department in an informal setting. We encourage you to take advantage of all such opportunities.

As mentioned previously, there are a number of graduate students in the department who enjoy going to the football games together. However, football is not the only sport at Penn State; many students also enjoy going together to watch the men's basketball team play. Basketball season tickets go on sale in October, so if you're a Hoops fan, keep your eyes and ears open. There are also smaller groups of students who enjoy watching some of the less marquee sports at Penn State, like hockey, soccer, baseball, volleyball, wrestling, and gymnastics. Penn State is very competitive in many of these sports, and most offer free admission. If these or other sports interest you, please ask around; you'll probably find someone else who is interested as well.

There are also groups of students from the department who have actively take part in Intramural competition. In the past years, we've had teams represent the department in sports like coed volleyball and men's soccer. And these teams have done well, too. The Fall 1996 coed volleyball team finished in 2nd place in their division with a 5-1 record and the Spring 1995 men's soccer team won the Intramural Championship!

Another major event held in the Spring semester is the Alumni Workshop. The intent of this workshop is to provide an opportunity for current graduate and undergraduate students to network with alumni from our department. During this event, alumni give talks about their research, job and/or their companies. Interviews may also take place during this event for internships and job opportunities.

10.2 Assistantship Opportunities

Many graduate students are TA's for Stat 200 during their first year in the Department of Statistics; however, there are many other possibilities for assistantships as you continue through the program. These opportunities include:

- teaching an undergraduate statistics course
- grading for one or more statistics courses
- research assistantship
- Statistical Consulting Center assistantship
- Biostatistics assistantship at The Hershey Medical Center
- Ecology assistantship with the Center for Statistical Ecology and Environmental Statistics

- Population Research Institute consulting assistantship
- Minitab assistantship
- Dupont assistantship

10.3 Pre-Doctoral Lecturers

Between the time you finish your Ph.D coursework and pass the Graduate School Comprehensive exam, you will be classified as a Pre-Doctoral lecturer. If you are an instructor, you will be paid 4 times during each semester instead of the usual 5. In the fall, you will be paid in September through December and in the spring, you will be paid in January through April. In addition you are responsible for paying for your own tuition and fees as well as health insurance at the beginning of each semester. The department will reimburse you for these expenses through the 4 paychecks plus add additional money to cover the increased taxes.

10.4 Taxes

Every year, the Graduate Student Association publishes *The GSA Tax Guide* to aid Penn State graduate students in understanding and completing their taxes. This publication is free of charge and may be obtained from the GSA office in 111B Kern. It is also available online through the GSA homepage at <http://cac.psu.edu/~gsa>. Tax regulations for graduate assistants may change on a yearly basis, so it is important to be aware of how the regulations may affect your tax status. For example, research assistants who are doing research toward their degree may have different state tax obligations than other types of assistantships. To find out more about these PA state tax regulations regarding, contact the GSA tax office during tax season.

10.5 Career Resources

As graduation approaches, your thoughts include what career path you want to pursue. There are several resources that may help you in this search. During the Alumni Workshop, various companies conduct interviews. This is a great way to network with alumni and learn more about their work. Another resource is the Penn State Career Services, They provide interviews with different employers every week throughout the year. Check out <http://www.sa.psu.edu/career> for more information. They also hold a Career Fair each semester. Finally, from our department homepage we have links to other statistical websites, such as the ASA webpage, which has links to postings for various statistical positions.