**TIPS AND CLARIFICATIONS FOR THE COMPUTATIONAL AND APPLIED MATHEMATICS MAJOR**

The major in Computational and Applied Mathematics (CAM) is a degree offered jointly by the departments of Computer Science, Mathematics, and Statistcs. (We will refer to these as the CAM departments below.) Students interested in the major should look at the requirements in the college catalog. This guide is to help understand the requirements. There is also a worksheet at the end that will be useful in discussing the program the Director of Undergraduate Studies (DUS).

This guide will discuss how to choose courses. There is some discussion about substitutions but this guide is not a “legal” document in the same way that the college catalog is. Any substitution (other than those listed below as not needing preapproval) must be approved in writing by the DUS.

The current Director of Undergraduate Studies (DUS) is **Greg Lawler**, 415 Eckhart, [lawler@math.uchicago.edu](mailto:lawler@math.uchicago.edu). If you wish to discuss the major with him, feel free to e-mail to set up an appointment.

**PHYSICAL SCIENCE**

**REQ:** PHY 13100-13200 CHEM 12100-12200 or higher.

PHYS 14100-14200 definitely satisfies this requirement (and does not need preapproval by the DUS). AP credit in Physics is for the 120’s sequence of physics and does **not** satisfy this requirement. Students with AP Physics credit can talk with the DUS about possible courses in other departments that could satisfy this requirement. Students without AP credit should take one of the sequences listed above.

**MATHEMATICS IN FIRST AND SECOND YEARS (1 + 3 courses)**

**REQ:** MATH 16300 or 15900; MATH 20300-20400-20500 or

MATH 20700-20800-20900

The selection of math courses in the first and second year is identical to what one would choose for a mathematics or statistics major; indeed, a student does not need to decide in their first year which major they will follow. The mathematics department makes recommendations for incoming mathematics students and these should be followed. The initial sequence of courses should end with either MATH 16300 or MATH 15900. Students must complete one of these courses for the major. (Note: MATH 15900 is the same as what used to be numbered MATH 19900; either fulfill this requirement.)

The next course to take is the analysis sequence MATH 20300-20400-20500 which is required for the major. The honors sequence MATH 20700-20800-20900 also satisfies this requirement. (Students who complete MATH 20700-20800-20900 do not need to take either MATH 16300 or MATH 19900.)

**PROGRAMMING (2 courses)**

**REQ:** CMSC 12100-12200 OR 15100-15200 OR CMSC 16100-16200

Students must complete a two-quarter sequence in programming. This can be CMSC 12100-12200, 15100-15200, or 16100-16200. The last of these is a sequence designed for well-prepared prospective computer science majors. Any of these sequences is fine for the CAM major, and we suggest consulting the computer science department if you wish guidance as to which course is best for you. We recommend that this sequence be taken by the end of the second year but this is not a requirement.

**LINEAR ALGEBRA (1 course)**

**REQ:** STAT 24300

This course is on numerical linear algebra and assumes the introduction to linear algebra in either MATH 16300 or MATH 15900. It is offered in the autumn and we recommend that it be taken no later than autumn of the third year. Students who take a full year of abstract algebra in the mathematics department (MATH 25400-25500-25600 or 25700-25800-25900) can use those three courses to fulfill this requirement (this does not need preapproval of the DUS). (Note that this requires three quarters in order to be exempted from a one-quarter course, so it is not an easy way to satisfy the requirement!)

**PROBABILITY AND STATISTICS (3 courses)**

**REQ:** STAT 244\*0-24500 and one of STAT 25100, STAT 25300, OR MATH 23500

The sequence STAT 24400-24500 is the major sequence in statistics. It is offered autumn/winter and winter/spring. The course STAT 25100 is the introduction to probability and is the course most CAM majors will use for this requirement. It is currently offered autumn and spring. There is a little overlap between STAT 24400 and STAT 25100. In the autumn, STAT 24410 is designed for students who have already had STAT 25100; we recommend the students who started with STAT 25100 to take this. Students should know some multivariable calculus (multiple integration, in particular) to take these courses.

MATH 23500 is a second course in probability (Markov chains, martingales, and Brownian motion) and covers different material than in STAT 25100. Strong students who have done well in STAT 24400-24500 may take MATH 23500 without having STAT 25100 in which case this will count for this requirement. Students who want to take both STAT 25100 and MATH 23500 can count the latter course as an elective course if the DUS approves it as part of the three-course elective group. MATH 23500 is offered in the spring.

STAT 25300 is a course that does part of STAT 25100 and part of MATH 23500. It may be being phased out, so students should not count on being able to take this course. However, if a student has taken this course, it satisfies this requirement.

**DISCRETE MATH AND ALGORITHMS (2 courses)**

**REQ**: CMSC 27100—27200

This sequence is offered fall/winter. Well prepared students who are strong enough to place in CMSC 27200 without CMSC 27100 may substitute a higher level course in discrete math/algorithms given by the computer science department. Courses that are approved without prior approval are CMSC 27410, CMSC 27500, or graduate courses in the range 37100 to 37503. The DUS might approve other courses but they should be in the area of discrete math with a view towards algorithms.

**OTHER REQUIRED COURSES (3 courses)**

**REQ:** MATH 27300, STAT 28000, MATH 21100 or 21200

MATH 27300 is a course on ordinary differential equations and is offered in the winter.

STAT 28000 is an applied mathematics course on optimization and is offered in the spring.

MATH 21100 and 21200 are courses in numerical analysis. The more theoretical version MATH 21200 is offered in the fall and the less theoretical version MATH 21000 is in the spring. Either one satisfies this requirement.

**THREE ELECTIVE COURSES (3 courses)**

**REQ**: three elective courses approved by the DUC

Students must choose three elective courses in consultation with and approved by the DUS. These will be more advanced and generally taken after more of the required courses have been completed. The idea is for the student for focus on the areas of computational and applied mathematics that are relevant for his or her interests. Some of these courses may be in departments other than the CAM departments, but they must have a quantitative level equivalent to an upper level course in the CAM departments. The choices should complete a cohesive program focused on a particular specialty. (Cohesive choices do not have to be in the same department, and courses in the same department are not necessarily cohesive.) As noted above, if a student has taken STAT 25100 for the probability requirement, then MATH 23500 is eligible to be used as an elective course (although it, as well as any other selection, must be chosen in the consultation with the DUS).

**HONORS AND SENIOR PAPER**

Students who wish to graduate with honors must have a minimum GPA of 3.25 in the major courses as well as complete a senior paper. If a student wishes to do this, he or she should give a proposal by the end of the third year suggesting an advisor and topic. The proposal will be evaluated by the CAM committee and must be approved. The main advisor does not need to be a member of a CAM department, but the project must have a significant computational or quantitative component. We would expect such papers to be finished by the beginning of the last quarter, and a presentation given in the last quarter. (We hope to have a special “presentation day” with talks by all the students writing senior papers that year.)

ANSWERS TO SOME QUESTIONS

**What should I do if I am interested in the CAM major?**

Please send an e-mail to the DUS (Greg Lawler, 415 Eckhart, [lawler@math.uchicago.edu](mailto:lawler@math.uchicago.edu)) and your name will be put on the electronic mailing list. You can also make an appointment to talk to Professor Lawler and go over a tentative program. The actual declaration of the major is done through the college.

It might be useful to fill out the worksheet (as much as you can) before the visit.

**Can I do a double major?**

We do not recommend a double major of CAM with computer science, statistics, or a “regular” math major. Students would be better served just choosing one and perhaps using the resources of other majors in selecting their electives.

However, for students considering Ph.D. level work in applied and computational mathematics, especially in programs in mathematics departments, we might suggest combining the CAM major with an honors mathematics major. This would be excellent background for this.

Double majors with other departments are challenging but we encourage students to try if they want to. One natural double major is CAM and economics which would give excellent training for graduate work in economics or work in the financial industry. Biological sciences give another natural possibility for a double major.

**WORKSHEET --- MAJOR IN COMPUTATIONAL AND APPLIED MATHEMATICS**

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**COURSE NUMBER**  **QUARTER (TO BE) TAKEN**

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First course (MATH 15900/19900 or MATH 163)

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Analysis (MATH 20300-20400-20500 or MATH 20700-20800-20900)

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Programming (CS 12100-12200, 15100-15200, or 16100-16200)

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Linear Algebra (STAT 24300)

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Discrete math and algorithms (CS 27100 and 27200 or higher level)

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Statistics (STAT 244\*0-24500)

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Probability (STAT 25100 or MATH 23500 or other)

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Differential Equations (MATH 27300)

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Numerical methods (MATH 21100 or 21200, and STAT 28000)

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Three approved elective courses

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If going for honors give the advisor and tentative title for the Senior Paper.

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