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## A. ECON 354 WINTER 2020 SYLLABUS

Any changes or corrections to this information will be announced on Q and in class. Students are responsible for making note of these changes.

### Contact Information

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**Hours** **Please check on Q for regular hours.** Feel free to request by email or in person an appointment at other times.  
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### A&S Calendar Description & Course Format

An introduction to numerical methods as used in economics, finance, and related fields. Topics include

- optimization
- non-linear systems
- numerical approximation
- simulation.

Includes a major project where students implement economic models or replicate work found in the literature. Prerequisite: ECON 255 Co-requisite ECON 250 (or Stats 263). Programming experience is recommended but not required. Econ 354 does *not* follow a standard lecture-assignment-exam format. Some differences:

- Some class meetings are more "active" through students working on code and algorithms both individually and in teams.
- Not-for-credit assignments are posted in a discussion forum which allows students to see answers submitted by other students after they have submitted their own.
- Students select one of two grading schemes. The "Crash Course" is a lower risk and lower "return" plan designed for students with limited programming experience. The "Challenge Course" has higher risk and higher return to appeal to students with stronger programming backgrounds. However, students are free to choose either stream.

### Learning Outcomes

#### By the end of this course, students will:

1. Be able to design, write, debug and test simple Ox programs. As this process is similar across most computer languages a student will be to learn a new language much more quickly.
2. Understand how numbers, matrices, and functions are represented in computers and the implications for accuracy of computations
3. Be familiar with standard algorithms used to solve economic models and how they are implemented in Ox.
4. Students in the "crash course" scheme will have written Ox programs to solve specific problems. Students in the "challenge course" will have designed, tested and documented a program that relates to economics.

### Assessment

#### Five items can enter the course grade, denoted G

The five items are labeled **M** (midterm), **H** (homework), **A** (final assignment), **F** (final exam), and **P** (project).

In turn, M and H are combined into a term grade **T** for all students

For most students, items A and F are combined into a course completion grade **C**.

Some students can select an option so that **C** is based on a project grade (P).

#### Graded Items

All items in Econ 354 are graded with letter grades, including plus or minus.

- Work During the Term (**T**)
  - In-class Midterm (M) covering Part I and some of II of C4E
  - Group-eligible Homework Assignment (H)
  - The term portion of the grade will be completed and posted by week 10.
  - There are many optional exercises and in-class activities that are not graded.

- Course Completion (**C**)

**The Course Completion phase has two possible streams: Crash Course or Challenge Stream**

- To have the option to take on the Challenge Option, the student must receive at least an A- on the term work **T**.
  - perform reasonably well in the 'hackathons' and other non-graded assignments.
- Challenge Project (P)

Students who meet the criterion can choose to carry out a final coding project (probably in a group) instead of the final assignment and exam. The project parameters are agreed upon with me and a commitment made by a deadline.

Once finalized, a student cannot switch back to the Crash Course option. The grade item **C** will equal the project's grade, **P**.

▪ Crash Course:

Students not meeting the criterion or who do not want to work on a project complete the course with two items: an *individual* assignment (**A**) and a final exam (**F**) combined into **C**.

### Weights and Grade Calculations

All items in Econ 354 are graded with letter grades, including plus or minus. These letter grades are combined by taking the midpoint grade and adding one "tick" if there is a gap. Call this  $mid^+(x, y)$ .

**The term grade (T) equals  $mid^+(M, H)$ .**

Example: the midpoint of B and A- is B+. By adding a tick the result is **T=A-**. The midpoint of B- and A- is somewhere between B and B+, so this gets rounded up to **T=B+**. The same grade occurs for C+ and A-, because the midpoint is B, but adding a tick results in B+.

**The course completion grade (C) equals  $mid^+(A, F)$  for the Crash Course stream. For the Challenge Stream it is simply the project grade C=P.**

**The course grade (G) is the midpoint of T and C, except an extra tick is given only if the C grade is better than the T grade.**

Example: **T=B** and **C=A-**. Then **G= $mid^+(B, A-)=A-$**  (the student did better at the end so receives a "tick" up). However, if **C=B** and **T=A-**, then **G= $mid(B, A-)=B+$** , that is the midpoint without the plus tick. If **C=B-** then **G=B** (the partial tick is not given).

In other words, your performance at the end of the term matters more than during the term if it is better. If your performance at the end is worse it gets equal weight.

Also, note that a project in the Challenge Stream that receives A+ results in a **G=A+** for the course, because **T** is at least A-.

## Required Resources

### C4E: Computation For Economists

Lecture notes. The printed version is available directly from the instructor. It costs \$20 payable in cash or by Interac transfer.

There is a large incentive for purchasing the paper version of the notes: your copy can be used in the midterm and final exams. Nothing else can be brought in.

### Ox Console on Your Laptop

Students are expected to have a laptop available for use during some classes and to carry out assignments.

### Code Directory

Programs referred to in the lecture notes and exercises. One of the files in the directory is a Zip file containing all the programs that you can download to your laptop.

### A free student GitHub account

### GitHub Desktop software on your Laptop

## Activities

### Optional Exercises

The course notes have exercises. Some of these exercises (or possibly new ones) will appear on the course's GitHub classroom page or posted as a *topic* in the Econ354 onQ Assignment Forum. They are chosen to keep the student on track with the material and to prepare for the graded activities. The due date is when the forum topic is locked and students cannot post a response to the topic.

Since use of GitHub Classroom is new and experimental more details will be given later about the optional exercises.

### Hackathons

Hackathons are planned in-class programming activities. Typically they start from an assignment in the Assignment Forum that is locked just before class. Students begin with that program and we build on it incrementally. Instructions show up on the screen with no code so that students get practice converting a plan or desired calculation into code.

## Expected Schedule

| Week | Monday Topic                 | Wednesday Topic                      |
|------|------------------------------|--------------------------------------|
| 1    | Overview, Intro to GitHub    | Examples, Ox Essentials, more GitHub |
| 2    | Expressions & Hardware       | Plans (ifs and loops)                |
| 3    | Codes and Numbers            | Functions                            |
| 4    | Addresses, Scope             | Hackathon                            |
| 5    | Coding Style                 | Linear Algebra                       |
| 6    | Calculus 1                   | Midterm (M)                          |
| 7    | Sys. & Opt. 1                | Sys. & Opt. 2                        |
| 8    | Calculus 2                   | Hackathon                            |
| 9    | Simulation 2 (HW due)        | Economics                            |
| 10   | Economics ( <b>T</b> posted) | Economics                            |
| 11   | Economics                    | Projects, Code Development           |
| 12   | Review, practice, help       | Review, practice, help               |

### Exam Period

Final, Assignment and Project due dates TBD

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## B. WHAT'S GOING ON PLAN OF THIS BOOK

The plan of this book is simple:

- Begin with the `hello world` program in the Ox programming language.
- End with applications of numerical methods to some basic economic models and a few advanced ones.