ECON 3127
Computational Methods in Economics

This course will teach the basics of programming and computational skills for economic analysis and enable the students to take numerical approach to familiar mathematical problems. Students will learn to graphically represent familiar ideas such as supply and demand curves, equilibrium prices and consumer choice. They will explore how these choices and equilibria change with shifts in policy instruments, preferences and technologies. In the process they will learn to use common computational solution methods, such as root finding and optimization. Students will also learn how to obtain, manipulate and represent data, using tools such as scatterplots and histograms.

Mode of Delivery	On campus
Prerequisites	To enrol in this course you must have previously completed ECON2125 or equivalent.
Incompatible Courses	Incompatible with ECON4414 and ECON8014
Course Convener:	Fedor Iskhakov
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Office hours for student consultation:	By appointment
Research Interests	Structural microeconometrics, computational economics
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RSE Students Webpage	https://www.rse.anu.edu.au/students/
Lecturer(s)	Fedor Iskhakov
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Office hours for student consultation:	As above

COURSE OVERVIEW
Course Description

This course will teach the basics of programming and computational skills for economic analysis and enable the students to take numerical approach to familiar mathematical problems. Students will learn to graphically represent familiar ideas such as supply and demand curves, equilibrium prices and consumer choice. They will explore how these choices and equilibria change with shifts in policy instruments, preferences and technologies. In the process they will learn to use common computational solution methods, such as root finding and optimization. Students will also learn how to obtain, manipulate and represent data, using tools such as scatterplots and histograms.

Learning Outcomes

1. Basic programming skills (conditions, loops, flow control, iteration, etc.)
2. Ability to implement familiar mathematical methods on computer
3. Reinforcement of key ideas from economic analysis
4. Algorithm and data manipulation and visualization of economic data

Assessment Summary

Assessment Task	Value	Due Date	Date for Return of Assessment	*Linked Learning Outcomes (optional)*
1. Weekly problem sets		Approximately weekly	*The aim is to have the assessment returned ca. 2 teaching weeks after each assessment*	*1-3*
2. Midterm exam (take home group assignment)	40%	By the end of semester break		*1-3*
3. Final exam	60%			*1-4*

There will be no special examinations for the mid-semester exam. Instead for students who would normally meet the requirements for a special exam (eg medical certificate), the weighting will be moved to the final exam. Students who do not sit the mid-semester exam and do not meet the necessary requirements for a special exam will receive a zero.

Research-Led Teaching
The teaching methodology in this course is strongly motivated by recent research in computational economics.

Feedback
Staff Feedback
Students will be given feedback in the following forms in this course:
- In class interactions with verbal comments;
- Weekly lab tutorials with questions/answers and verbal comments;
- Consultations by appointments;
- Mid term exam (take home group assignment) with written comments;

Student Feedback

ANU is committed to the demonstration of educational excellence and regularly seeks feedback from students. One of the key formal ways students have to provide feedback is through Student Experience of Learning Support (SELS) surveys. The feedback given in these surveys is anonymous and provides the Colleges, University Education Committee and Academic Board with opportunities to recognise excellent teaching, and opportunities for improvement.

For more information on student surveys at ANU and reports on the feedback provided on ANU courses, go to
http://unistats.anu.edu.au/surveys/selt/students/ and
http://unistats.anu.edu.au/surveys/selt/results/learning/

Policies

ANU has educational policies, procedures and guidelines, which are designed to ensure that staff and students are aware of the University's academic standards, and implement them. You can find the University's education policies and an explanatory glossary at:
http://policies.anu.edu.au/

Students are expected to have read the Academic Misconduct Rules 2014 before the commencement of their course.

Other key policies include:
- Student Assessment (Coursework)
- Student Surveys and Evaluations

Recommended Resources
- Lecture notes
- Jérôme Adda, Russell W. Cooper "Dynamic Economics: Quantitative Methods and Applications", MIT Press, 2003
- Online resources to be advised specifically for each topic

Examination material or equipment
Check course Wattle page for final details.

COURSE SCHEDULE

Week/ Session	Summary of Activities	Assessment
1	Course introduction. Housekeeping. Introduction to Python. Floating point arithmetics.	None
2	Python essentials. Flow control. Algorithms. Complexity.	Weekly problem sets Midterm exam Final exam
3	Object oriented programming. Data structures. More on graphics.	Weekly problem sets Midterm exam Final exam
4	Linear programming with Python.	Weekly problem sets Midterm exam Final exam

5	Optimization. Newton and quasi-newton methods.	Weekly problem sets Midterm exam Final exam
6	Simulation. Interpolation. Probability and statistics.	Midterm exam Final exam
7	Function approximation. Interpolation and extrapolation.	Weekly problem sets Final exam
8	Finite Markov chains.	Weekly problem sets Final exam
9	Dynamic programming I. Sequential discrete choice.	Weekly problem sets Final exam
10	Dynamic programming II. Continuous choice.	Weekly problem sets Final exam
11	Data manipulations and analysis. Data visualization.	Weekly problem sets Final exam
12	Introduction to structural estimation of economic models.	Weekly problem sets Final exam
	Examination period	

ASSESSMENT REQUIREMENTS

The ANU is using Turnitin to enhance student citation and referencing techniques, and to assess assignment submissions as a component of the University's approach to managing Academic Integrity. For additional information regarding Turnitin please visit the [ANU Online](#) website.

Students may choose not to submit assessment items through Turnitin. In this instance you will be required to submit, alongside the assessment item itself, copies of all references included in the assessment item.

Assessment Tasks

Participation
Completing weekly problem sets and taking midterm exam are optional though highly recommended. Students who do not submit weekly problem sets or the midterm exam will be able to count the final exam for bigger weighting of the total mark. No supplementary weekly problem sets or midterm exam assignments will be given.

Assessment Task 1: Weekly problem sets
Details of task: The weekly problem sets will build on the week's lecture material and ask students to perform short coding exercises. The answer will be posted a week later and discussed in the lab tutorial.
Value: 5% in total
Estimated return date: The following week.

Assessment Task 2: Midterm exam
Details of task: Take home group assignment to be performed in small groups of max 3 people using "pair programming" approach with switching roles. The nature of the task is coding up a particular economic model and performing simple analysis with it.
Value: 35%

Presentation requirements: One person from each group (or subset of groups, depending on the enrollment) will present the code in the first lab tutorial following the midterm break.
Estimated return date: Approximately two weeks after the due date.
Individual Assessment in Group Tasks: as a rule, identical grades for group participants, with the possibility of special considerations.

Assessment Task 3: Final exam
Details of task: The final exam will cover material presented throughout the semester and will be held during the university examination period.
Value: 60%
Estimated return date: Approximately two weeks after the due date.

Examination(s)
Please check Wattle course page for final details.

Assignment submission
Online Submission: Assignments are submitted using Turnitin in the course Wattle site. You will be required to electronically sign a declaration as part of the submission of your assignment. Please keep a copy of the assignment for your records.

Extensions and penalties
Extensions and late submission of assessment pieces are covered by the Student Assessment (Coursework) Policy and Procedure.

No submission of assessment tasks without an extension after the due date will be permitted. If an assessment task is not submitted by the due date, a correspondingly bigger weight for the final exam will be used.

Returning assignments
Please check Wattle course page for details.

Scaling
Your final mark for the course will be based on the **raw** marks allocated for each of your assessment items. However, your final mark may not be the same number as produced by that formula, as marks may be **scaled**. Any scaling applied will preserve the rank order of raw marks (i.e. if your raw mark exceeds that of another student, then your scaled mark will exceed the scaled mark of that student), and may be either up or down.

Privacy Notice
The ANU has made a number of third party, online, databases available for students to use. Use of each online database is conditional on student end users first agreeing to the database licensor's terms of service and/or privacy policy.   Students should read these carefully.

In some cases student end users will be required to register an account with the database licensor and submit personal information, including their: first name; last name; ANU email address; and other information.

In cases where student end users are asked to submit 'content' to a database, such as an assignment or short answers, the database licensor may only use the student's 'content' in accordance with the terms of service – including any (copyright) licence the student grants to the database licensor.

Any personal information or content a student submits may be stored by the licensor, potentially offshore, and will be used to process the database service in accordance with the licensors terms of service and/or privacy policy.

If any student chooses not to agree to the database licensor's terms of service or privacy policy, the student will not be able to access and use the database. In these circumstances students should contact their lecturer to enquire about alternative arrangements that are available.

SUPPORT FOR STUDENTS
The University offers a number of support services for students. Information on these is available online from http://students.anu.edu.au/studentlife/

Other Information
Building Access Hours
Both CBE and HW ARNDT are:
TEACHING PERIOD = Mon – Fri 07.45 to 21.15 and SAT, SUN and Public Holidays is not accessible by students.
Both CBE and HW ARNDT are:
NON TEACHING PERIOD = Mon – Fri 08.00 to 18.00 and SAT, SUN and Public Holidays is not accessible by students.

RSE has a Frequently Asked Questions page where you can find relevant policies and information on a broad range of topics, the onus is on the student to familiarise themselves with this page and the information available.
https://www.rse.anu.edu.au/students/students/frequently-asked-questions/