

CS1112

Foundations of Computer Science I

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<http://osullivan.ucc.ie/teaching/cs1112/>

Acknowledgement

I would like to thank the previous professor who delivered this module, Professor Ken Brown, for generously sharing his teaching materials with me. I will be basing much of my own lectures on his content, along with some new material.

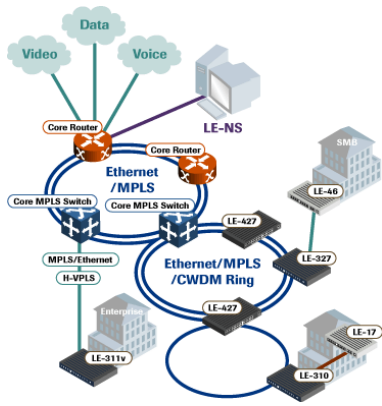
This Lecture

what is CS1112?
how CS1112 works

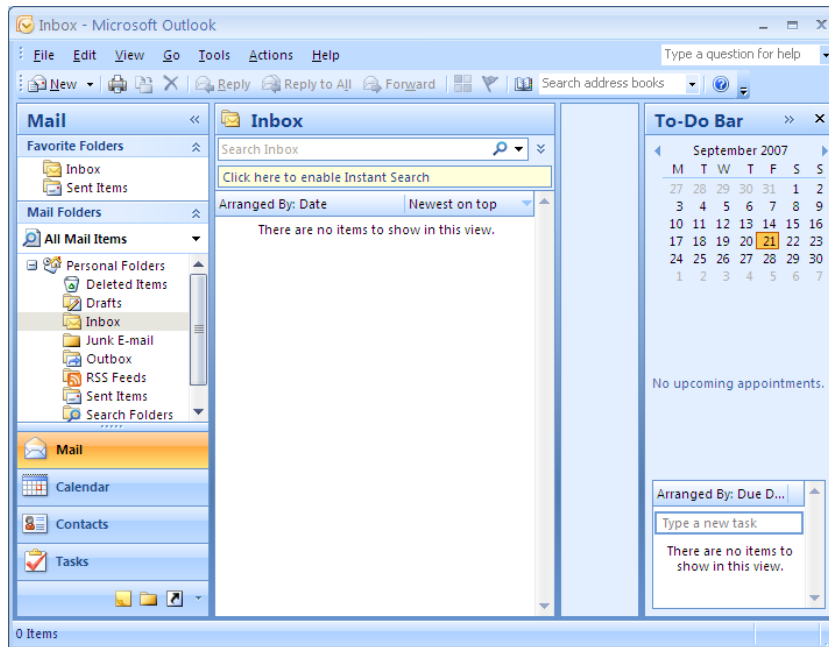


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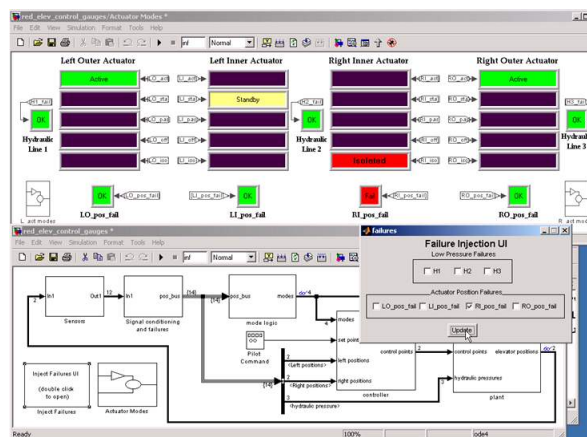
Computers



Using Computers



Click on the values in each percentile to view the organisations within.



... but what is Computer Science?

Computer science is the study of:

- Computer systems
 - What are they? How do they work? How do we link them together? How do we design and build them? How do people interact with them?
- Computer software
 - What is it? How does it run on computer systems? How do we write it? How do we use it?
- Computation
 - What can be computed? What are the principles underlying it all? What implications do they have?

Models

A *model* is a representation of (part of) a world that can be used to explain or predict or demonstrate features of the world that is being modeled.



Example:

An ordnance survey map is a model of some terrain that can be used to work out where you are, where you should go next, and what you can expect to find.

Computer science is all about models – representing them, manipulating them, and understanding their limitations

Computer Science

How does
a computer
work?

How are
computers
networked
together?

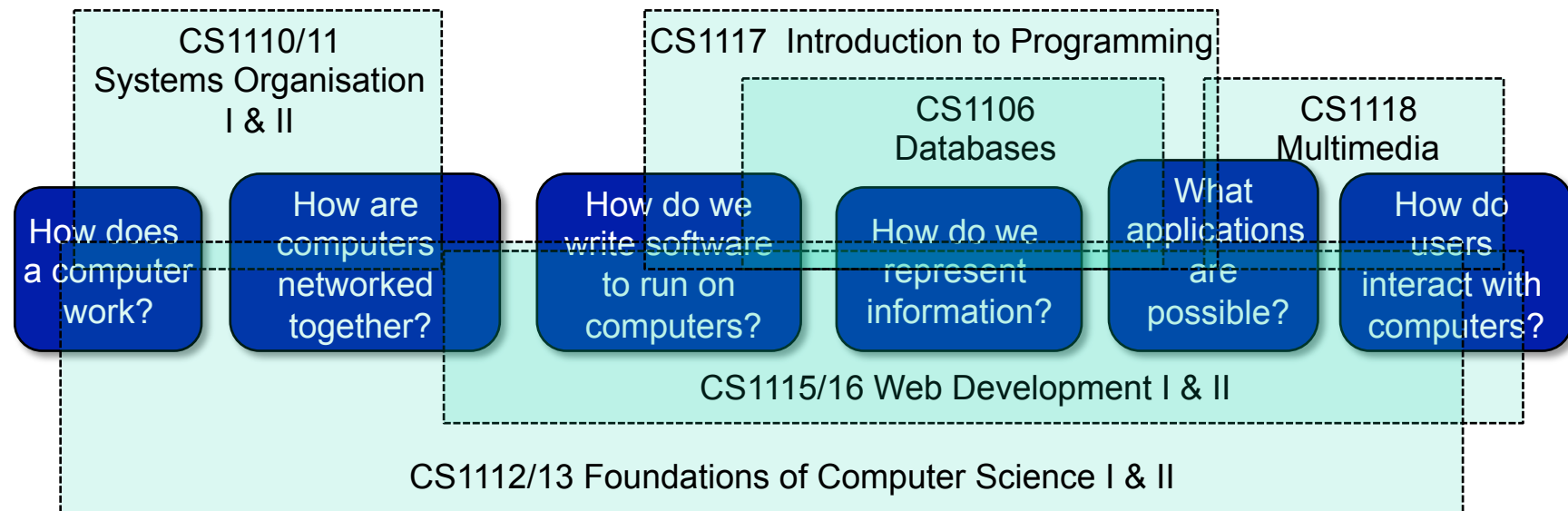
How do we
write software
to run on
computers?

How do we
represent
information?

What
applications
are
possible?

How do
users
interact with
computers?

Computer Science and UCC's 1st year modules



And what are we going to do in “Foundations...”?

- The main aim is to provide you with the skills you need to complete the rest of the degree program
- We will start with a broad picture of Computer Science
- We will teach you:
 - How to describe collections of objects
 - How to express yourself clearly and precisely
 - How to understand requirements
 - How to understand arguments
 - How to analyse what you have done
 - Many techniques used throughout computer science
- And you will succeed by practising regularly ...

Is this mathematics?

- In one sense, yes it is ... but it is unlike most of the mathematics you did in your final years in school
- In some cases, it is going back to the type of maths you did in primary school
 - counting, matching, colouring, ...
- We are going to concentrate on how you do things and why you would want to do them
 - practical techniques with plenty of examples
- The syllabus includes: sets, functions, relations and logic
- **All of it** will be useful for Computer Science and beyond

Glove Selection

I have 24 gloves in a drawer:

- 5 pairs of blue gloves
- 4 pairs of black gloves
- 3 pairs of red gloves

The gloves are mixed up and loose in the drawer. The room is dark, and I can only check the colours and shapes when I take the gloves out of the room.

What is the minimum number of gloves I need to take out the room to guarantee

- a matching pair?
- a matching pair of each colour?



Carrying the torch

4 people need to cross a bridge at night, all starting on the same side, and they have 1 torch between them. Only two people can cross at a time, and to be safe one of them must be carrying a torch. The torch must be carried back for the next crossing. Any group must cross at the speed of the slowest member of the group.

- Angela takes at least 1 minute to cross
- Barack takes at least 2 minutes to cross
- David takes at least 5 minutes to cross
- Enda takes at least 10 minutes to cross



How quickly can you get them all across the bridge?

And now the formal module description ...

When does CS1112 meet?

The course consists of lectures and supervised problem solving classes.

2 **lectures** per week:

Monday 2 pm, WGB 1.07

Tuesday 2 pm, WGB G.05

2 hours of supervised **problem solving classes** per week:

Monday 10--12, WGB G-20, or

Monday 3--5, WGB G-20

The problem solving class schedule is tentative at the moment and will be confirmed over the next few days.

Course Aims

The main aims of CS1112 are:

- To develop a broad understanding of the discipline of Computer Science and related topics
- To prepare students for further study in Computer Science, by developing skills in the foundational techniques needed to analyse, design, implement and communicate computational problems and solutions.

Intended learning Outcomes

On successful completion of the course, you should have **knowledge and understanding** of

- the discipline of Computer Science
- methods of representing collections of objects
- logical representation
- some basic tools for analysing computational problems

(**Intellectual skills**) You should be able to

- Read, interpret and manipulate statements in simple formal notation

Learning outcomes (continued)

(**Practical skills**) You should be able to

- Formulate computational problems using representations such as sets, functions and logical specifications
- Solve problems expressed in formal notation
- Derive formal proofs of logical statements

(**Transferable skills**) You should also be able to

- think creatively in problem solving
- express problem-solving ideas logically

Assessment

- 1 90-minute written exam in December, worth 80% of the total marks.
- Continuous assessment, worth 20% of the marks.

You must pass the **combined** exam and continuous assessment.

There will be a repeat exam in the Autumn.

The continuous assessment will consist of in-class tests, at times to be announced.

Course Material

<http://osullivan.ucc.ie/teaching/cs1112/>

All course information, practical problems, and notes will be posted on the course website.

News items will be posted here - you must look at it regularly - at least once a week.

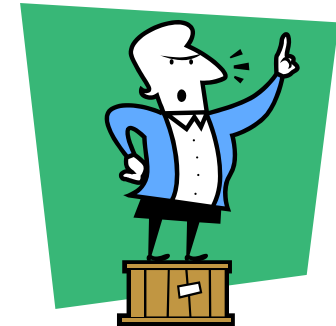
Course notes

- Course notes will soon be available on the Resources tab of the web page. The notes also include all of the problem exercises we will look at in problem solving classes.
- All definitions, notation, concepts and results are listed in these notes.
- **BUT BEWARE:** you cannot survive just by reading these notes. You must attend the lectures and problem classes.
 - The notes are provided to make sure you have a clean copy of every definition and result.

Textbook

- There is **no** required textbook for this module.
- All information you need to succeed on the module will be provided in class or in the online course notes.
- Three different textbooks are suggested on the course web page, and using these books should help you develop your skills.

- Lectures are there to guide you through a module
 - Description of new concepts and techniques
 - Motivation for why they are useful
 - Examples of how to use the techniques
 - Explanations, demonstrations, and discussion
- You need to take notes during each lecture
 - the course notes contain all definitions of new concepts, methods and symbols
 - but you cannot survive with these notes alone
- Bring an A4 notepad and pen to each lecture.
 - you must write down the examples and solutions
- Attendance at lectures is a vital part of the course
 - read ahead, and come prepared



Problem Solving

- Problem solving is an art - if you don't practise it, you will not become good at it
- the exam will be testing your practical ability at solving problems
- the continuous assessment is mostly problem solving
- if you can't solve problems, you won't pass
- the problem solving classes are so that you can practice, and get help from the demonstrators as you go along
- you **must** attend, and you **must** attempt the problems
- There will be regular course work assignments for submission – you are expected to make a serious attempt at each one

Working in your own time

The University assumes you will spend ~8 hours per week on a single semester 5-credit course, not counting revision. For CS1112 there are 4 timetabled hours, so you should be doing ~4 hours of work in your own time. To do well on the course, **you will need to spend this time**, and possibly more.

- some of this will be reading the lecture notes, or completing answers to tutorial questions
- most of it will be problem solving - you will need to spend time sitting down with pencil and paper, trying to solve problems - it is the only way to learn how to do it.
- **you need to do this as you go along** - you can't leave it all until the weeks before the exam, and you cannot rely on memorising things

THIS IS IMPORTANT!

Every year, some students don't treat the practical classes and private study seriously. They don't attend, or come late, or don't make an effort. They don't ask for help. They fall behind and can't do the assignments. They panic in December, and try to memorise large chunks. They fail the exam. They fail the repeat exam in August.

Don't let this happen to you.

You need to take responsibility for your own learning. Attend. Work steadily. You will know fairly quickly if you are struggling. If you don't understand something, re-read the notes, look for other sources, ask the demonstrators to explain.

How difficult is CS1112?

The pass rate in CS1105 (the previous version) was strongly correlated with effort. The key to success in CS1105 was **regular work**. If you work steadily throughout the year, make a serious attempt at all the assignments, and ask for help when you are struggling, you can expect to pass, and you will enjoy it more.

The main idea of CS1112

precise communication

- be clear in your head about what you want to say
- make sure what you write says exactly what you want
- make sure you are only using terms or symbols that have already been defined for the reader
- beware of possible misinterpretations

Next lecture ...

The fundamental idea in Computer Science:

An Introduction to Algorithms