CA215 Languages and Computability

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Recommended Text: *"Elements of the Theory of Computation"*, H.R. Lewis and C.H. Papadimitriou, Prentice Hall, ISBN 0-13-272741-2

Schedule

Lectures

Day	Time	Location	Type
Tuesday	11:00	CG86	Lecture
Tuesday	16:00	Q122	Lecture
Tuesday	17:00	QG22	Tutorial

Labs

There are no scheduled labs on this course.

Assessment

Assessment for this course will be as follows:

Component	Weight
Mid-term exam	25%
End-of-year exam	75%

The mid-term exam will actually take place about week 8 and will be multiple-choice.

The end-of-year exam will consist of ten reasonably short questions, all of which must be attempted.

What is the Point of This Course?

Within this course, we will be answering the following questions:

1. What are the limits of what can be solved by computer?
2. What are the limits of what can be solved by computer within a reasonable period of time or space?

Obviously, a computer has only a finite amount of memory, so there are problems which are too large for it to solve. We abstract away from these limitations and consider the questions of what can be solved by an ideal computing device, one which is not limited in its memory capacity - but is still required to produce an answer in a finite amount of time.

- *Computability theory* is concerned with exploring the limitations of such idealized computing devices.
- *Complexity theory* is concerned with calibrating the resources - both time and space - required to solve a problem.

Languages and Computability

In this course, we will see that computation can be regarded as a process of *language recognition*.

We will study a number of languages of increasing descriptive power.

We will also study a number of abstract machines of increasing power, which can be used to recognise each of these languages.

Some of the machines which we will study are as powerful as any real computer, while others are less powerful.

We will see that these less powerful machines are nevertheless quite useful.

Course Outline

1. Mathematical Prerequisites
2. Regular Languages and Finite Automata
3. Context-Free Languages and Pushdown Automata
4. Context-Sensitive Languages and Linear-Bounded Automata
5. Unrestricted Languages and Turing Machines
6. Unsolvable Problems
7. Computational Complexity