

4CCS1ELA – ELEMENTARY LOGIC WITH APPLICATIONS

PRELIMINARIES TO THE COURSE

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Outline

1. Lecturers and Structure
2. Practical Information
3. Logic and Applications
4. Syllabus and Reading List

LECTURERS AND STRUCTURE

Lecturers and Structure

Lecturer (main part of the course)

Dr. Odinaldo Rodrigues

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Office hours: No appointment necessary for ELA. Just turn up!

- Mondays: 1pm–2pm, S1.19
- Thursdays 2pm–3pm:

6/10	S6.06	3/11	By appointment	1/12	S4.29
13/10	K-1.88	10/11	S6.06	8/12	S6.06
20/10	S4.29	17/11	S4.29	15/12	S4.29
27/10	S6.06	24/11	S6.06		

Course structure

12 weeks, with a *reading* week (break from classes).

- Lectures: Mondays 3pm–5pm, FWB-B.5
- Tutorials: Mondays 5pm–6pm, FWB-B.5 (guided exercises)
- Small Group Tutorials (SGTs), allocated in smaller groups every second week, starting in week 2 (next week). Find out what your session is. Answer questions and go through exercises together with assistant. Please take a proactive attitude.

*College regulations stipulate that attendance at lectures, tutorials, and SGTs is **compulsory**. Do not miss them!*

PRACTICAL INFORMATION

Practical Information

Course material: <http://keats.kcl.ac.uk>.

- Please download and print out the slide handouts and problem sheets before the lectures and tutorials
- Try to familiarise yourself with the material before the lectures to anticipate difficulties
- Attend office hours to clarify doubts
- Use your KCL e-mail address in all communication with me and include your student id for easy identification
- Try not to lag behind the material, as it gets “challenging” fairly quickly!

Assessed Coursework

- Two early examinations
- Taking place in week 4 (starting 17/10) and week 9 (starting 21/11)
- Together worth 15% of total marks
- More details to be announced

Reading week

- Occurs in conjunction with the rest of the department
- 31/10 – 04/11
- There are no classes during this week
- Please confirm office hours if you plan to attend
- It is a catch up opportunity

Lecture style

Combination of slide projection and visualiser where appropriate.

- Slides contain definitions, theorems, some proofs, and class exercises
- Visualiser is used for “live” solutions, examples, explanations

As a rule of thumb, only the slides are available for download. I will aim to upload visualiser material, but this is not always possible: take notes.

Lecture style (contd.)

Policy on questions:

- Questions during class are very welcome. Feel free to interrupt me at any time.
- Do not feel embarrassed to ask anything you do not understand.
- If the answer to your question is relatively short, you will get an immediate response.
- Use the Q&A forum on KEATS to ask questions outside classes, so that your friends can benefit from the answers.

Help me to help you

Your responsibilities:

- Bring the slides and tutorial sheets to the classroom
- Remember that the slides *do not replace attendance in class*
- Pay attention to the lectures, take notes
- Check KEATS frequently for updates

Discipline

Use common-sense, respect your colleagues.

During lectures:

- ☐ No talking
- ☐ No eating
- ☐ No drinking
- ☐ No doing homework during class
- ☐ Put your mobiles on silent
- ☐ Feel free to ask questions!

Beware of illusions of understanding!

Learning mathematics is very different from learning many other subjects.

- ☐ Theory requires **precise** as opposed to 'sloppy' understanding.
- ☐ How to check understanding?
 - ☐ Follow examples in class/textbook/tutorials.
 - ☐ Do as many exercises as you can: practice makes perfect!
 - ☐ Past exam questions are available and can be taken as advanced exercises (tutorial questions=longer, exam questions=more focussed)
 - ☐ Solutions to past exams not available, but I'm happy to discuss your solutions with you

LOGIC AND APPLICATIONS

Logic and Applications

What is Logic?

It is the formal study of reasoning, i.e., how to construct and understand arguments and verify whether certain conclusions follow from designated premises.

Symbolic logic:

- Use of formal languages – syntax and semantics.
- Proof theory and model theory.
- Use of *formal reasoning*, as opposed to intuition.

Mathematical logic was developed in an attempt to confront the crisis in the foundations of mathematics at the turn of 20th century.

Where is Logic today?

Alan Turing (1912-1954):

“I expect that digital computing machines will eventually stimulate a considerable interest in symbolic logic. The language in which one communicates with these machines ... forms a sort of symbolic logic”

M. Davis (A half-century survey on The Universal Turing Machine, 1988):

“Today the connections between logic and computers are a matter of engineering practice at every level of computer organization”.

Interest trend (a non-scientific indication)

Google search statistics:

Term	Sep 2009	Sep 2011	July 2015
Logic and Mathematics	97.4K results	37.9M results	74.6M results
Logic and Philosophy	132K results	70.5M results	104M results
Logic and Computer Science	3.6M results	26.5M results	120M results

Logic in Computer Science

- Computer circuits design
- Knowledge representation and reasoning
- Database query languages, query optimization
- Computer aided software and hardware verification
- Computational and description complexity
- Planning and automated theorem proving
- Problem solving research
- Programming language development, operational and denotational semantics
- Semantic web

SYLLABUS AND READING LIST

Course syllabus

- Propositional logic:
 - Languages of propositional logic
 - Semantics of propositional logic
 - Formal reasoning in propositional logic
- Predicate (first-order) logic:
 - First-order languages
 - Semantics of first-order languages
 - Formal reasoning in first-order logic
- Proof methods and strategies
- Applications of logic to programming

Reading list

Most introductory logic books will do nicely!

Here are some suggestions:

- Dov M. Gabbay and O. Rodrigues, Elementary Logic with Applications, to appear 2016, College Publications
- Dov M. Gabbay, Logic for Artificial Intelligence and Information Technology. Texts in Computer Science, Vol. 9, ISBN 978-1-904987-39-0, College Publications, 2007
- Kenneth H. Rosen, Discrete Mathematics and its applications. McGraw Hill
- James Hein, Discrete Structures, Logic and Computability. Second edition, Jones and Bartlett 2002

Complementary books

- David Makinson. Sets, Logic and Maths for computing. Springer-Verlag London Ltd (May 2008)
- John Kelly. The Essence of Logic. The Essence of Computing Series. Prentice Hall, 1997
- Jean H. Gallier. Logic for Computer Science. Revised online version, 2003

All material needed for a successful result in the exam is covered by the slides, tutorial problem sheets, and SGT lists, but it is likely you will need further help to understand the subject.