

# Logic

## HUMA 1720 – Spring 2021

The Hong Kong University of Science and Technology (HKUST)

<b>Lecturer:</b>	Dr. T.Y. William Wong
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<b>Office Hours:</b>	Weds 2-4pm
<b>Lecture Location:</b>	Online via Zoom (Links on Canvas)
<b>Schedule:</b>	T, Th 3:00pm to 4:20pm (see lecture outline for public holiday exceptions)
<b>TA:</b>	TBA
<b>TA E-mail:</b>	TBA

### HKUST Catalog Course Description

This course is designed to provide students with a basic knowledge of logic, so that they can apply logical techniques to analyze various problems of reasoning in ordinary language and to examine the fallacies of thinking in daily life. The course includes topics such as the basic concepts of logic, logic and language, fallacies and definitions, sentential logic, and syllogism.

### Further Description

Logic is the systematic study of arguments for internal cogency. Colloquially, one is most likely to have encountered philosophical logic through everyday concepts such as premises, conclusions, validity, fallacies, and inferential rules.

This Spring 2021 course is an introduction to formal philosophical logic and can be divided into *three* parts. In the first part, we will systematically consider basic concepts in logic, such as validity, soundness, and inferential rules, as well as learn how to recognise logical structure in natural language (i.e. English). In the second part, we will learn the syntax and semantics of sentential logic (*aka* propositional logic), in order to be able to identify and understand the logical structure of sentences written in sentential logic. In the third part, we will extend the very same learning objectives to predicate logic. Importantly, students will also be taught how to perform natural derivations for both sentential and predicate logic in parts two and three.

*A brief note:* students from mathematics, computer science, linguistics, and related areas may appreciate the familiarity of logical thinking and symbol manipulation. However, there is no expectation nor requirement for students to have had any experience in logic, maths, computer science, or linguistics. Rest assured that students from other disciplines will also be able to master this course and perform well, as history has shown.

### Course Objectives

There are three key objectives. Students will, first, gain an understanding of key concepts and principles in philosophical logic, including, validity, soundness, inferences, and fallacies. Secondly, students will be able to use these concepts and logic to identify logical structures in natural language and assess their validity.

Thirdly, and more technically, students will learn how to manipulate logic symbols, use predicate quantifiers, and perform derivations in both sentential and predicate logic (first-order logic).

<b>HKUST HUMA 1720 Course ILOs</b>	
1	Paraphrase the logical definition of argument.
2	Distinguish valid from invalid arguments and translate sentences of ordinary language into the formal language of logic.
3	Explain in their own words important logical terminology such as valid, invalid, sound, unsound, consistent, inconsistent, contingent, necessary, theorem, tautology.
4	Use logical methods to elaborate correct reasoning, construct proofs in formal systems for sentential logic and syllogism, and use semantic methods (truth tables, counter-models) to test for validity and related properties.
5	Examine some of the sophisticated and interesting problems in philosophy through some paradigm examples.

### Course Assessment

Participation (Attendance) .....	5%
Test 1 (Validity, Fallacies, Sentential Logic Symbolisation, Truth Tables).....	15%
Test 2 (Sentential Logic Derivations Only).....	20%
Test 3 (Predicate Logic Symbolisation and Derivations) .....	20%
Final Exam (All Material Covered) .....	40%

### Participation Policy

Participation points for this course are solely by attendance (Zoom logs attendance time). You can miss up to three mandatory lectures or tutorials. Attendance is counted after the drop date.

### Assignments and Practice Aids (How to Do Well)

It is relatively straight forward to do well in this course. Like almost any other skill, one can simply get better with practice. As such, the practice with problem sets will allow one to get better at identifying logical structures and performing derivations. For each week (but not each lecture), students will be expected to practice, on their own, a number of problem sets provided in the reading. If you do not practice, you will fall behind (I guarantee it).

Students will be able to attend a maximum of two group tutorials – one in the week of the 9<sup>th</sup> of March, and the other in the week of the 25<sup>th</sup> of March. Office hours on an individual basis are also available by appointment.

### Associated Course Materials (Readings and Software)

1. *LogicText*. Terence Parson. (made available online by author).
2. *An Introduction to Formal Logic*. Peter Smith. (recently made available online by author).
3. Excerpt from *A Concise Introduction to Logic*. Patrick J Hurley (2014). (will be posted online).
4. Logic2010 (made available for free by David Kaplan). I will provide an in-class demonstration on the 2<sup>nd</sup> of March.

## Online Proctored Examinations and Academic Honesty

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In the spirit of social distancing, examinations and tests will be conducted online via Zoom, and will be appropriately proctored to ensure academic honesty. Accordingly, all students will require a webcam and a quiet place in which to partake tests and examinations.

All tests and examination are open book, and students will be provided a 'cheat sheet' of all logical rules with which to perform derivations.

At the beginning of a test or examination, access to the examination questions will be provided to students attending the Zoom exam. Students are to complete the exam with pen and paper on A4 lined paper, whilst being proctored via webcam. At the end of the examination, students are to take a photograph or scan their exam papers and then upload them to Canvas (further details to be announced) within a period of 10 minutes.

Each page must have the student's name, SIS ID, page number, and the student's signature at the top.

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**Lecture Outline**

<b>Date</b>	<b>Lecture # and Topic</b>	<b>Agenda</b>	<b>Reading and Practice Assignments (not graded)</b>
2 <sup>nd</sup> February 2021	1. <b>Introduction</b>	<ul style="list-style-type: none"> <li>• What is Logic?</li> <li>• Why study Logic?</li> <li>• Course Overview</li> <li>• Introduction to Argumentation</li> <li>• How to Do Well in This Course</li> <li>• Poll (Background and Year)</li> <li>• Deduction vs Induction</li> </ul>	
4 <sup>th</sup> February 2021	2. <b>Logical Basics</b>	<ul style="list-style-type: none"> <li>• Validity</li> <li>• Soundness</li> <li>• Reading Comprehension Exercise</li> <li>• Introduction to Symbolisation</li> <li>• Logical Operators</li> </ul>	Start Reading Peter Smith (2003) Chapters 1 & 2 <i>before</i> class.
9 <sup>th</sup> February 2021	3. <b>Sentential Logic Symbolisation I</b>	<ul style="list-style-type: none"> <li>• Validity Review</li> <li>• SL Symbolisation</li> <li>• More Logical Operators</li> <li>• WFFs</li> <li>• Order of Precedence</li> <li>• If, Only If</li> <li>• Examples</li> </ul>	<i>Finish</i> Reading Peter Smith (2003) Chapters 1 & 2 <i>before</i> class.
11 <sup>th</sup> February 2021	4. <b>Sentential Logic Symbolisation II</b>	<ul style="list-style-type: none"> <li>• Necessary and Sufficient Conditions</li> <li>• Or, Unless, Although, Even</li> <li>• Examples</li> </ul>	Read LogicText Chapter 1 (sections 1 to 3) <i>before</i> class.
16 <sup>th</sup> February 2021	5. <b>Truth Tables I</b>	<ul style="list-style-type: none"> <li>• Full Truth Tables</li> <li>• TVAs</li> <li>• Shortened Truth Tables</li> <li>• Truth Table Semantics</li> </ul>	Read Peter Smith (2003) Chapter 3 <i>before</i> class.
18 <sup>th</sup> February 2021	6. <b>Truth Tables II &amp; Inferential Rules</b>	<ul style="list-style-type: none"> <li>• Shortened Truth Tables</li> <li>• Truth Table Semantics</li> <li>• Modus Ponens</li> <li>• Modus Tollens</li> <li>• Modus Tollendo Pollens</li> </ul>	<b>Do Practice Sheet 1</b> <i>after</i> class.

Date	Lecture # and Topic	Agenda	Reading and Practice Assignments (not graded)
23 <sup>rd</sup> February 2021	7. <b>Inferential Rules &amp; Fallacies</b>	<ul style="list-style-type: none"> <li>• MP, MT, MTP Review</li> <li>• Introduction to Formal Fallacies</li> <li>• Denying the Antecedent</li> <li>• Affirming the Consequent</li> <li>• Live Examples</li> <li>• Informal Fallacies</li> </ul>	Read Patrick J. Hurley (2014) Chapter 3 Excerpt (i.e. until section 3.2) <i>before</i> class.
25 <sup>th</sup> February 2021	8. <b>Term Test 1</b> (On Material from Lectures 2-7)	<ul style="list-style-type: none"> <li>• Proctored Online</li> <li>• Webcam and Student ID Required</li> <li>• A4 Lined Paper</li> </ul>	
2 <sup>nd</sup> March 2021	9. <b>Derivations in Sentential Logic I</b>	<ul style="list-style-type: none"> <li>• Symbolisation</li> <li>• Direct Derivations</li> <li>• Why Derivations?</li> <li>• Basic Mechanics of Derivations</li> <li>• MP, MT, MTP in Derivations</li> <li>• Logic2010 Demonstration</li> </ul>	Read LogicText Chapter 1 (section to 4) <i>before</i> class.
4 <sup>th</sup> March 2021	10. <b>Derivations in Sentential Logic II</b>	<ul style="list-style-type: none"> <li>• MP/MT/MTP Revision</li> <li>• Group Exercise</li> <li>• More Rules: DN, S, ADJ, ADD</li> <li>• Conditional Derivations</li> <li>• Indirect Derivations</li> <li>• Rules 'Cheat Sheet'</li> <li>• Informal Anonymous Feedback &amp; Suggestions (Qualtrics Link)</li> </ul>	Read LogicText Chapter 1 (section 5), Chapter 2 (sections 1 to 3) <i>before</i> class. Do Chapter 1 section 5 exercises <i>after</i> class.
9 <sup>th</sup> March 2021	11. <b>Derivations in Sentential Logic III</b>	<ul style="list-style-type: none"> <li>• CD and ID Review</li> <li>• Even More Rules: BC, CB</li> <li>• Miscellaneous</li> </ul>	Read LogicText Chapter 1 (sections 6-8), Chapter 2 (sections 4-5) <i>before</i> class. Do Chapter 1 section 6 and 9 exercises <i>after</i> class. <b>Do Practice Sheet 3 <i>after</i> class.</b>
11 <sup>th</sup> March 2021	12. <b>Tutorial Group A</b> (Half the Class)	<ul style="list-style-type: none"> <li>• Demonstrations</li> <li>• 'Tricky' Questions</li> <li>• Problem Sets</li> <li>• Questions and Answers</li> </ul>	
16 <sup>th</sup> March 2021	13. <b>Tutorial Group B</b> (Half the Class)	<ul style="list-style-type: none"> <li>• Demonstrations</li> <li>• 'Tricky' Questions</li> <li>• Problem Sets</li> <li>• Questions and Answers</li> </ul>	

Date	Lecture # and Topic	Agenda	Reading and Practice Assignments (not graded)
18 <sup>th</sup> March 2021	14. Term Test II	<ul style="list-style-type: none"> <li>• Proctored Online</li> <li>• Webcam and Student ID Required</li> <li>• A4 Lined Paper</li> </ul>	
23 <sup>rd</sup> March 2021	15. Introduction to Predicate Logic	<ul style="list-style-type: none"> <li>• Differences between SL and PL</li> <li>• Syntax and Symbolisation Beginnings</li> <li>• Universal and Existential Quantifiers</li> <li>• Group Exercises</li> <li>• Relation to Syllogistic Logic</li> </ul>	Read LogicText Chapter 3 (sections 1 to 4) <i>before</i> class.
25 <sup>th</sup> March 2021	16. Predicate Logic Symbolisation I	<ul style="list-style-type: none"> <li>• Symbolisation</li> <li>• Universal and Existential Quantifiers</li> <li>• Restricted Antecedents and Predicating Consequents</li> <li>• Symbolisation Exercises</li> </ul>	Read LogicText Chapter 3 (section 5) <i>before</i> class. Do LogicText Chapter 3 (section 5 all exercises) <i>after</i> class.
30 <sup>th</sup> March 2021	17. Predicate Logic Symbolisation II	<ul style="list-style-type: none"> <li>• Continuation of Symbolisation</li> <li>• Universal and Existential Quantifiers</li> <li>• Two and Three Place Predicates</li> <li>• Scope</li> <li>• Symbolisation Exercises</li> </ul>	
1 <sup>st</sup> April 2021	18. No Class: Mid Term Break		
6 <sup>th</sup> April 2021	19. No Class: Mid Term Break		
8 <sup>th</sup> April 2021	20. Predicate Logic Symbolisation III	<ul style="list-style-type: none"> <li>• Multiple Quantifiers</li> <li>• Groupings</li> <li>• Following the Canonical Forms</li> </ul>	<b>Do Practice Sheet 3 <i>after</i> class.</b>
13 <sup>th</sup> April 2021	21. Derivations in Predicate Logic I	<ul style="list-style-type: none"> <li>• Derivations in PL (Basic Rules)</li> <li>• UI and EI</li> <li>• Exercises</li> <li>• PL in Logic 2010</li> </ul>	Read LogicText Chapter 3 (section 6 to 7) <i>before</i> class. Do LogicText Chapter 3 (section 6 exercises) <i>after</i> class.

Date	Lecture # and Topic	Agenda	Reading and Practice Assignments (not graded)
18 <sup>th</sup> April 2021	22. Derivations in Predicate Logic II	<ul style="list-style-type: none"> <li>• Derivations in PL</li> <li>• UI, EG, EI, and QN</li> <li>• Universal Derivations</li> <li>• Exercises</li> <li>• Questions and Answers</li> </ul>	Read LogicText Chapter 3 (section 8) <i>before</i> class. Do LogicText Chapter 3 (section 7 exercises) <i>after</i> class
20 <sup>th</sup> April 2021	23. Derivations in Predicate Logic III	<ul style="list-style-type: none"> <li>• Group Exercise</li> <li>• Further Derivations</li> <li>• Strategy</li> </ul>	Do LogicText Chapter 3 (section 8 exercises 1a, 1b, 1c, 1e, 1f, 2 (T203), 2 T(204)) <i>after</i> class.
25 <sup>th</sup> April 2021	24. Tutorial Group A (Half the Class)	<ul style="list-style-type: none"> <li>• Demonstrations of PL Derivations</li> <li>• ‘Tricky’ Questions</li> <li>• Problem Sets</li> <li>• Questions and Answers</li> </ul>	
27 <sup>th</sup> April 2021	25. Tutorial Group B (Half the Class)	<ul style="list-style-type: none"> <li>• Demonstrations of PL Derivations</li> <li>• ‘Tricky’ Questions</li> <li>• Problem Sets</li> <li>• Questions and Answers</li> </ul>	
29 <sup>th</sup> April 2021	26. Test III (Predicate Logic Only)	<ul style="list-style-type: none"> <li>• Proctored Online</li> <li>• Webcam and Student ID Required</li> <li>• A4 Lined Paper</li> </ul>	
4 <sup>th</sup> May 2021	27. Sentential Logic Review	<ul style="list-style-type: none"> <li>• Review of concepts and practice</li> </ul>	Do SL Final Review Practice Sheet
6 <sup>th</sup> May 2021	28. Predicate Logic Review	<ul style="list-style-type: none"> <li>• Review of concepts and practice</li> </ul>	Do PL Final Review Practice Sheet