

COMP-330

# Theory of Computation

Fall 2019 -- Prof. Claude Crépeau

## COURSE OUTLINE

# COMP 330 Fall 2019

- Class Schedule :

Tuesday–Thursday 13:05–14:25 MAASS 112

- Instructor :

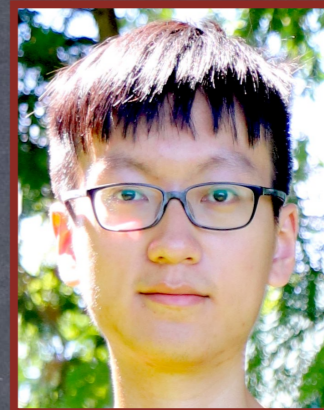
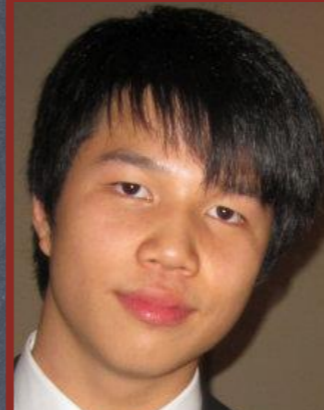
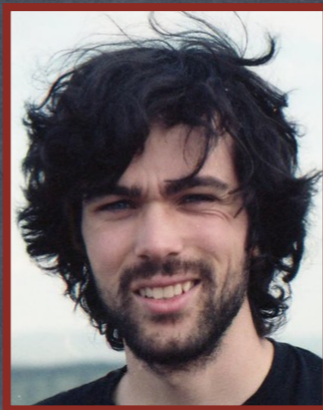
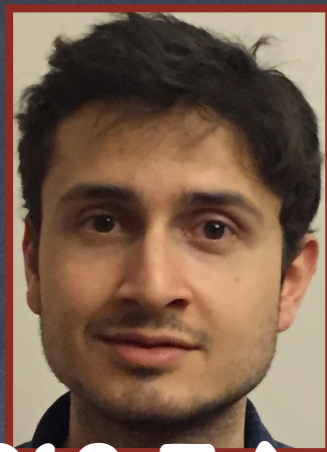
Prof. Claude Crépeau

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phone: (514) 398-4716

email: [crepeau@cs.mcgill.ca](mailto:crepeau@cs.mcgill.ca)





👁️ 2019 T.A.s :

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 Pierre-William Breau  
 Anirudha Jita  
 Justin Li  
 Yanjia Li  
 Shiquan Zhang

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👁️ Office Hours :

Claude : Wednesday 13:00–16:00 ENGMC 110N

Pouriya : Friday 13:00–14:00 ENGTR 3090

Pierre-William : Monday 15:00–16:00 ENGTR 3110

Anirudha : Monday 16:00–17:00 ENGTR 3090

Justin : Tuesday 15:00–16:00 ENGTR 3110

Yanjia : Friday 10:00–11:00 ENGTR 3110

Shiquan : Thursday 15:00–16:00 ENGTR 3110

# COMP-330 Fall 2019 — Weekly Schedule

<b>Mon</b> 10:00	<b>Tue</b> 10:00	<b>Wed</b> 10:00	<b>Thu</b> 10:00	<b>Yanjia</b> <b>TR-3110</b>
<b>Mon</b> 10:30	<b>Tue</b> 10:30	<b>Wed</b> 10:30	<b>Thu</b> 10:30	
<b>Mon</b> 11:00	<b>Tue</b> 11:00	<b>Wed</b> 11:00	<b>Thu</b> 11:00	<b>Fri</b> 11:00
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<b>Mon</b> 12:30	<b>Tue</b> 12:30	<b>Wed</b> 12:30	<b>Thu</b> 12:30	<b>Fri</b> 12:30
<b>Mon</b> 13:00	<b>Claude</b> <b>MA-112</b> course	<b>Claude</b> <b>MC-110N</b> office hours	<b>Claude</b> <b>MA-112</b> course	<b>Pouriya</b> <b>TR-3090</b>
<b>Mon</b> 13:30				
<b>Mon</b> 14:00				<b>Fri</b> 14:00
<b>Mon</b> 14:30	<b>Tue</b> 14:30		<b>Thu</b> 14:30	<b>Fri</b> 14:30
<b>Pierre-W.</b> <b>TR-3110</b>	<b>Justin</b> <b>TR-3110</b>		<b>Shiquan</b> <b>TR-3110</b>	<b>Fri</b> 15:00
				<b>Fri</b> 15:30
<b>Anirudha</b> <b>TR-3090</b>	<b>Tue</b> 16:00	<b>Wed</b> 16:00	<b>Thu</b> 16:00	<b>Fri</b> 16:00
	<b>Tue</b> 16:30	<b>Wed</b> 16:30	<b>Thu</b> 16:30	<b>Fri</b> 16:30

MC = MCENG = McConnell • TR = ENGTR = Trottier

# COMMUNICATION

WWW:

<http://crypto.cs.mcgill.ca/~crepeau/COMP330/>

email:

[cs330@cs.mcgill.ca](mailto:cs330@cs.mcgill.ca)

FaceBook:

COMP 330 Fall 2019

# CSUS Helpdesk

**HOURS: 12pm – 5pm (mon-fri)**

**LOCATION: Trottier 3090**

## WHO ARE WE? WHAT DO WE DO?

- U2 and U3 students who have taken this course and want to help you!
- We are a **FREE** drop-in tutoring service, perfect for study help, and guidance on assignments.
- We provide review sessions for midterms and finals for intro courses!

# COMP-330 Fall 2019 — Weekly Schedule

<b>Mon</b> 10:00	<b>Tue</b> 10:00	<b>Wed</b> 10:00	<b>Thu</b> 10:00	<b>Yanja</b> <b>TR-3110</b>
<b>Mon</b> 10:30	<b>Tue</b> 10:30	<b>Wed</b> 10:30	<b>Thu</b> 10:30	
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<b>CSUS</b> <b>Helpdesk</b> <b>TR-3090</b>	<b>CSUS</b> Claude MA-112 course	<b>CSUS</b> Claude MC-110N office hours	<b>CSUS</b> Claude MA-112 course	<b>Pouriya</b> <b>TR-3090</b>
Pierre-W. TR-3110	Justin TR-3110		Shiquan TR-3110	<b>CSUS</b> <b>Helpdesk</b> <b>TR-3090</b>
Anirudha TR-3090	<b>Helpdesk</b> <b>TR-3090</b>	<b>Helpdesk</b> <b>TR-3090</b>	<b>Helpdesk</b> <b>TR-3090</b>	

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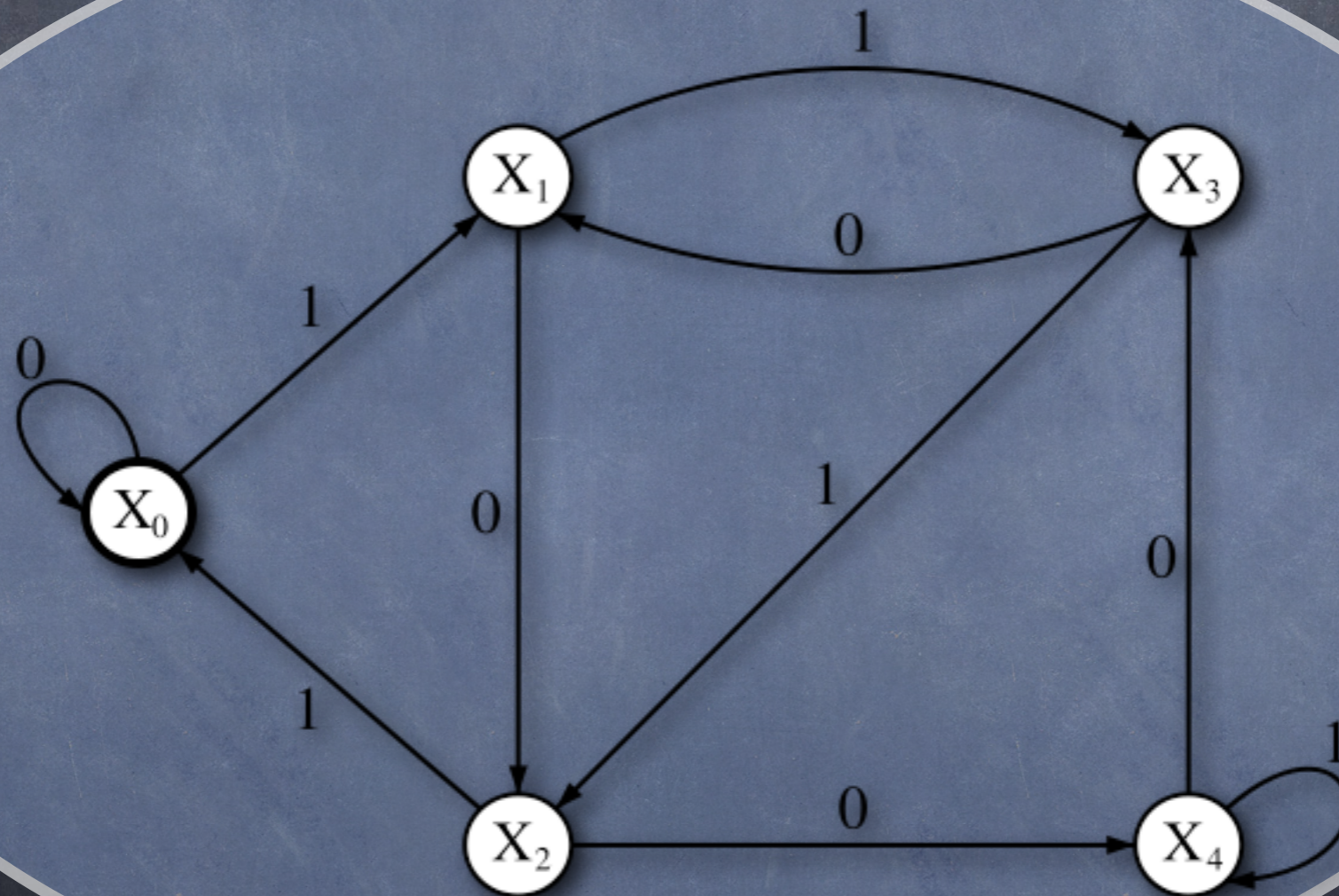
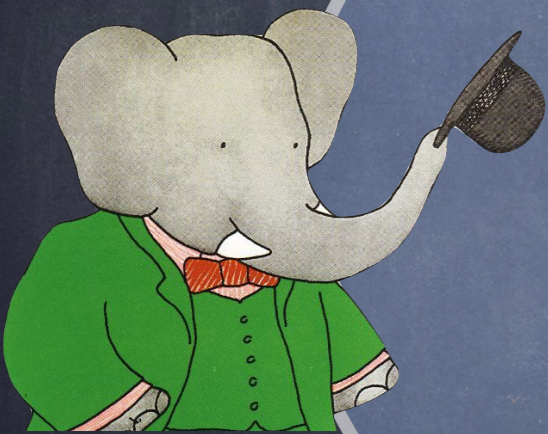
# COMP 330 Fall 2019

Description: (3 credits, 3 hours).

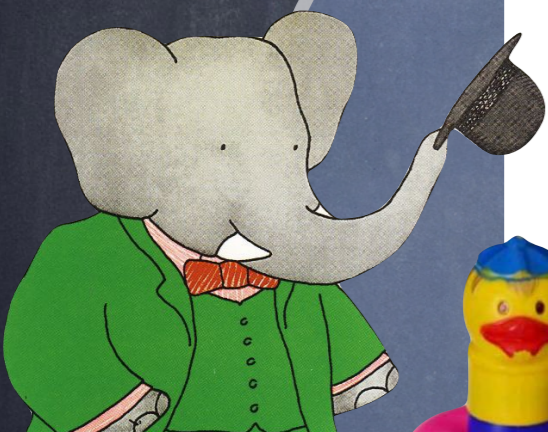
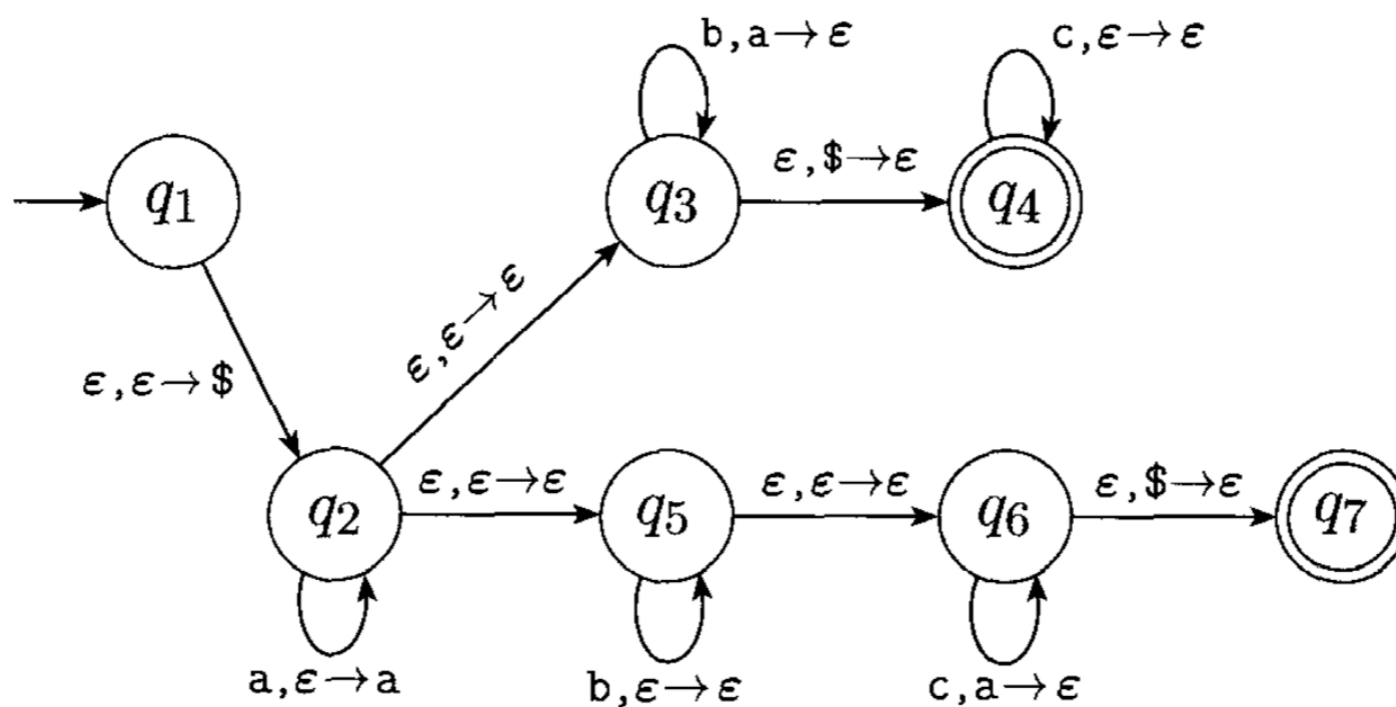
- We study models of computation of increasing power.
- We begin with finite automata and regular languages.
- The next phase deals with context-free languages invented by linguists and now an essential aspect of every modern programming language.
- Finally we explore the limits of computability with the study of recursive sets, enumerable sets, self-reproducing programs and undecidability theory.



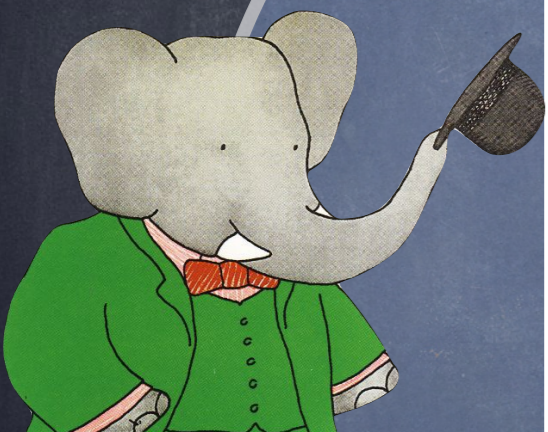
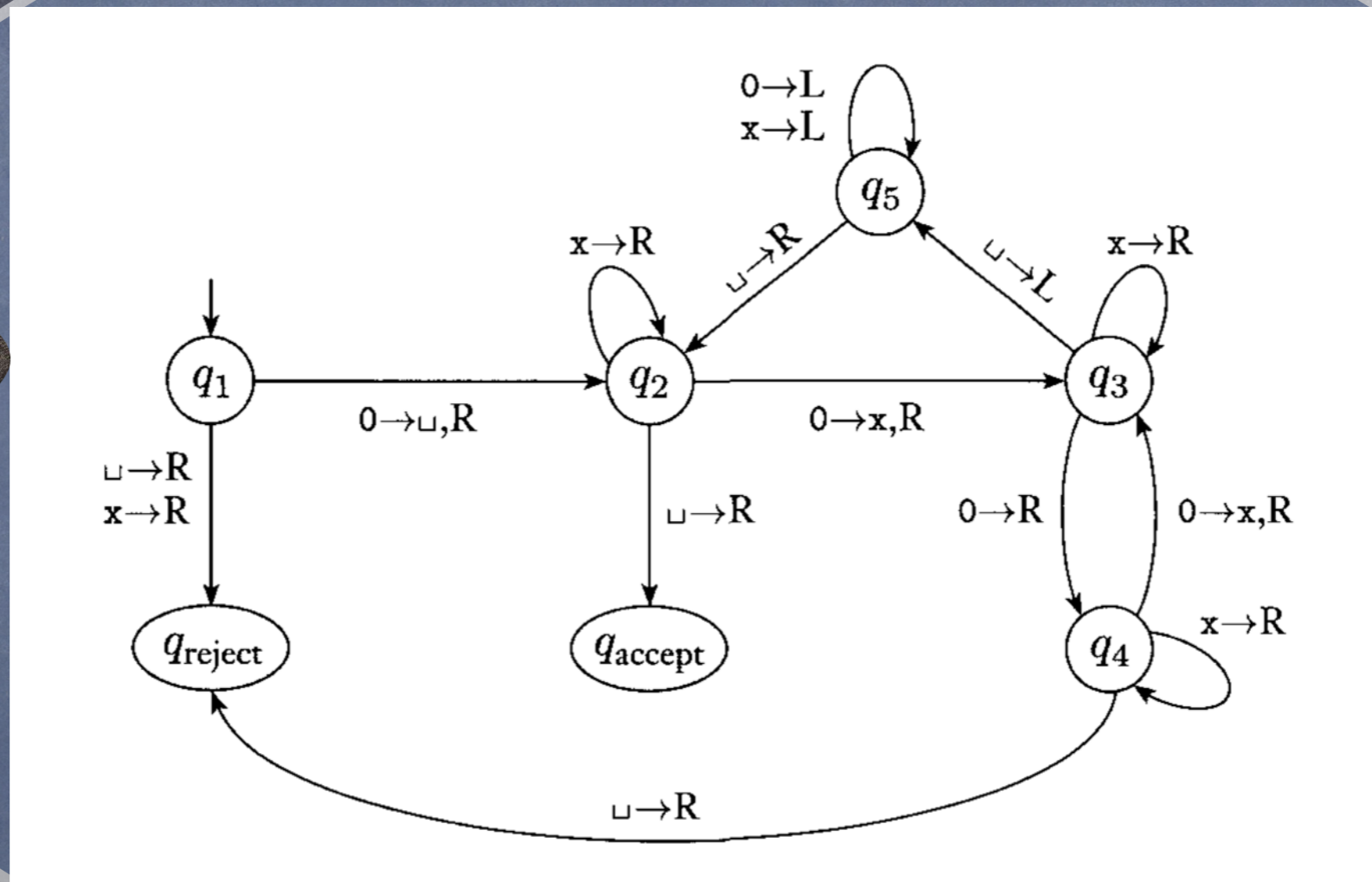
# Part 1: Regular expressions & Deterministic Finite Automata



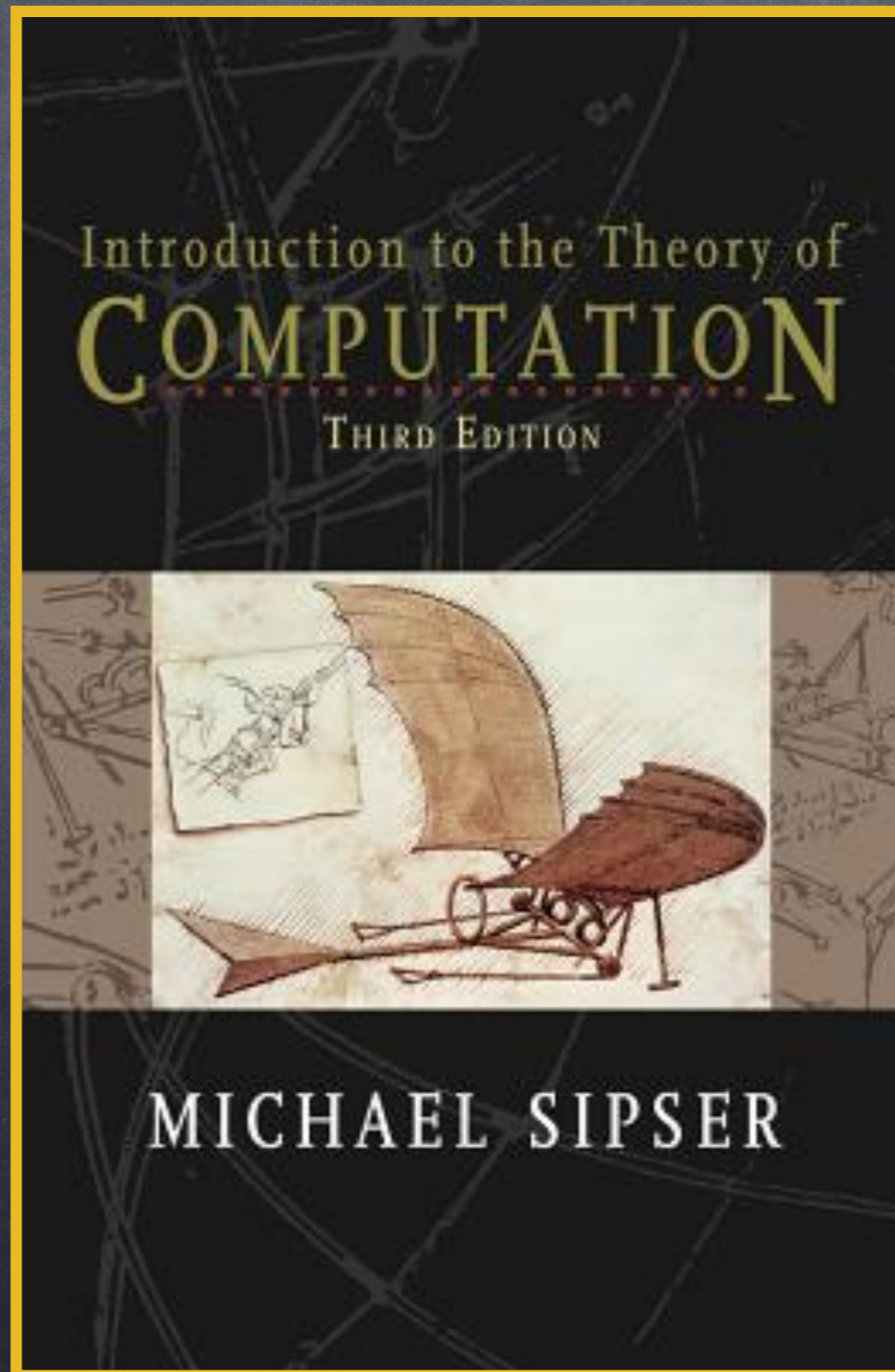
# Part 2: Context-free Language & Pushdown Automata



# Part 3: Turing Machines, Computability & Complexity



# Mandatory Textbook



# COMP 330 Fall 2019:

## Lectures Schedule

1. Introduction
  - 1.5. Some basic mathematics
2. Regular expressions, DFAs
3. Nondeterministic finite automata
4. Determinization
5. Closure properties, Kleene's theorem
6. The pumping lemma
7. The pumping lemma
8. Minimization
9. Lexical analysis
10. Duality
11. Myhill-Nerode theorem
12. Labelled transition systems
13. MIDTERM
14. Context-free languages
15. Pushdown automata
16. Parsing
17. The pumping lemma for CFLs
18. Introduction to computability
19. Models of computation
  - Basic computability theory
20. Reducibility, undecidability and Rice's theorem
21. Undecidable problems about CFGs
22. Post Correspondence Problem
23. *Validity of FOL is RE / Gödel's and Tarski's thms*
24. *Universality / The recursion theorem*
25. *Degrees of undecidability*
26. Introduction to complexity

# COMP 330 Fall 2019

## • Evaluation:

There will be

- 4 assignments worth 40%,
- a midterm exam worth 10%, and
- a final exam worth 50% of your final grade.

# COMP 330 Fall 2019

- In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.
- En vertu de la chartre des droits des étudiants de l'université McGill, les étudiants de ce cours ont le droit de soumettre leurs travaux écrits en anglais ou en français, à leur guise.

# COMP 330 Fall 2019

- Academic integrity : McGill University values academic integrity. Therefore all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see <http://www.mcgill.ca/students/srr/honest> for more info).
- Honnêteté académique : L'université McGill attache une grande importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et des procédures disciplinaires (pour de plus amples renseignements, consultez <http://www.mcgill.ca/students/srr/honest>).



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