

St. Francis Xavier University
Department of Computer Science
CSCI 356: Theory of Computing
Final Examination Review
Fall 2021

1 Topics Covered

The following list gives an overview of every topic covered in CSCI 356. You should ensure you have a good understanding of each topic. All final examination questions will test some topic on this list, but not all topics will be tested on the final examination.

Although the final examination is a comprehensive examination, there will be a greater emphasis placed on topics covered after the midterm examination.

- **Pre-Midterm Material**

- Regular languages/operations/expressions
- Finite automata
- Nondeterminism
- Context-free languages/grammars
- Pushdown automata
- Pumping lemma

- **Turing Machines**

- Def'n of Turing machines
- Configurations
- Accepting and rejecting computations
- Deciding and decidable languages
- Semidecidable languages
- Turing machine variants
- Nondeterminism
- Universal Turing machines
- Church–Turing thesis

- **Decidability**

- Decision problems (A, E, U, EQ)
- Decidable problems for regular langs.
- Decidable problems for CFLs
- Undecidable problems for TMs
- Proving decidability/semidecidability

- **Reducibility**

- Def'n of mapping reductions
- Computable functions
- Reductions and (un)decidability
- Halting problem
- More undecidable problems for TMs

- **Time Complexity**

- Big-O notation
- DTIME and NTIME
- The class P
- Proving problems are in P
- The class NP
- Proving problems are in NP
- Hardness and completeness
- Cook–Levin theorem
- P vs. NP
- ★ *Proving NP-completeness won't be tested*

- **Space Complexity**

- ★ *Won't be tested*

2 Format

The final examination is 150 minutes (2.5 hours) long. It consists of 7 questions worth a total of 75 marks.

The first question is split into ten multiple-choice style parts. Multiple-choice questions test both pre- and post-midterm material.

The second and third questions are split into a total of ten short answer style parts. Short answer questions test both pre- and post-midterm material. The second question covers general course material, while the third question asks about language classes and complexity classes.

The fourth question is about proving languages nonregular or non-context-free.

The fifth question is about Turing machines. It is split into three parts.

The sixth question is about decidability. It is split into two parts.

The seventh question is about time complexity. It is split into two parts.

3 Tips and Tricks

- Double-check the date, time, and room of the final examination. You will not get extra time to write if you arrive late.
- Use your time wisely. Short and long answer questions will likely take more time than multiple choice questions, so make sure you allocate the appropriate amount of time for each question.
- Use the resources you are given. The lecture notes contain everything you need to know. The assignment questions are similar in content and difficulty to the midterm examination questions. The course textbook serves as great supplementary material.
- Don't leave your questions until the last minute. Seek help before the final examination if you have questions. Send an email or make a post on Moodle.
- Don't try to memorize concepts. Instead, focus on understanding the meaning behind a concept and how it is applied.
- Don't panic!