Final Exam Study Guide

CSE 30151 Fall 2020

2020/11/18

The final exam will be from Tuesday 11/17 at 5pm to Thursday 11/19 at 5pm. It will be comprehensive, but focusing more on material from after the midterm exam. Here are the instructions from the exam booklet:

- This exam has eight questions, worth 15 points each, for a total of 120 points (20% of your grade).

- Allowed sources

  - You **may** use the textbook, lectures, videos, and lecture notes for this course. Please cite your source only if you need to use a definition or proof and don't want to re-define or re-prove it.

  - You **may not** communicate with any people (inside or outside the class) about any topic related to this exam. Doing so is a violation of the Honor Code and will be reported.

  - You **may** use sources other than the ones listed above. Please cite all sources that contributed substantially to your solution. You **may not** copy or quote from these sources.

- Please post clarification questions as private questions on Piazza.

- Please create a PDF file containing your solutions.

  - You can write your solutions by hand, but please scan them to convert them to PDF.

  - Please don't put any identifying information in the file, so that we can grade the exams blind.

- Please submit your PDF in Sakai under the assignment "Final Exam."

Many of the practice problems below are from the textbook. The numbers are from the 3rd US edition. If I can find the number in the 3rd international edition, I've written it followed by "intl."

1–2. Two of the questions ask about factual knowledge. They might be about general principles covered in the course or specific details of a concept or proof covered in the course. Examples: Quiz 2 #3, HW8 #1.

3–4. Two of the questions ask you to prove that a language is regular by giving a finite automaton or regular expression; or context-free by giving a context-free grammar or pushdown automaton; or decidable by giving a Turing machine.

These questions might also ask you to prove that the same language is non-regular or non-context-free. Examples: Sipser 1.29ac, 1.46b (intl. 1.51b); 2.30bc (intl. 2.42bc).

5. This one is hard to classify; it's most similar to proofs that some operation on regular languages is regular (like HW2 Q3, Sipser 1.31 (intl. 1.36), Sipser 1.66a (intl. 1.60)) or some operation on context-free languages is context-free (like Sipser 2.38 (intl. 2.50), but not as hard).

6–7. Prove that a language is undecidable. Examples: Sipser 5.1 (EQ_{CFG}), 5.13 (useless states).

8. Prove that a language is NP-complete. Examples: Sipser 7.28 ("You are given a box"), 7.30 (*SET-SPLITTING*).

Topics *not* covered

- Conversion between DFAs, NFAs, and regular expressions

- Conversion between CFGs and PDAs

- Chomsky normal form (108–110)

- Deterministic context-free languages (§2.4)

- Proving undecidability by diagonalization (pages 202–209)

- Advanced topics in computability theory (§6)

- Examples of decidable languages (§4.1) and polynomial languages (§7.2).

- Proving NP-completeness by reduction from all of NP (pages 299–304)

- §8 and beyond