MATH 4931 / 5931 – SPECIAL TOPICS: THEORY OF COMPUTATION AND FORMAL LANGUAGES

Final Project Information

The final project will count as Homework 6 and can replace the previous lowest homework score. There are two different tracks you can choose between for your final project.

Track 1: (Research Paper) Read a research paper, understand it, give a 15-20 minute presentation about it to the class.

- You can pick a research paper on your own, or I will help you choose one.
- You will work on reading and understanding the paper over the course of several weeks. I will be available to help you if you get stuck.
- You will give a 15-20 minute presentation to the class using slides, describing the paper, its mathematical results, how it proved the results, and its relation to topics we covered in class.

Track 2: (Python Software) Write python software that lets a user input DFAs and NFAs and perform various operations on them, give a 10-15 minute presentation/demonstration to the class.

- You will implement software in Python that can perform the following tasks:
  - Input DFAs.
  - Input NFAs.
  - Given a DFA or NFA M and a word w, determine whether M accepts w.
  - Given a DFA or NFA M and an integer n, generate the list of words up to length n that are accepted by M.
  - Convert an NFA N to a DFA M that accepts the same language, removing any unreachable states.
  - Given two DFAs or NFAs, find an NFA for their union.
  - Given two DFAs or NFAs, find an NFA for their intersection.
  - Given two DFAs or NFAs, find an NFA for their concatenation.
  - Given one DFA or NFA, find an NFA for its Kleene star.
- Your software is not required to have a graphical user interface (GUI). A user should be able to use the functions you wrote (which should have descriptive comments) to do the operations above. That could mean, for example, writing their own lines of code that use your functions to create DFAs / NFAs and perform the operations, interacting with a GUI (if you have one), etc.
- You will give a 10-15 minute presentation to the class showing a demonstration of your code and showing your code itself and how you designed it.

Timeline:

- **Monday, March 27, by the start of class:** Declare in class whether you want to follow Track #1 or Track #2.

- **Monday, April 3, by the start of class:**
  - Track 1: Decide on a research paper and send to Dr. Pantone via email to approve.
  - Track 2: Submit by email a one page summary of your plan for your software. Things you can discuss in your plan include: How users will interact with the code you have written (e.g., how will they create a DFA), how you are going to structure your code, how you plan to implement the algorithms, etc.
- **Monday, April 17 or Wednesday, April 19:** Come to office hours and discuss your progress with Dr. Pantone.
- **Presentations will be scheduled for the last two weeks of class.** Possible presentation dates are Monday, April 24; Wednesday, April 26; Friday, April 28; Monday, May 1; Wednesday, May 3; Friday, May 5. Actual dates for each person will be scheduled after everyone has declared which track they will do.

The final project will be worth 60 points. Rubrics for each track are given below.

Track 1 Rubric:

- 5 points — Student declares Track 1 or Track 2 by March 27.
- 5 points — Decide on a paper and submit to Dr. Pantone for approval by April 3. Dr. Pantone can help you find a paper before this deadline!
- 10 points — Visit office hours on Monday April 17 or Wednesday April 19 to discuss progress. (If you can't make it to these, contact me early to arrange another time.)
- 10 points — Presentation is no shorter than 15 minutes and no longer than 21 minutes.
- 10 points — Student demonstrates that they have understood most or all of the content in the research paper.
- 10 points — Student prepares slides that are organized, cogent, and help explain the content of the research paper.
- 5 points — Student is able to answer questions asked by the audience.
- 5 points — Student ties the material back to topics covered in class.

Track 2 Rubric:

- 5 points — Student declares Track 1 or Track 2 by March 27.
- 10 points — Student submits one page summary by April 3 that details plans for their software.
- 5 points — Visit office hours on Monday April 17 or Wednesday April 19 to discuss progress. (If you can't make it to these, contact me early to arrange another time.)
- 10 points — Presentation is no shorter than 10 minutes and no longer than 16 minutes.
- 10 points — Student's code is organized and well documented with enough comments that I can understand it and that I can figure out how to use it.
- 10 points — Student prepares a demonstration that is organized, cogent, and adequately explains how their code works and how a user should use it.
- 10 points — Student's code is capable of performing all of the tasks required. (I reserve the right to deduct more than 10 points if capabilities are severely lacking.)