

Algorithm Design and Analysis

CS 376, Spring 2023

Smaller Assignment 0

Due **BY THE BEGINNING OF CLASS** Monday, February 6

- For this Smaller Assignment, the standard file naming conventions apply: Please submit your typewritten answers in a PDF file named

CS376_SA0_<userid>.pdf

where <userid> is replaced by your Colby userid—for example, my file would be called CS376_SA0_eaaron.pdf. **Please be sure to give your full userid, including the numbers representing your class year.**

To submit this Small Assignment, please use our standard HW submission process: Place the properly named file in your **Private** directory in your CS376 filespace on **filer**. (That is, go to filer.colby.edu/Courses/CS376 to find your folder in the course's filespace; you should find a sub-folder called **Private** in your filespace.) **Please make sure all Problem Set and Smaller Assignment submissions are to your Private folders!**

- As usual for Smaller Assignments in CS376 this semester, this is due by the beginning of the next class meeting, and it will be marked on a $\checkmark + / \checkmark / \checkmark - / 0$ scale.
- From your textbook (CLRS), please read:
 - Appendices A, B.1, B.2, C.1, and D.1. [The rest of Appendix B will be helpful later, too!] Please let me know if any material in these sections is unfamiliar to you (but don't worry if it is)!
 - Chapter 1.
 - **Please also** make sure you can answer exercise CLRS C.1-1 (page 1187). There's no need to turn that in, but feel free to talk with me about it!
- *A general note for CS376:* When writing up your homework, please write neatly and **explain your answers clearly and thoroughly**, giving all details needed to make your answers easy to understand. Clear communication *is* the point, on every assignment.

You are expected to use L^AT_EX for all written work in CS376 this semester. Please see our course website for L^AT_EX resources, and please let me know if you have any additional questions about L^AT_EX!

Unless explicitly specified otherwise, answers in CS376 should be accompanied by explanations; as part of this, in general, when you present an algorithm, give an accompanying correctness argument. Answers without convincing explanations that show command of the relevant concepts may not receive full credit. Please feel free to ask me any questions about explanations that might come up!

Exercises

1. Here are some little exercises to make sure we're all comfortable with basic set operations. (For this exercise, you do not need to explain or justify your answers.) For the exercises below, let $A = \{x, y, z\}$ and $B = \{x, y\}$.

- (a) True or False: $A \subseteq B$?
- (b) True or False: $B \subseteq A$?
- (c) True or False: $B \subseteq B$?
- (d) What is $A \cup B$? (Explicitly show the elements of $A \cup B$.)
- (e) What is $A \cap B$? (Explicitly show the elements of $A \cap B$.)
- (f) What is $A \times B$? (Explicitly show the elements of $A \times B$.)
- (g) What is $\mathcal{P}(B)$, the power set of B ? (Explicitly show the elements of $\mathcal{P}(B)$.)

2. Give a fully detailed proof that for all sets S , S is a subset of itself. I.e., prove **Claim:** $\forall S. S \subseteq S$.

A fully detailed proof cites the relevant formal definitions and the formalized steps for manipulating those definitions—here, be sure to show all steps in your proof and explicitly state a reason for every step.

3. CLRS A.1-1 (page 1149). (That is, from our CLRS textbook, exercise 1 in section A.1.) As usual, please explain your answer.
4. CLRS B.1-5 (page 1163). (As usual, please explain your answer.)
5. How many ways are there to arrange n distinct elements in a list? (As usual, please explain your answer.)
6. Let $p = \text{True}$, $q = \text{False}$, $r = \text{True}$. What do the following propositional logic expressions evaluate to?

This exercise is to make sure we're all familiar with the definition of propositional logic expressions. For this exercise, you do not need to explain or justify your answers.

(If you're not already familiar with *truth tables*, see also the posted notes about propositions and truth tables, linked from our course website's *Additional Notes / Readings* page. Truth tables are a Generally Good Thing to know about! Please feel free to talk more with me about truth tables or the posted notes, if you'd like!)

- (a) $p \wedge \neg r$
- (b) $p \rightarrow q$
- (c) $q \leftrightarrow p$
- (d) $q \leftrightarrow \neg \text{True}$
- (e) $r \vee (p \wedge q)$
- (f) $(p \vee r) \rightarrow ((p \vee q) \wedge r)$
- (g) $\text{True} \rightarrow r$
- (h) $\text{False} \rightarrow q$