CSC165H1: Problem Set 0

Due 19 January 2021 before 17:00

General instructions

Please read the following instructions carefully before starting the problem set. They contain important information about general problem set expectations, problem set submission instructions, and reminders of course policies.

- Your problem sets are graded on both correctness and clarity of communication. Solutions that are technically correct but poorly written will not receive full marks. Please read over your solutions carefully before submitting them.
- Each problem set may be completed in groups of up to three—**except for Problem Set 0**. If you are working in a group for this problem set, please consult https://github.com/MarkUsProject/Markus/wiki/Student_Groups for a brief explanation of how to create a group on MarkUs.

  Exception: Problem Set 0 must be completed individually.
- Solutions must be typeset electronically, and submitted as a PDF with the correct filename. **Handwritten submissions will receive a grade of ZERO.**

  The required filename for this problem set is **problem_set0.pdf**.
- Problem sets must be submitted online through MarkUs. If you haven't used MarkUs before, give yourself plenty of time to figure it out, and ask for help if you need it! If you are working with one or more partner(s), you must form a group on MarkUs, and make one submission per group. "I didn't know how to use MarkUs" is not a valid excuse for submitting late work.
- Your submitted file(s) should not be larger than 9MB. You might exceed this limit if you use a word processor like Microsoft Word to create a PDF; if it does, you should look into PDF compression tools to make your PDF smaller, although please make sure that your PDF is still legible before submitting!
- MarkUs is known to be slow when many students try to submit right before a deadline. **Aim to submit your work at least an hour before the deadline. It is your responsibility to submit your work ahead of time to meet the deadline.** You can submit your work more than once; the most recent version submitted within the deadline or available grace periods is the version marked.
- Submissions must be made *before* the due date on MarkUs. Please see the Homework page for details on how late submissions will be handled.
- The work you submit must be that of your group; you may not use or copy from the work of other groups, or external sources like websites or textbooks. Please see the section on Academic Integrity in the course syllabus for further details.

Additional instructions

For this problem set only, you **must use LaTeX** to generate your document. In addition to your PDF file, submit on MarkUs a file named `problem_set0.tex`, the LaTeX source code used to generate your PDF.

Also, this problem set must be completed **individually**.

In this problem set, you will learn how to use LaTeX to create a beautiful document containing both text and mathematics. To get started, please go through the LaTeX Help section of the Problem Sets page on the course website, and the mini-tutorial found in `sample_latex.tex`. Then when you're ready to work on your own document, download the starter file from the website (`ps0-template.tex`), and complete the following tasks:

1. Create a title for your document that shows the course code (CSC165H1), the phrase "Problem Set 0", your name, and a date (this can either be the problem set due date or the LaTeX command `\today`).

2. Use the `itemize` environment to create an *unordered* list showing the courses you are taking this term. Each list item should contain the course's code, title, and the name of your instructor.

3. Let
$$S_1 = \{108, 148, 165, 207, 209, 236, 258, 263, 369, 373\}$$
and S_2 be the set of all integers that are multiples of 4. List all of the elements in the *difference* of S_1 and S_2 using set notation (i.e., $S_1 \setminus S_2 = \{\dots\}$, where you fill in the dots).

4. Write down the truth table for the propositional formula $\neg(p \wedge q \wedge r) \Leftrightarrow (p \Rightarrow q)$. There should be *eight* rows in your table (plus a header row). Make sure to use the `tabular` environment to create a table in LaTeX.

   You may, but are not required to, show "intermediate columns" (e.g., for $p \wedge q \wedge r$) in your truth table.

5. Finally, show the steps involved to solve the following problem: find the smallest positive integer n such that $\sum_{i=0}^{n-1}(4i - 315) > 2020$—without "guessing and checking" or writing a computer program! Your solution should consist of two parts:

   (a) Use the `align*` environment to simplify this summation (show at least two or three steps). You may use the following *arithmetic series* formula, which is valid for all $n \in \mathbb{N}$ and all $d, k \in \mathbb{R}$:
   $$\sum_{i=0}^{n-1}(di + k) = nk + \frac{dn(n-1)}{2}$$

   (b) Use the `align*` environment to manipulate an inequality. You will probably find the *quadratic formula* helpful.

   In both of the above parts, you should make use of the `&` symbol in the `align*` environment to vertically align the $=$, $\leq$, and/or $\geq$ symbols in your calculations.

Tip: this problem set doesn't have a lot of content, and we expect it to be very well done. In the past, the only time students have lost marks is for not following instructions. *Please carefully review your work to make sure you have followed all of the instructions on this page before your final submission.*