CS1303 - Fall 2021

Assignment # 1

Due: Monday, September 20, by 11:59 pm

Submission Instructions:

- Your answers should be submitted through Crowdmark. Contact Dr. Fleming if you have any questions.
- **Note:** Please submit the answer to only one question in each file that you submit on Crowdmark. Also, if possible, please leave try to leave some white space beside or below your solutions, to allow room for the marker to provide comments in Crowdmark.
- Assignments can be submitted up to 24 hours late with a 20% penalty. Assignments submitted more than 24 hours late will not be accepted, unless you have prior approval from Dr. Fleming.
- All answers you submit must be your own work. You may discuss general approaches to assignment problems with your classmates. However, these must be general and cannot include things such as detailed steps of an algorithm or a proof. Please see the course syllabus for more details.

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1. **(3 marks)** Which of the following are statements?

   (a) $8 - 4$

   (b) $8 - 4 = \frac{8}{4}$

   (c) $a - b = \frac{a}{b}$

   (d) There exist integers a and b such that $a - b = \frac{a}{b}$

   (e) Every multiple of 7 is odd.

   (f) Are there odd numbers that are not multiples of 3?

2. **(3 marks)** The conditional statements below might seem strange, since the hypothesis and conclusion are not really related to each other. However, based on our discussion in class about the truth of statements of the form $P \to Q$, which of the following statements are considered to be true?

   (a) If -3 is odd, then 12 is positive.
   (b) If -3 is even, then 12 is negative.
   (c) If -3 is odd, then 12 is negative.
   (d) If -3 is even, then 12 is positive.
   (e) If -3 is even, then Fredericton is the capital of Canada.
   (f) If -3 is even, then Fredericton is the capital of New Brunswick.

3. **(5 marks)** For each of the questions below, provide a 'yes' or 'no' answer.

   (a) Is the set of rational numbers closed under multiplication?
   (In other words, if you multiply two rational numbers, will the result always be a rational number?)

   (b) Is the set of negative integers closed under multiplication?

   (c) Is the set of negative integers closed under addition?

   (d) Let X be the set $\{-1, 0, 1\}$. Is X closed under multiplication?

   (e) Let Y be the set of all odd integers. Is Y closed under multiplication?

4. **(8 marks)** For the statement below,

   (i) Construct a know-show table, as discussed in class.
   (ii) Write a formal proof.

   If m is an odd integer, then $5m^2 + 8m + 4$ is an odd integer.

   [Make sure to use the formal mathematical definitions of even and odd; do not just provide an informal argument based on your own common-sense understanding of even and odd.]

5. **(6 marks)** Write a formal proof for the statement below. (If you wish to use a know-show table to organize your thoughts, you may do that, but you are not required to construct one for this question.)

   If m and n are odd integers and p is an even integer, then $mn+p$ is an odd integer.

   [Again, make sure to use the formal mathematical definitions of even and odd; do not just provide an informal argument based on your own common-sense understanding of even and odd.]