CSCI-246 Discrete Structures HW2

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Objective

- Understanding sets, direct proofs and Venn diagrams.
- Mathematical definitions.
- How to approach solving a problem.

Submission requirements

- ***Type or clearly hand-write*** your solutions into a ***PDF FORMAT.***
- ***DO NOT UPLOAD images.***
- ***non-pdf or emailed solutions will not be graded.***
- **If you take pictures of your handwritten homework, put it into pdf format.**
- ***Start each problem in a new page.***
- Follow the model that you have learned during the lectures for proofs.
- Do not wait until the last minute to submit the assignment.
- You can submit any number of times before the deadline.
- If you are using latex, and you do not know how to type a symbol, use the following website. You can draw the symbol here and it will give you the latex code and the packages that you have to import. `https://detexify.kirelabs.org/classify.html`

- If you are using latex to write the answer, you can use overleaf to make your life easier. **Overleaf is a free, online platform that helps users create and publish scientific and technical documents using LaTeX, a markup-based document preparation system**
- If you do not understand a problem, ask questions during/after the lectures, or during office hours or via discord.
- Go to TA office hours and talk with them and ask for help.
- ***Do not use generative AI to write answers.***

Homework 02 contains **3 questions**.

1 Q1

Consider the following proposition:

$$\{a \in \mathbb{Z} : 3|a\} \cap \{b \in \mathbb{Z} : 10|b\} \subseteq \{a \in Z : 6|a\} \cap \{b \in \mathbf{Z} : 15|b\}$$

Hint: We saw proofs involving divisibility of numbers. First try to write the left hand side of the subset equal in a way that easier to understand. Do the same thing for the set on the right hand side of the subset equal symbol. Try to figure out the behaviour of the elements in the left hand side and right hand side. Then try to show that any element of left hand side set follows the rule of the right hand side set.

Grading Notes: While detailed rubric cannot be provided in advance as it would give away the solution, use the following direction to understand how the points are distributed for the problem.

- Correctness
    1. If your proof is not correct you will points will be docked. Regardless of the proof, there are some facts that has to be stated in your proof. If those facts are not stated, a reader will feel that there are holes in your proof.
    2. Moreover, order of the facts must make sense.
- Communication
    1. You should use statement and reasoning format for your proof. For example, you state your claim using mathematical statement or in English depending on the context, then immediately you state the reasoning why your statement is true.

2 Q2

Draw Venn Diagrams for the following sets.

(a) $\overline{A \oplus B}$

(b) $\overline{A - B} \cup A - C$

(c) $\overline{A} \cap (B - C)$

(d) $(A \cap B) \cup (\overline{C})$

(e) $(A) \cap (B \cap C) \cap (D)$

3 Q3

Let $A = \{1, 3, 4, 5, 7, 8, 9\}$ and let $B = \{0, 4, 5, 9\}$. Define $C = \{0, 3, 6, 9\}$. Where relevant, assume that the universe is the set $U = \{0, 1, 2, \ldots, 9\}$. What are the following sets?

1. $A \cap B$
2. $A \cup B$
3. $A \oplus B$
4. $A - B$
5. $B - A$
6. $\overline{A} - B$