

Discrete Mathematics

CSIS 2430

Programming project 2

For this assignment, write, test, and execute code to solve the following problems. You should also answer all of the questions.

Unlike programming project 0 which was done individually, the remaining projects should be done in groups of 2 – 4 students.

We have looked at set operations. In real life there are several common extensions of sets that are commonly used.

- Given subsets A and B of a set with n elements, use bit strings or an array of Booleans to find $\text{not}(A)$, $A \cup B$, $A \cap B$, $A - B$, and $A \oplus B$ (the symmetric difference of A and B defined as $(A - B) \cup (B - A)$)
- Sometimes the number of times an element occurs in an unordered collection matters. A multiset (or mset or bag) is an unordered collection of elements where an element can occur as a member more than once (see <https://en.wikipedia.org/wiki/Multiset>). Given multisets A and B from the same universal set, find $A \cup B$, $A \cap B$, $A - B$, and $A + B$.
- You will need different data structures and different methods (or even different classes) for the two problems.
- You do not need to prompt the user for input for these, it's perfectly fine to hard code your input.

After writing your code, please answer the following questions.

Fuzzy sets are often used to capture concepts where the boundary is imprecise or contextual (such as young, old, tall, fast, rich, cool). The question “Is 25 young?” depends on the context. While fuzzy sets are not going to be coded in this assignment consider the use of fuzzy sets when answering questions 4, 5, and 6 below.

Often times, in natural language processing (i.e., the user types in queries in English, in Dutch, or in some other language) the user may not distinguish between sets, multisets, fuzzy sets, or other types of sets. For example, ‘Which of our customers attended SLCC?’ would likely answered using a set. ‘How many of our customers have graduated from the different colleges in Utah?’ would likely be answered using a multiset.

1) If you used different arrays/structures/classes to represent the different types of sets, would it be possible to have overloaded methods or operations that would provide the correct functionality regardless of whether or not you were using sets or multi sets? Why or why not? (You do not need to code this, just answer the question).

- 2) Would it be possible to use the same data set/structure/class to store sets and multi sets Why or why not?
- 3) How easy or difficult is it to determine the type of set that you need to use based on the users query? Why?
- 4) Is it possible to store the data from one type of set (plain sets or multi sets in another type? Would you need to lose data in order to do so? Why?
- 5) Discuss what implications your answers to questions 1 – 4 have for someone trying to code an interface which would allow users to type in natural language queries.
- 6) Discuss what implications your answers to questions 1 – 5 have for someone trying to code an interface which would allow users to access arbitrary types of data using natural language.

Your code needs to be well documented with proper comments and make good use of white space.

Make sure you clearly include your name, as well as the course and section number in a comment at the beginning of the code.