CSI 2372 – Assignment 3

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Templates in C++

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Your task in this assignment is to apply the concepts you learned so far about object-oriented programming, and templates in C++. Make sure you have C++ installed, and you are familiar with the header files, and coding files.

Then, you should do the following programming task. Each programming task in this assignment is a design based on the subjects you learned during lectures. Your task is the same as what you did in Lab 2. You need to implement two classes for the concept of relations but this time the relation could be of any type. You need to define two relation classes for this assignment. The first relation is a relation that is defined on $A \times A$. This is like the relation you defined on Lab 2 except that A can be a set of any type of members.

Class Relation	
Method	Description
Relation	The default constructor that initializes an empty relation
Relation	The copy constructor
~Relation	The destructor
cardinality	Returns the number of pairs in the relation
add_element	Adds a pair into the relation
remove_element	Removes an element from the relation
is_member	Checks if an element is in the relation
operator ==	Checks if two relations are equal
operator [ ]	Returns the list of elements that the given index mapped to (It should not be returned as a reference)
reflexive	Checks if the relation is reflexive
irreflexive	Checks if the relation is irreflexive
symmetric	Checks if the relation is symmetric
asymmetric	Checks if the relation is asymmetric
transitive	Checks if the relation is transitive
is_function	Checks if the relation is a function
operator <<	For printing the relation is the following format { (2, 5), (3, 3), (3, 4) }
inverse	Returns the inverse of the relation (R^{-1})
combination	Returns the combination of two relations (If R_1 is defined on A and R_2 is defined on B, then $R_1 o R_2$ is defined on $A \cup B$)

As for the second relation, it is a relation that is defined on $A \times B$. Note that A and B can be sets any types and their types might be different from each other. This structure is very similar to the map in STL with the exception that elements from A are not unique in the relation. Your class should have the following methods.

Class MappingRelation	
Method	Description
MappingRelation	The default constructor that initializes an empty relation
MappingRelation	The copy constructor
~MappingRelation	The destructor
cardinality	Returns the number of pairs in the relation
add_element	Adds a pair into the relation
remove_element	Removes an element from the relation
is_member	Checks if an element is in the relation
operator ==	Checks if two relations are equal
operator +	For getting union of two relations
operator -	For difference of two relations
operator [ ]	Returns the list of elements that the given index is mapped to (It should not be returned as a reference)
intersection	For getting intersection of two relations
is_function	Checks if the relation is a function
operator <<	For printing the relation is the following format { (2, 'a'), (3, 'r') }
inverse	Returns the inverse of the relation (R^{-1})
combination	Returns the combination of two relations

You can add any method you need. Methods in red have bonus mark.

You can use all libraries of STL except map.

Rules

You can do this assignment in a group of two to learn team work. Make sure you collaborate both in thinking and brainstorming about this problem and programming with your partner. Any similarity between your programs to other groups is considered plagiarism. Yes, if you do not like team work, you can do it alone. Do not use any code or program from the Internet because it is also considered plagiarism. See the university policies for plagiarism in the following link.

https://www2.uottawa.ca/about-us/provost

When you submit, on the top of every header file and cpp file, include your firstname, lastname, and student ID of yourself and your partner as follows.

// firstname lastname Student_ID

// firstname lastname Student_ID

Measures that we take to detect plagiarism

Teaching assistants have been instructed to report to the professor any suspicion of plagiarism they find when they mark assignments.

If plagiarism has been detected in any part or in the whole assignment, the professor will take appropriate measures. Recall that it is equally bad to copy a solution and to let someone else copy your solution.