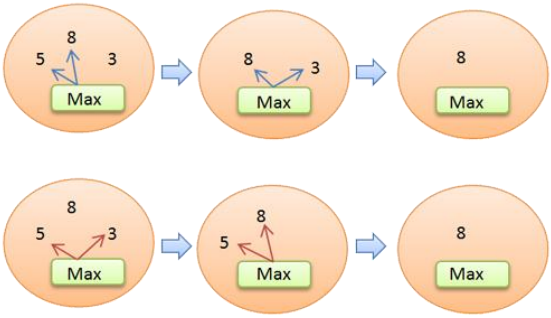
Project presentation

The main objective of this project is to design a chemical programming library for Java. Chemical programming is based on a paradigm where data is treated as chemical reagents in a chemical solution. This project includes a technology showcase using the library : a random music generator.

Chemical programming

Chemical programming is inspired by the chemical reaction mechanism, which is characterized by its indeterminism.
Calculations can be represented as reactions, controlled by a set of rules, and data as molecules. Both are present in a solution. When a reaction is started, it will proceed until the system becomes stable, and leads to a final solution.

This diagram represents a reaction which permits to find a maximum number among a set of numbers. The reaction rule is called "Maximum" and reagents are 5, 8 and 3. As shown by blue arrows, the rule will firstly react with 5 and 8, and only 8 will remain in the solution. Then, it will react with 8 and 3, and only 8 will remain in the solution. This solution is now inert, reaction is over. During another execution, the different reagents may be choosen in a different order, as shown by red arrows.



Java library

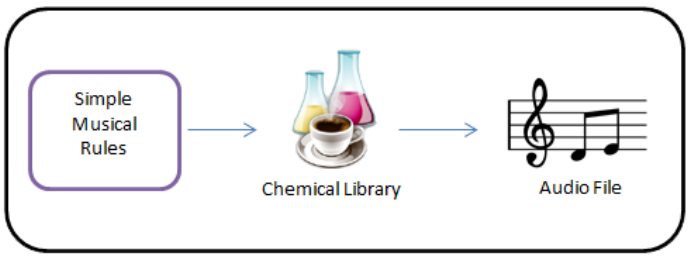
Until then, chemical programming was used in combination with a specific language called HOCL. In order to interest as many programmers as possible, our library can be used with Java, and respects every aspects of object-oriented programming (interfaces, inheritance, reflexivity). For example with the previous diagram, programmers can write their own reaction rule (MaxRule), then use it this way :

```
class RuleMax implements ReactionRule{
    private int a,b;
    public Object[] computeResult(){
        if(a>=b)
            return new Object[]{a};
        else
            return new Object[]{b};
    }
}
```

```
public class MyChemicalProgram{
   public static void main(){
      Solution sol = new Solution();
      sol.add(5);
      sol.add(8);
      sol.add(3);
      sol.add(new RuleMax());
      sol.run();
   }
}
```

Technology showcase

In order to provide an example of what can be done with the library, we decided to design a random music generator using it. We focused on a very theorical musical form : the tonal system of classical music, mainly used from 1750 to 1820. This way we can set different reaction rules governing the track creation.



Using a GUI, users can specify some parameters like tempo, range and number of bars. Then, the application will automatically generate a song dependent on these parameters.

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