

## Homework 3 - Modern Family

Your aunt Clara wants to explore your family tree. Auntie Clara has information on your family background in a text file. A similar problem has been covered on your course on data structures and algorithms. You decide to implement a program that can model relations between people.

Information on persons can be added into the program. People can be declared a couple and both parent-child and child-parent relations can be created between people. The program can give two types of family information: genetic and social. Based on the family tree information, one can search if two people are blood relatives, i.e. genetically related. The program can also be used to print the person's social family, i.e. spouses, children, grandchildren etc.

### Functionality of the Program

The program models family relations. It can be used for modeling both types of family: the biological one, i.e. genetic, and social relationships. People who share a common ancestor, are genetically related to each other, i.e. they are blood relatives. Social relationships include the concept of a partner: a person's spouse or parent to one's offspring.

People are added to the family tree with the following information: name, year of birth and year of death, which is 0 if the person is still with us. As there can be several people of the same name in the tree, a separate archive number (id) is used to identify people. The archive numbers as integers and numbers 001762 and 1762 are interpreted as the same id.

The genetic relation can be searched between two people. As a result, the program prints if the two people are biologically related to each other or not. In addition, the program must be able to print the social family tree of a given person as an indented list.

| Command                        | Description  |
|--------------------------------|--|
| M name<br>id yearborn yeardied | If the archive number (id) is not unique, print "V".<br>Otherwise a new man is added into the tree and "M" is printed.<br>A missing year of death is indicated with 0. |

|                                |  |
|--------------------------------|--|
| N name<br>id yearborn yeardied | <p>If the archive number (id) is not unique, print "V".</p> <p>Otherwise a new woman is added into the tree and "N" is printed.</p> <p>A missing year of death is indicated with 0.</p>  |
| A id1 id2                      | <p>A spousal relationship is formed between the two people. "A" is printed.</p> <p>If one of the people are not found in the family tree, "V" is printed.</p> <p>If there already is a spousal relationship between the two, "A" is printed, but nothing gets added.</p>                                       |
| P child_id mother_id father_id | <p>Forms the required family relations between the people and prints "P".</p> <p>A spousal relationship is created between the mother and the father.</p> <p>If some of the people are not found in the family tree, someone is of an impossible gender, or the child already has parents, "V" is printed.</p> |
| K id_1 id_2                    | <p>Investigates if the persons are genetically related to each other.</p> <p>If they are, "+" is printed, otherwise "-" is printed.</p> <p>A person is related to him/herself.</p> <p>If one is not found in the tree, "V" gets printed.</p>   |

|      |   |
|------|---|
| T id | Prints the id's social family<br>i.e. partners and offspring data<br>hierarchically as an indented list<br>A child together forms a spousal<br>relationship between people.<br>The relationships are printed<br>in the order they have been added.<br>Children are printed in age<br>order, oldest first.<br>If the person is not found in the tree,<br>"V" gets printed. |
| Q    | Quits the program   |

Note! There are no loops in genetic relations, i.e. timetravelling has not been invented yet. Children born during the same year are printed in the order they were added.

## Files Provided by the Course

The goal of the assignment is to practice implementing a graph. Typically data structure implementations are done as interfaces, here as well. Your task is thus to implement the infrastructure defined for the Datastructure class.

The main program is provided by the course staff. The main implements input handling, T creates an instance of a Datastructure class and calls its public interface based on the given commands. The task of the main program is to test the given implementation. You do not need to and should not change the main program.

The file datastructure.hh defines the Datastructure class and its interface. You must implement the interface functions and the member functions and variables needed on the private side into the .cc file. You can modify the file but it defines the public interface the class must have. You may not change the public interface.

The given parts are available in the student's kurssiSVN-repository.

## Example

The input for the example run of the program can be found in test\_public.in. The output can be found in test\_public.out. These files and more test material is available in your kurssiSVN repository.

N Elizabeth II, Queen of England  
 1 1926 0  
 M Philip Mountbatten  
 2 1921 0  
 A 2 1  
 M Charles, Prince of Wales  
 3 1948 0  
 P 3 1 2  
 N Lady Diana Spencer  
 4 1948 1997  
 A 3 4  
 M Prince William, Duke of Cambridge  
 5 1982 0  
 M Prince Harry  
 6 1984 0  
 P 5 4 3 P 6 4 3  
 N Princess Anne  
 7 1950 0  
 P 7 1 2  
 M Captain Mark Phillips  
 8 1948 0  
 A 8 7  
 M Commander Timothy Laurence  
 9 1954 0  
 A 9 7  
 M Peter Phillips  
 10 1977 0  
 N Zara Phillips  
 11 1981 0  
 P 10 7 8 P 11 7 8  
 M Andrew, Duke of York  
 12 1960 0  
 P 12 1 2  
 N Sarah Ferguson  
 13 1959 0  
 A 12 13  
 N Princess Beatrice  
 14 1988 0  
 N Princess Eugenie  
 15 1990 0  
 P 14 13 12 P 15 13 12

M Edward, Earl of Wessex  
16 1964 0  
N Camilla, Duchess of Cornwall  
17 1947 0  
A 3 17  
N Catherine, Duchess of Cambridge  
18 1982 0  
A 5 18  
P 16 1 2  
T 1  
K 1 15 K 11 5 K 10 4 K 8 9  
Q

The correct ouput:

N M A M P N A M M P P N P M A M A M N P P M P N A N N P P M N A N A P  
Elizabeth II, Queen of England 1926 -  
& Philip Mountbatten 1921 -  
    Charles, Prince of Wales 1948 -  
    & Lady Diana Spencer 1948 - 1997  
        Prince William, Duke of Cambridge 1982 -  
        & Catherine, Duchess of Cambridge 1982 -  
        Prince Harry 1984 -  
    & Camilla, Duchess of Cornwall 1947 -  
Princess Anne 1950 -  
    & Captain Mark Phillips 1948 -  
        Peter Phillips 1977 -  
        Zara Phillips 1981 -  
    & Commander Timothy Laurence 1954 -  
Andrew, Duke of York 1960 -  
    & Sarah Ferguson 1959 -  
        Princess Beatrice 1988 -  
        Princess Eugenie 1990 -  
Edward, Earl of Wessex 1964 -  
+  
+  
-  
-  
the end