İTÜ Computer Engineering Department
BLG252E Object Oriented Programming
2nd Homework

Due Date: April 18, 2011 09.00 AM

There is a game to pass some people across the river with some constraints(rules). The goal is to pass all 8 people(The father, the mother, two daughters, two sons, a policeman and a thief) across the river by using the only available raft with capacity of carrying 2 people.

The following rules apply:

- Only 2 people on the raft at a time.
- The father cannot stay with any of the daughters, without their mother's presence.
- The mother cannot stay with any of the sons, without their father's presence.
- The thief (striped shirt) cannot stay with any family member, if the policeman is not there.
- Only the father, the mother and the policeman know how to operate the raft.

Note: You can play the game from the link provided on the picture.

For this assignment, **only** consider the action of sailing across by using the raft. To be consistent with the rules:

- At least one of the two people getting on the raft must be able to operate it.
- The father cannot get on the raft with any of his daughters.
- The mother cannot get on the raft with any of her sons.
- The thief cannot get on the raft with anyone except the policeman.
- Also consider the remaining people on the left side of the river:
  - The father cannot stay with any of the daughters, without their mother's presence.
  - The mother cannot stay with any of the sons, without their father's presence.
  - The thief (striped shirt) cannot stay with any family member, if the policeman is not there.
- You **DO NOT** need to think about inconsistencies on the other side across the river.

In this assignment, you will design C++ classes to model the people(The father, the mother, two daughters, two sons, a policeman and a thief) in the game. Use inheritance and polymorphism effectively to be consistent with the rules mentioned above. Your design should **avoid repetition** as much as possible. The classes you provide **must** be compatible with the test code given below. While grading the homework this test code will be used as it is, so do not modify test_code.cpp. Write all your classes in **person.h** and **person .cpp** files.

Test code (included in the archive file):

1-Main function of test_code.cpp:

```
int main(int argc, char *argv[]){
    // a list to contain all 8 people's names and another list for remainders
    List people, remaining_people;
    // creating each person and adding it to the list
    Mother m("Mother");
    people.push_back(m.getName());
    Father f("Father");
    people.push_back(f.getName());
    Daughter d1("Daughter 1"), d2("Daughter 2");
    people.push_back(d1.getName());
    people.push_back(d2.getName());
    Son s1("Son 1"), s2("Son 2");
    people.push_back(s1.getName());
    people.push_back(s2.getName());
    Policeman p("Policeman");
    people.push_back(p.getName());
    Thief t("Thief");
    people.push_back(t.getName());

    // Trying sailAcross function for some different combinations
    remaining_people = people;
    remaining_people.remove("Mother");
    remaining_people.remove("Daughter 2");
    sailAcross(m,d2,remaining_people);
    // ERROR: Father is left with daughter1 without mother's presence.

    remaining_people = people;
    remaining_people.remove("Father");
    remaining_people.remove("Daughter 2");
    sailAcross(f,d2,remaining_people);
    // ERROR: Father is left with daughter2 without mother's presence.

    remaining_people = people;
    remaining_people.remove("Son 1");
    remaining_people.remove("Son 2");
    sailAcross(s1,s2,remaining_people);
    // ERROR: None of them can operate the boat.

    remaining_people = people;
    remaining_people.remove("Policeman");
    remaining_people.remove("Daughter 1");
    sailAcross(p,d1,remaining_people);
    // ERROR: Thief is left with family without policeman's presence

    remaining_people = people;
    remaining_people.remove("Mother");
    remaining_people.remove("Father");
    sailAcross(m,f,remaining_people);
    // OK: This does not violate any rule

    return EXIT_SUCCESS;
}
```

2-Part of the code added to use C++ Standart Template Library(STL) list container: To maintain the list of remainders, STL list container is used, as it is a convenient way for maintaining linked lists easily. You can examine the test_code.cpp to see how it is used.

```
#include <list>    // to be able to use STL list
using namespace std;

// a list of strings and an iterator to be able to move on the list
typedef list<string> List;
typedef List::const_iterator Iter; // const_iterator is used to move on const List
```

3-sailAcross method:

```
// method to check if the given pair can sail across without violating the rules or not
void sailAcross(const Person &p1, const Person &p2, List &remainders){
     cout<<p1.getName()<<" and "<<p2.getName()<<" are trying sail across together"<<endl;
     cout<<"leaving ";
     for(Iter i = remainders.begin(); i != remainders.end(); i++)
         cout<<*i<<" ";
     cout<<"behind."<<endl;
     // check if p1 or p2 can operate the raft
     if ( !p1.canOperateTheRaft() && !p2.canOperateTheRaft() )
         cout<<"ERROR: None of "
             <<p1.getName()<<" and "<<p2.getName()
             <<" can operate the raft";
     // check if p1 and p2 can sail across together, leaving remainders behind
     // without violating the rules
     else if ( !p1.canGetOnTheRaftWith(p2, remainders) )
         cout<<"ERROR: Violation of game rules"<<endl;
     else
         cout<<p1.getName()<<" and "<<p2.getName()
             <<" can succesfully sail across the river together";
     cout<<endl<<endl;
}
```

Expected Output:

```
Mother and Daughter 2 are trying sail across together
leaving Father Daughter 1 Son 1 Son 2 Policeman Thief behind.
Father is left with daughter without mother's presence.
ERROR: Violation of game rules


Father and Daughter 2 are trying sail across together
leaving Mother Daughter 1 Son 1 Son 2 Policeman Thief behind.
Father is left with daughter without mother's presence.
ERROR: Violation of game rules


Son 1 and Son 2 are trying sail across together
leaving Mother Father Daughter 1 Daughter 2 Policeman Thief behind.
ERROR: None of Son 1 and Son 2 can operate the raft

Policeman and Daughter 1 are trying sail across together
leaving Mother Father Daughter 2 Son 1 Son 2 Thief behind.
Thief is left with a family member without policeman's presence.
ERROR: Violation of game rules


Mother and Father are trying sail across together
leaving Daughter 1 Daughter 2 Son 1 Son 2 Policeman Thief behind.
Mother and Father can succesfully sail across the river together
```

Submission Procedure:

1. Your source code archive should contain **person.h** and **person.cpp**.
2. Make sure you write your name and number to **person.h** with the following format.

```
/*
 *
 *  BLG252E
 *  2011 Spring
 *  2nd Homework
 *
 */

/*
 *
 * Student Name: !! enter here !!
 * Student ID  : !! enter here !!
 *
 */
```

3. Make sure that GNU C++ Compiler (g++) compiles your project and the application runs in Unix smoothly. This is important because we will evaluate your homework in Unix using g++.
4. Use comments wherever necessary in your code to explain what you did.
5. After you make sure that everything is compiled smoothly, archive all files into a zip file. Submit this file through www.ninova.itu.edu.tr. Ninova enables you to change your submission before the submission deadline.

Academic dishonesty including but not limited to cheating, plagiarism, collaboration is unacceptable and subject to disciplinary actions. Any student found guilty will get grade F.