Course $C^{++}$, Exercise Number 9

Date: 26.04.2012 + two weeks

This exercise is about templates. The task is to implement the class below. It cannot be called union, because union is a reserved word in $C^{++}$.

```cpp
template< typename A, typename B >
class unionof
{
    A* a;
    B* b;
    // Invariant: Exactly one of them is non-zero.

public:
    unionof( const A& a );
    unionof( const B& b );
    unionof( const unionof& u );

    void operator = ( const A& a );
    void operator = ( const B& b );
    void operator = ( const unionof& u );

    const A& first( ) const;
    A& first( );

    const B& second( ) const;
    B& second( );

    bool hasfirst( ) const;
    bool hassecond( ) const;

    ~unionof( );
};

template< typename A, typename B >
std::ostream& operator << ( std::ostream& stream,
                         const unionof< A, B >& u );
```

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1. Implement the constructors of `unionof`.
2. Implement the assignment operators of `unionof`.
3. Implement the destructor of `unionof`.
4. Implement the `first( )` methods and the `second( )` methods.
5. Implement `hasfirst( ) const` and `hassecond( ) const`.
6. Implement `operator << ( std::ostream&, unionof< > & )`. You will need to make it friend of class `unionof`, which is not so easy at it seems. Write, just before the definition of class `unionof`:

   template<typename A, typename B> class unionof;

   template<typename A, typename B>
   std::ostream& operator << ( std::ostream& stream,
                               const unionof< A, B >& );

   The friend declaration has the following form:

   friend std::ostream& operator << ( std::ostream& stream,
                                       const unionof< A, B >& );

   Now it should work.

Make sure that `unionof< >` has no memory leaks. Test it on a few different classes, e.g. `double`, `int`, `std::string`, etc.