```
// FILE: IntSet.cpp - header file for IntSet class
//       Implementation file for the IntStore class
//       (See IntSet.h for documentation.)
// INVARIANT for the IntSet class:
// (1) Distinct int values of the IntSet are stored in a 1-D,
//     compile-time array whose size is IntSet::MAX_SIZE;
//     the member variable data references the array.
// (2) The distinct int value with earliest membership is stored
//     in data[0], the distinct int value with the 2nd-earliest
//     membership is stored in data[1], and so on.
//     Note: No "prior membership" information is tracked; i.e.,
//           if an int value that was previously a member (but its
//           earlier membership ended due to removal) becomes a
//           member again, the timing of its membership (relative
//           to other existing members) is the same as if that int
//           value was never a member before.
//     Note: Re-introduction of an int value that is already an
//           existing member (such as through the add operation)
//           has no effect on the "membership timing" of that int
//           value.
// (4) The # of distinct int values the IntSet currently contains
//     is stored in the member variable used.
// (5) Except when the IntSet is empty (used == 0), ALL elements
//     of data from data[0] until data[used - 1] contain relevant
//     distinct int values; i.e., all relevant distinct int values
//     appear together (no "holes" among them) starting from the
//     beginning of the data array.
// (6) We DON'T care what is stored in any of the array elements
//     from data[used] through data[IntSet::MAX_SIZE - 1].
//     Note: This applies also when the IntSet is empry (used == 0)
//           in which case we DON'T care what is stored in any of
//           the data array elements.
//     Note: A distinct int value in the IntSet can be any of the
//           values an int can represent (from the most negative
//           through 0 to the most positive), so there is no
//           particular int value that can be used to indicate an
//           irrelevant value. But there's no need for such an
//           "indicator value" since all relevant distinct int
//           values appear together starting from the beginning of
//           the data array and used (if properly initialized and
//           maintained) should tell which elements of the data
//           array are actually relevant.

#include "IntSet.h"
#include <iostream>
#include <cassert>
using namespace std;

IntSet::IntSet() : used(0) {}

int IntSet::size() const { return used; }
```

```
bool IntSet::isEmpty() const
{
    if (used == 0) return true;
    return false;
}

bool IntSet::contains(int anInt) const
{
    for (int i = 0; i < used; i++) {
        if (data[i] == anInt) return true;
    }
    return false;
}

bool IntSet::isSubsetOf(const IntSet& otherIntSet) const
{
    if (isEmpty() == true) return true;
    for (int i = 0; i < used; i++) {
        if (otherIntSet.contains(data[i]) == false) return false;
    }
    return true;
}

void IntSet::DumpData(ostream& out) const
{  // already implemented ... DON'T change anything
   if (used > 0)
   {
      out << data[0];
      for (int i = 1; i < used; ++i)
         out << "  " << data[i];
   }
}

IntSet IntSet::unionWith(const IntSet& otherIntSet) const
{
    assert(size() + (otherIntSet.subtract(*this)).size() <= MAX_SIZE);
    IntSet newSet = otherIntSet;
    for (int i = 0; i < used; i++)
        newSet.add(data[i]);
    return newSet;
}

IntSet IntSet::intersect(const IntSet& otherIntSet) const
{
    IntSet newSet = *this;
    for (int i = 0; i < used; i++)
        newSet.remove(otherIntSet.data[i]);
    return newSet;
}
```

```
IntSet IntSet::subtract(const IntSet& otherIntSet) const
{
    IntSet newSet;
    for (int i = 0; i < used; i++)
        newSet.remove(data[i]);
    return newSet;
}

void IntSet::reset() { used = 0; }

bool IntSet::add(int anInt)
{
    assert(contains(anInt) ? size() <= MAX_SIZE : size() < MAX_SIZE);
    if (contains(anInt) == true) {
        return false;
    } else {
        used += 1;
        data[used - 1] = anInt;
        return true;
    }
}

bool IntSet::remove(int anInt)
{
    if (contains(anInt) == true)
    {
        for (int i = 0; i < used; i++)
            if (data[i] == anInt)
            {
                data[i] = data[i + 1];
                for (int x = i + 1; x < used + 1; x++)          // This for
                 loop shifts the numbers to the right
                    data[x] = data[x + 1];                      // of the
                     removed element 1 index to the left
            }
        used -= 1;
        return true;
    }
    return false;
}

bool equal(const IntSet& is1, const IntSet& is2)
{
    if (is1.size() != is2.size()) return false;
    bool flag = is2.isSubsetOf(is1);
    return flag;
}
```