H9-H11 作业说明

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教学内容(chap10):
1. [课内完成] H9
2. [课外完成, due:4.01 24:00] H10, H11

H9. (集合类)
Create class IntegerSet for which each object can hold integers in the range 0 through 100. A set is represented internally as an array of ones and zeros. Array element a[i] is 1 if integer i is in the set. Array element a[j] is 0 if integer j is not in the set. The following member functions are required:

(1) **The default constructor** initializes a set to the so-called “empty set”, i.e., a set whose array representation contains all zeros.

(2) **An additional constructor** receives an array of integers and the size of that array and uses the array to initialize a set object. （注意，在参数 array 中，数据是元素值，而不是 0/1 表示的数组，如 {1,2,4,10}）

(3) **getSetSize** member function gets the number of elements of the current set

(4) **isEmptySet** member function determines whether the current set is empty, which returns true or false

(5) **insertElement** member function inserts a new integer k into a set

(6) **deleteElement** member function deletes integer m

(7) **inputSet** member function reads a set from user

(8) **printSet** member function prints a set as a list of numbers separated by spaces. Print only those elements which are present in the set (i.e., their position in the array has a value of 1). Print ---- for an empty set

(9) **isEqualTo** member function determines whether two sets are equal

(10) **Union** member function creates a third set that is the set-theoretic union of two existing sets (两个集合的并集)

(11) **Intersect** member function creates a third set which is the set-theoretic intersection of two existing sets (两个集合的交集)

(12) **Subtract** member function creates a third set which is the set-theoretic subtraction of two existing sets (两个集合相减)

Write a driver program to test your IntegerSet class. Instantiate several IntegerSet objects. Test that all your member functions work properly. Refer to sample output.
Sample usage:

```c
int a[3]={1,2,3};
int b[2]={1,4};
IntegerSet A(a, 3);
IntegerSet B(b, 2);
bool result = A.isEqualTo(B); //result=false
IntegerSet C = A.Union(B); //C={1,2,3,4}
IntegerSet C = A.Intersect(B); //C={1}
IntegerSet C = A.Subtract(B); //C={2,3}
```

Sample output:

```plaintext
Enter set A:
Enter an element (-1 to end): 45
Enter an element (-1 to end): 76
Enter an element (-1 to end): 34
Enter an element (-1 to end): 6
Enter an element (-1 to end): -1
Entry complete
Enter set B:
Enter an element (-1 to end): 34
Enter an element (-1 to end): 8
Enter an element (-1 to end): 93
Enter an element (-1 to end): 45
Enter an element (-1 to end): -1
Entry complete
Union of A and B is:
{ 6 8 34 45 76 93 }
Intersection of A and B is:
{ 34 45 }
Set A is not equal to set B
Inserting 77 into set A...
Set A is now:
{ 6 34 45 76 77 }
Deleting 77 from set A...
Set A is now:
{ 6 34 45 76 }
Invalid insert attempted!
```
Invalid insert attempted!

Set e is:

$\{ 1 \quad 2 \quad 9 \quad 25 \quad 45 \quad 67 \quad 99 \quad 100 \}$

Tips:
1. 注意元素的有效值范围为0-100
2. isEqualTo, Union, Intersect, Subtract并不改变两个操作数的值，想想看，参数和返回值应为何种类型？
3. 想想看哪些成员函数应该是const成员函数？
4. 课后思考一下，这种方式实现集合有何不足？有没有更好的实现方式？
**H10. (多项式类)**

Write the class **Polynomial** for a polynomial of the form:

\[ a_0 + a_1x + a_2x^2 + \ldots + a_nx^n \]

where \( n \) is the degree of the Polynomial, and \( a_i (i = 1, \ldots, n) \) are coefficient (系数). Assume that the largest polynomial to be used has degree 10. Member functions include:

1. a **constructor** receives an **int** argument to initialize degree
2. another **constructor** receives another **Polynomial** object to initialize a **Polynomial** object
3. **SetDegree** member function sets degree
4. **GetDegree** member function gets degree
5. **SetCoef** member function sets coefficient for a degree
   - **GetCoef** member function sets coefficient for a degree
6. **add** member function creates a third polynomial object which is the addition of two existing polynomials
7. **subtract** member function creates a third polynomial object which is the subtraction of two existing polynomials
8. **multiply** member function creates a third polynomial object which is the multiplication of two existing polynomials
9. **print** member function prints a polynomial
10. **printPolynomial** friend function prints a polynomial object

Write a driver function to test all the member functions and friend functions.

**Sample usage:**

```cpp
Polynomial p0(3); // set degree as 3
p0.SetCoef(0, 1.0); // a0=1.0
p0.SetCoef(1, 2.0).SetCoef(3, 5.0); // a1=2.0, a3=5.0
Polynomial p1(p0);
P1.print();
Polynomial p2(5);
p2.SetCoef(5, 10.0);
p2.print();
Polynomial p3(7);
p3.SetCoef(7, 1.0);
p3.print();

Polynomial p4 = p1.add(p2); // p1+p2
Polynomial p5 = p1.subtract(p2); // p1-p2
Polynomial p6 = p1.multiply(p2); // p1*p2
```
print Polynomial(p4);
print Polynomial(p5);
print Polynomial(p6);

Tips:
1. 哪些成员函数应为 const 成员函数？
2. 注意参数和返回值的类型
3. this 指针的用法
4. friend(友元)的使用
H11. (修改 Date 类)
Modify class Date in Fig. 10.10 to have the following capabilities:
a) Output the date in multiple formats such as
   - DDD YYYYY (where, DDD represents the total days from the first day of current year)
   - MM/DD/YY (e.g. 03/31/2012)
   - June 14, 1992
b) Use overloaded constructors to create Date objects initialized with dates of the formats in part (a).
c) Create a Date constructor that reads the system date, using the standard library functions of the <ctime> header, and sets the Date members. (See your compiler’s reference documentation or visit the Web site wwwcplusplus.com/ref/ctime/index.html for information on the functions in header <ctime>.)

Hints:
1. There are four constructors for this class:
   1) a default constructor that sets the date to the current date, using <ctime>
   2) a constructor that takes a date in the form (DDD, YYYYY), where DDD represents the day of the year
   3) a constructor that takes a date in the form (MM, DD, YY)
   4) a constructor which takes the month name, day and year. Use a char* and two ints for this constructor.

2. In addition to the four constructors, include functions for setting the month, day and year. No other data members are necessary.
   1) setDay sets the day
   2) setMonth sets the month
   3) setYear sets the year

3. Write three different printing member functions.
   1) print prints date in month/day/year format
   2) printDDDYYYY prints date in DDD YYYY format
   3) printMMDDYY prints date in MM/DD/YY format
   4) printMonthDDYYYY prints date in Month DD, YYYY format

4. You may find it necessary to implement helper member functions that perform the following tasks:
   1) daysInMonth returns the number of days in a month.
   2) isLeapYear tests for a leap year. A year is a leap year if it is divisible 400 or divisible by four and not by 100.
   3) setMMDDFromDDD converts DDD to MM DD.
   4) convertDDToDDD converts MM DD to DDD.
(5) **convertMMToMonth** returns the name of a month (as a char*).
(6) **setMMFromMonth** converts from month name to MM.
(7) **convertYYYYToYY** gets 2-digit year based on 4-digit year
(8) **setYYYYFromYY** sets year based on 2-digit year

Sample output:

<table>
<thead>
<tr>
<th>Date String</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/13/1999</td>
</tr>
<tr>
<td>3/25/2004</td>
</tr>
<tr>
<td>9/1/2000</td>
</tr>
<tr>
<td>12/14/2004</td>
</tr>
<tr>
<td>256 1999</td>
</tr>
<tr>
<td>85 2004</td>
</tr>
<tr>
<td>245 2000</td>
</tr>
<tr>
<td>349 2004</td>
</tr>
<tr>
<td>09/13/99</td>
</tr>
<tr>
<td>03/25/04</td>
</tr>
<tr>
<td>09/01/00</td>
</tr>
<tr>
<td>12/14/04</td>
</tr>
<tr>
<td>September 13, 1999</td>
</tr>
<tr>
<td>March 25, 2004</td>
</tr>
<tr>
<td>September 1, 2000</td>
</tr>
<tr>
<td>December 14, 2004</td>
</tr>
<tr>
<td>Date object destructor for date 12/14/2004</td>
</tr>
<tr>
<td>Date object destructor for date 9/1/2000</td>
</tr>
<tr>
<td>Date object destructor for date 3/25/2004</td>
</tr>
<tr>
<td>Date object destructor for date 9/13/1999</td>
</tr>
</tbody>
</table>

Tips:

1. 请在 MSN 或者百度搜索关于 `<ctime>` 中获得时间的用法，提示如下：

```c
struct tm *ptr;
time_t t = time( 0 ); // determine current calendar time

// convert current calendar time pointed to by t into
// broken down time and assign it to ptr
ptr = localtime( &t );

day = ptr->tm_mday; // broken down day of month
month = 1 + ptr->tm_mon; // broken down month since January
year = ptr->tm_year + 1900;
```

2. 哪些成员函数为 const 成员函数？