



[**Open book, handouts, and notes**] Show all of your work clearly in the space provided or on the additional page at the end of the exam. If the additional page is used, clearly identify to which exam question it is related. Be sure to **read each problem carefully**. You should answer all 4 questions, and you may wish to answer the bonus question if you have time. Note that the exam is double sided.

1. (10 points) Briefly, in your own words, describe how *rvalues* and *lvalues* differ. Use examples when appropriate.

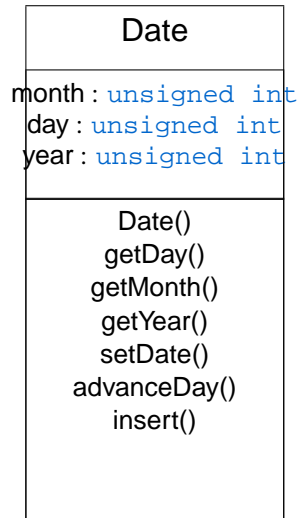


2. (20 points) Write a function called `aveLength` that will accept an STL list of strings and return the average length of the strings in the list.

3. (15 points) If any errors are present in the following code, identify the line where the first error occurs, and draw a diagram (like the ones done in lecture) to describe the memory conditions just prior to the error. If no errors are present, draw a diagram to describe the memory conditions after lines 1-23 have been executed.

```
int main()
2 {
  const double x = 3.14;
4  double y[3];
  int i = -17;
6  int j = 22;
  int& k = i;
8  for(j=0; j<1; ++j) {
    int* ptr1 = &j;
10 }
  int* ptr2;
12 int* ptr3 = 0;
  int* ptr4 = &i;
14 ptr3 = ptr4;
  ptr4 = 0;
16 double* ptr5 = &x;
  double* ptr6 = &y[1];
18 ptr5 = y;
  ptr6;
20 if(ptr5!=ptr6) {
    i = 7;
22 }
  ptr6++;
24 return 0;
26 }
```

4. In this multi-part problem, you will make use of a `Date` class. The UML description of the class is given as:



(a) (15 points) Write the class definition for the `Date` class.

(b) (10 points) Consider the following implementation of the copy constructor for the `Date` class:

```
Date::Date(Date rhs)
2 {
  month = rhs.month;
4  day = rhs.day;
  year = rhs.year;
6 }
```

How could this implementation be improved? Are improvements necessary for this to compile or are they just a good idea? Be sure to explain your reasoning.



(c) (10 points) Write the `getMonth` member function of the `Date` class.



(d) (20 points) Write the `advanceDay` member function of the `Date` class. You may assume that there is a `private` member function in the `Date` class with the following prototype:

```
// Returns the number of days in the current month
2 unsigned int numDaysInMonth() const;
```



bonus (5 points) Implement the overloaded increment operator as a class member function. (No partial credit will be given for the bonus question.)



Additional work area for any problem. Clearly identify to which problem the work on this page is related.



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