1. Fill in the Blank (20 pts)

1. (2 pts) A ________________ is a special member function that is called prior to an object being deallocated.

2. (2 pts) A ________________ can occur when we have two pointers which refer to the same object and we call delete on one of them.

3. (2 pts) An outside function can be defined to be a ________________ of the class definition and will be able to access the private members of the class definition.

4. (2 pts) A ________________ is a public function in a class definition which is used to change the value of private variables in the class definition.

5. (2 pts) The ________________ is a special area of memory where dynamic variables are stored when they are created and we must be sure to return the space taken up by the variables so we don’t run out.

6. (2 pts) If we place a ________________ in front of a variable, we can obtain the memory address of the variable.

7. (2 pts) The purpose of the ________________ is to initialize the member variables contained in the class definition.

8. (2 pts) The purpose of a ________________ is to initialize the current object with the contents of the object that is sent as the parameter.

9. (2 pts) ________________ is a binding together of data and the code which operates on the data.

10. (2 pts) The class that is created by adding functionality to an existing class is called a ________________ class.
II. **Short Answer** (60 pts)

11. (4 pts) Suppose p is a pointer to a double and a double is stored in 8 bytes. If the value of p is 0200, what is the value of p+5?

12. (4 pts) What are three requirements of an ADT?

13. (4 pts) What is printed by the following loop?

   ```
   int counter = 0;
   while (++counter < 10)
       cout << counter << endl;
   ```

14. (4 pts) Suppose we have a class definition named Number. We wish to overload the = operator in the class definition. Show the declaration of the = operator in the class definition.

15. (4 pts) When will a default constructor be generated for us and in which situations will it not?

16. (4 pts) What can we not do if we overload the = operator?

17. (4 pts) Suppose p is a pointer to an int. Show how you would create a dynamic int using p and assign 3 to it.

18. (4 pts) How do we return space to the freestore?
19. (4 pts) Suppose we want to define a class definition named Word with a char pointer named characters and an int named size as its member variables. Show the declaration of the constructor in the class definition that will accept one int parameter.

20. (4 pts) Suppose we have a class definition named TernaryNumber. Show how we would declare the destructor for this class in the class definition and how we would write the destructor in the implementation. You may leave the body empty.

21. (4 pts) If we have a class definition called Vector, what is the syntax of the copy constructor in the class definition?

22. (4 pts) Show the syntax for creating an array of ints called numbers with 5 spaces and then show a for loop which will initialize each element to 1.

23. (4 pts) What is printed by the following?

```c
int num = 1;
int* p = &num;
*p = *p + 2;
cout << num << endl;
```

24. (4 pts) What are the two ways variables can be sent to functions?

25. (4 pts) Suppose we want to have a structure called RationalNumber which contains two member variables, numerator and denominator. Show the definition of the structure and how you would create an instance of the structure.
III. Problems (20 pts)

26. (10 pts) Show the class definition for a Vector. The class should have one pointer variable of type int named p, one int named size, and one int named index which will indicate where the next number added to the Vector will go. Include one constructor which will accept one int parameter to initialize the variable size and then create a dynamic array of that size. Include one member function named add which will accept an int and place that int into the dynamic array. If the array is full, increase its size by 10 before adding the number to it. Show both the declaration and the implementation.
27. (10 pts) Show the class definition for a ComplexNumber. The class should have two member variables: 
realPart and imaginaryPart both of type double. You should include one constructor that will accept two 
doubles and initialize realPart and imaginaryPart. You should also overload the + operator to find the sum of 
two ComplexNumbers. Show both the declaration of the class and the implementation.