Name: _____

SSN: _____

CS 12 - Final Exam
June 9, 1997

Be sure to read each problem carefully and follow the directions. Points may be marked off if you do not follow the directions. For example, if the problem asks you to write a function, do not write an entire program. Please feel free to ask if you have any questions.

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Problem 16	25	
TOTAL	185	

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1. (20 pts) State whether the following are True or False.

   (a) Overloaded stream operators are defined as members of the class they are overloading.

   (b) Any function that can be written recursively can be written iteratively.

   (c) Friend functions can access the public and protected members of a class, but not the private members of the class.

   (d) The invocation of a virtual function is always determined at run-time.

   (e) A string is a character array.

   (f) A recursive function must have a base case.

   (g) When using inheritance the derived class constructor is the first constructor to be called.

   (h) A template function takes precedence over a non-template function when the compiler decides which to call.

   (i) A derived class object is also an object of that derived class's base class.

   (j) The following function declarations are valid.

```
double cube(int);
int cube(int);
```

2. (10 pts) Define pass-by-value and pass-by-reference.

3. (10 pts) Show the output of the following code.

```
char str = ‘‘balloon’’;
char *ptr = str;
ptr = strchr(str, ’a’);
*ptr = ’e’;
ptr++;
*ptr = ’a’;
ptr++;
*ptr = *(ptr+3);
ptr++;
*ptr = *(ptr+3);
cout << str << endl;
```

4. (12 pts) State the differences between an array, a dynamically allocated array, and a list. What effect do they have on the number of elements allowed? At what time is the size determined?

5. (10 pts) Write a function that takes in a string and creates, prints and returns the equivalent pig latin string. A pig latin word can be created by placing the first letter of the word at the end and adding the letters "ay". You should not waste memory and should use the string functions wherever possible.

```
English          Pig Latin

jump             umpjay
the              hetay
computer         omputercay
```

6. (12 pts) Define the three ways that class members can be declared that determine that member's accessibility (public, private, and protected).

7. (12 pts) Given the following class declarations, write a member function that enters a new family into the list. The information for the family node should be passed to the function.

```
// keeps track of the information for a family
class family
{
  public:
    char dad_name[20];
    char mom_name[20];
    int num_children;
};

class list
{
  private:
    family *head;
  public:



};
```

8. (6 pts) Write the constructor for the list class of the previous problem.

9. (10 pts) State whether a destructor is necessary for the previous list class. Explain why or why not. If one is needed, write the code for the destructor.

10. (8 pts) Define function signature and function prototype.

11. (10 pts) Show the value of each variable after the following code.

```
char ch1, ch2;
char str1[10];
char str2[10];
char str3[10];
infile >> str1;
infile.get(ch1);
infile.getline(str2, 5, '\n');
infile.getline(str3, 5, ' ');
infile.get(ch2);
```

Assume the input file contains:

```
``Have a nice summer.''
```

12. (10 pts) Given the following class declaration, overload the = operator for the *car* class.

```
class car
{
  private:
    char make[20];
    char model[20];
    int year;
  public:


};
```

13. (10 pts) Write a template function that accepts two parameters of the same type and compares them. It should return 1 if they are equal and 0 if they are not equal.

14. (10 pts) Write a recursive function that prints an array backwards. You should be sure to pass any necessary parameters to the function. Do not assume any global variables or prompt the user for any information in the function.

15. (10 pts) Write a recursive function to compute and return the factorial of an integer. The factorial of a non-negative integer n written $n!$ is the product

$$n \cdot (n-1) \cdot (n-2) \cdot ... \cdot 1$$

16. (25 pts) Write a program that reads from a file called "clients.dat", stores the information (assume that someone may add other functions later that will manipulate this data), and prints the contents to the screen. You may assume there will not be more than 25 clients. The file contains an account number, the client's name, and the account balance on each line. For example:

```
100 Jones 24.98
2000 Doe -420.14
600 White 276.80
```

The corresponding output should look like:

```
Account   Name          Balance
100       Jones           24.98
2000      Doe           -420.14
600       White          276.80
```

Be sure to use good coding style and implementation.