You must turn in all copies of the answer sheet and test. This pledged test is closed-book, closed-notes. All answers must be written on the answer sheet. Unless otherwise stated within a problem, assume that each program and/or program segment compiles and runs without error. Also assume that all necessary header files are included and that the standard namespace is used. Each question is independent unless otherwise stated. In the questions that follow you are sometimes asked to give the output of a code segment. If you believe the code segment does not produce any output, write NONE.

1. Function _____ is when two or more functions have the same name.
2. _____ is when a function calls itself.
3. When one wishes to convert one type to another, explicit _____ is preferable to implicit coercion.
4. One of the standard libraries defines the _____ function that enables an integral/boolean expression to be evaluated. If the expression is false, the program is terminated.
5. A logical expression that is being evaluated is subject to the _____rule that states that once the overall value of an expression is known, evaluation ceases.
6. Many member functions of container classes such as `vector`s use _____ returns so that the returned object can be used either on the left-hand-side or right-hand-side of an assignment statement.
7. S*ubscripting* or _____ is used to refer to a particular element of an array.
8. When defining a function with an array parameter, the _____ parameter definition does not need to include the size of the first dimension.
9. What phrase is abbreviated API?
10. What phrase is abbreviated GUI?
11. True or False A new class that is created from an existing class using inheritance is called a derived class. The parent class is called the base class.
12. True or False When an object that is an instance of a derived class is instantiated, the constructor for the base class is invoked before the body of the constructor for the derived class is invoked.
13. True or False The *erase* member function of a class performs the same action as the *destructor* function.
14. True or False The relationship has-a indicates inheritance. For example, a car has-a steering wheel.
15. True or False An array element may be either a value parameter or reference parameter.
16. True or False Arrays are first-class objects.
17. True or False A `continue` statement indicates that the body of the innermost loop that contains the statement is finished for the current iteration.
18. True or False For the arithmetic operators, the precedence from highest to lowest is unary plus and minus; then multiplication, division, and remainder; and then addition and subtraction.
19. True or False Every class definition must include a copy constructor; the compiler will issue an error message if one is not defined.
20. True or False Client code can use any member function of a given class as long as the member function is in the `public` section.
21. True or False Functions and operators are sometimes defined as auxiliary to a given class so that they have global scope.
22. True or False The size of an array is given as a bracketed expression whose value is derived from run-time constants.
23. True or False In an array, each element has its own subscript value. The first element in the array has a subscript of 1, the second element has a subscript of 2, and so on.
24. True or False In `C++` multidimensional arrays, the array elements are always stored in row-major order.

25. True or False A binary digit is called a byte.
26. True or False Data members of a class must all be *private*.
27. True or False The statement `#include <iostream>` is a preprocessor directive that in part defines the error stream `cerr`.
28. True or False Characters are always encoded using the ASCII character set.
29. True or False A `C++` name consists of a sequence of letters, digits, and underscores. A valid name can only begin with a letter.
30. True or False `C++` names are not case sensitive.
31. True or False Integer division can produce a floating-point result.
32. True or False The assignment operator is right associative and has lower precedence than the arithmetic operators.
33. True or False Elements of a global array whose base type is a numeric type are initialized by default to zero.
34. True or False When an array is defined with a class base type, initialization is always performed regardless of the scope.
35. True or False Container classes such as `vector`s are more flexible than arrays in that a `vector` can consist of elements of various types whereas all of the elements of an array must have the same type.
36. Consider the following code segment:

```
if ( 5 / 2 == 2.5 )
   cout << "1";
   cout << "2";
cout << "3" << endl;
```

Which of the following is the correct output?

(a) 1 2 3
(b) 1 3
(c) 2 3
(d) 3

37. Will the following program fragments compile? Answer yes or no.

```
a) int sum(int x, int y = 3, int z = 2) {
      return x + y + z;
   }

b) double Flow(int x, int y) {
      return x + y;
   }

c) vector<int> A[10];
   A[0] = 5;
```

38. What values are assigned to the variables `i`, `j`, and `k` after execution of this program segment?

```
int i = 10;
int j = 20;
int k = 30;
i = (j = (k = k + 7) - 3) + 4;
```

39. Write a single C++ statement that defines `Suit` to be an enumeration type whose possible values are `Heart`, `Diamond`, `Club`, and `Spade`. Your statement must compile.
40. What is the output of the following program segment?

```
cout << 20 /* 10 */ / 5;
```

41. What is the decimal value of the largest integer that can be stored in a 8-bit `unsigned int` variable? No calculators are allowed.

42. Show the 16-bit, two's-complement representation of each of the following C++ integer constants. No calculators are allowed.

    (a) -39

    (b) 01276

    (c) 0xABCD

43. Given the following code segment, will an insertion to the output stream occur? Answer yes, no, or indeterminate.

```
float a = 1.0 / 10.0;
float b = a + a + a + a + a + a + a + a + a + a;
if ( b == 1.0 )
{
   cout << "We're here" << endl;
}
```

44. The following object definitions are in effect for all parts of this question:

```
bool P = true;
bool Q = false;
bool R = true;
int x = 0;
```

    Evaluate each of the following as Boolean expressions:

    (a) `P != Q && P == R`

    (b) `x = 0`

45. What is the output of the following program segment?

```
cout << - 2 - 3 * 4 + 6 % 7;
```

46. What value is assigned to `x` after execution of this program segment?

```
int i = 10;
int j = 20;
int k = 30;
int x = i * j % k;
```

47. For the following program:

```
int main() {
   char c = 'c';
   char d = 'd';
   cin >> c;
   cin >> d;
   cout << "c = " << c << " d = " << d << endl;
   return 0;
}
```

    What is the output if the standard input stream contains the following?

```
A   12   B
```

48. What is the output of the following program segment?

```
int j;
for (int i = 0; i < 100; ++i) {
   j = i;
}
cout << j << endl;
```

49. Suppose the following definitions are in effect.

```
class A {
   public:
      A();
      void f();
      int value1;
   protected:
      int value2;
   private:
      int value3;
};
class B : public A {
   // ...
   protected:
      void g();
   // ...
};
```

Indicate which of the numbered lines of the following functions compile correctly (answer yes or no):

```
      void A::f() {
         A a;
L1.         a.value1 = 1;
L2.         a.value2 = 2;
L3.         a.value3 = 3;
      }
      void B::g() {
         B b;
L4.            b.value1 = 1;
L5.            b.value2 = 2;
L6.            b.value3 = 3;
      }
      void MyFunction() {
         B b;
L7.            b.value1 = 1;
L8.            b.value2 = 2;
L9.            b.value3 = 3;
      }
```

50. What is the output of the following program segment?

```
int i = 10;
int j = 20;
{
   int i = 30;
   j = 40;
}
cout << "i = " << i << " j = " << j << endl;
```

51. Suppose that you run the following C++ program:

```
#include <iostream>
using namespace std;
// here we have a prototype for function search
XXXXXXXX;

int main()
{
      int key= 2;
      int count = 0;
      int a[7] = {3, 2, 1, 2, 3, 2, 3};
      search(a, 7, key, count);
      cout << "There are " << count << " " << key
            << "'s in the array." << endl;
      return 0;
}
// here is the definition of search
XXXXXXXX
{
      for (int i = 0; i < size; i++)
            if (ary[i] == target)
                  result = result+1;
      return;
}
```

and obtain the following output:

```
There are 3 2's in the array.
```

What should replace **XXXXXXXX** in the code given above to result in a correct program which will produce the given output? (The same code segment works in both places.)

52. What is the output of the following program segment?

```
int count1 = 0;
int count2 = 0;
int count3 = 0;
for (int i = 0; i < 2; i++) {
   count1 += 1;
   for (int j = 1; j < 5; j++) {
      count2 += 1;
      for (int k = -10; k < 0; k++) {
         ++count3;
      }
   }
}
cout << "count1 =" << count1 << endl;
cout << "count2 =" << count2 << endl;
cout << "count3 =" << count3 << endl;
```

53. Given the definition:

```
vector<int> A(10,5);
```

How many elements does A have?

54. What is the output of the following program segment?

```
vector<int> List;
List.resize(10,5);
cout << List.at(4) << endl;
```

55. What is the output of the following program segment?

```
vector<int> List(5);
List[0] = 100;
List[1] = 101;
List[2] = 102;
List[3] = 103;
List[4] = 104;
vector<int>::iterator p = List.begin();
vector<int>::iterator q = List.end();
cout << *p << endl;
++p;
cout << *p << endl;
--q;
cout << *q << endl;
```

56. Given the following program segment:

```
vector<string> List;
string s;
while (cin >> s) {
   List.push_back(s);
}
cout << List[1][2] << endl;
```

What is the output of the above segment if the standard input stream contains the following?

```
she moves me
```

57. What is the output of the following program segment?

```
void f(int a[]) {
   int i;
   for (i = 0; a[i] > 0; ++i) {
      cout << a[i] << " ";
   }
   cout << endl;
   return;
}
int main() {
   int b[7] = {6, 4, 2, 0, -2, 7, 5};
   f(b);
   return 0;
}
```

58. Suppose the following global definitions are in effect.

```
class A {
   public:
      A(int v1 = 0, int v2 = 0);
      int get1() const;
      int get2() const;
      int set1(int v1);
      int set2(int v2);
   protected:
      void f1();
   private:
      int value1;
      int value2;
      void f2();
}
A a(1, 1);
const A b(1, 2);
```

(a) Does A have a copy constructor?

(b) Does A have a default constructor?

(c) Can function `main()` invoke `a.set1(3)`?

(d) Can function `main()` invoke `b.set1(3)`?

(e) Can function `main()` invoke `a.f1()`?

(f) Can `A::f1()` invoke `A::f2()`?

(g) A non-A function `g()` invokes `A::f1()`. What can you say about `g()`?

59. Consider the following program segment that reads in 75 character values into the array `message`:

```
int i;
const int n = 75;
char message[n];
for (i = 0 ; i < n; ++i) {
   getit(message[i]);
}
```

Complete the following function definition.

```
void getit(_____________________) {
   cin >> b;
   return;
}
```

60. What is the output of the following program segment?

```
vector<int> List;
List.push_back(84);
List.push_back(87);
cout << List.back() << endl;
cout << List.size() << endl;
```

61. Suppose the following definitions are in effect.

```
int A[10];
int B[10];
vector<int> D(10);
vector<int> E(100);
vector<char> F(10);
```

Identify which of the following assignments will compile and which will not. Answer yes or no.

```
(a) A = B;
(b) A = D;
(c) D = A;
(d) D = E;
(e) D = F;
```

62. Here is a function prototype with a description of what the function does:

```
double biggest( const double A[], int sizeA)
{
      // given input of array A with sizeA elements,
      // this function returns the value of the largest
      // (most positive) value in A as the value of the
      // function.
```

Here is a main function which calls the function above:

```
int main()
{
      int size;
      double answer;
      double MyArray[100];
      //.....various statements.......;
      answer = biggest(XXXXXXXXXXX);
      cout << answer << endl;
      return 0;
}
```

Write down a possible replacement for **XXXXXXXXXXX** in the code above:

63. Give the truth table for the following logical expression: (*not P*) or *Q*. (The last column of the table on the answer sheet is what will be graded.)

64. Complete the table describing inheritance access rights (there are nine slots to complete in the third column).

65. The factorial of a positive integer n is the number n! obtained by multiplying n by all of the positive integers less than n:

`n! = n × (n-1) × (n-2) × … × 2 × 1`

Write a function `Fact`() that computes and returns the factorial of its positive integer parameter.

66. Fill in the necessary code to accomplish the following (each of part a through e is a single line of code):

(a) Defines a constant `MaxSize` equal to 10.

(b) Defines an array `List` whose base type is integer that can represent at most `MaxSize` values.

(c) Sets the second element of `List` to the value 12.

(d) Sets the last element of `List` to the value 66.

(e) Is the value 3.1415 a legal subscript for `List` ?

67. Develop a class `Date` (as would appear in the header file `date.h`) for representing a calendar as follows. The class has a single constructor, with three optional integer parameters, `NewMonth`, `NewDay`, and `NewYear`, corresponding to the `private` data `Month`, `Day`, and `Year`, thereby providing a default constructor which initializes the date to September 14, 1752. The class should have three public inspectors and three public mutators that allow the month, day, and year to be accessed and modified. The operator `++` should be auxiliary overloaded so that when applied to a `Date` object, the object's new value is the successive day. Also prototype an auxiliary function `ToString()` that returns a `string` version of its `Date` parameter.

68. Recall that a matrix is a two-dimensional array where each row has the same number of columns. The matrix `Temp`, implemented as a `vector` of `vector`s, is made up of individual elements which are double-precision floating-point numbers, each number representing a temperature in degrees Fahrenheit. Write a function `Average()` that computes the average of all the temperatures in matrix `Temp`. (Assume that the matrix input to the function has at least one row and one column.) Your function must be compatible with this invocation:

```
cout << "Average temperature is: " << Average(Temp) << " degrees.";
```

The following is the class definition for Rational.

```
class Rational {
   public:
      Rational();
      Rational(int numer, int denom = 1);
      Rational Add(const Rational &r) const;
      Rational Multiply(const Rational &r) const;
      void Insert(ostream &sout) const;
      void Extract(istream &sin);
   protected:
      int GetNumerator() const;
      int GetDenominator() const;
      void SetNumerator(int numer);
      void SetDenominator(int denom);
   private:
      int NumeratorValue;
      int DenominatorValue;
};
Rational operator+(const Rational &r, const Rational &s);
Rational operator*(const Rational &r, const Rational &s);
ostream& operator<<(ostream &sout, const Rational &s);
istream& operator>>(istream &sin, Rational &r);
```

69. A new `public` member function `FloatingPoint()` is to be added to the class `Rational`. It will return a `double` representation of the `Rational` object which invokes it. Write the code to implement this new function (as it would appear in `rational.cpp`). Make sure your answer follows the conventions developed in class and lab. With a correct implementation of `FloatingPoint()`, the following code segment would result in `x` being assigned the value `0.5`.

```
const Rational OneHalf(1,2);
double x = OneHalf.FloatingPoint();
```