You may take this test with you after the test, but you must turn in your answer sheet.

This test has 25 multiple-choice questions, each worth 4 points, for a total of 100 points. This test is worth 20% of your final grade. You must put your answers on the bubble form.

This test is open book and open notes. For the multiple choice problems, select the best answer for each one and select the appropriate letter on your answer sheet. Be careful - more than one answer may seem to be correct. Some questions are tricky. When a problem describes a segment or fragment of code you may assume the reset of the program is correct and would be supplied to make it work. Assume all code is in a C++ program compiled with a C++ compiler.

1. Consider the following function declaration:
   
   \[
   \text{void f1 ( int x, char y, float z = 3.14);}
   \]

   How many of the following function calls would match the above declaration?

   I. \( f1(3, 'a', 1.5) \)
   II. \( f1(3, 'a') \)
   III. \( f1(3) \)
   IV. \( f1(1.5) \)

   a. 1
   b. 2
   c. 3
   d. 4

2. When passing an array to a function, what is the effect of adding \texttt{const} to the array declaration within the function declaration parameter list?

   a. Local changes are allowed and are reflected back in the calling code
   b. Local changes are allowed, however they will not be reflected back in the calling code.
   c. An attempt to make a local change results in a compiler error
   d. An attempt to make a local change results in a run-time error

3. What is the output from the following code?

   ```
   int x=1;
   char c2='0';
   cout << (int)(x+c2) << endl;
   ```

   a. There is no output because of a compiler error.
   b. 1
   c. 49
   d. 'A'
4. Consider the code segment shown below:

```cpp
for( int k=0; k<=5; k++) {
    cout << k << " ";
}
```

Which of the following two code segments will give the same output as the above code?

Option I:

```cpp
int i=0;
do {
    cout << i++ << " ";
} while( i<6);
```

Option II:

```cpp
int j=1;
while( j<=5) {
    cout << j-1 << " ";
    j++;
}
```

a. Neither option I nor option II will give the same output.
b. Option I will give the same output, but option II will not
c. Option II will give the same output, but option I will not
d. Both option I and option II will give the same output.

5. Consider the design options shown below, to be used in creating a tic-tac-toe program:

I. displayBoard
   while( ! done) {
     promptForMove
     makeMove
     displayBoard
   }

II. while( true) {
      displayBoard
      promptForMove
      makeMove
      if( done)
      break;
   }
      displayBoard

III. do{
       displayBoard
       promptForMove
       makeMove
       if( done)
       break;
    } while( true);

What is the best description of the above designs?

a. Only one of the options is correct
b. Only options I and II are correct
c. Only options I and III are correct
d. Only options II and III are correct
e. All three options are correct
6. Consider the code segment shown below. If after the function call to `changeLetters(...)` the value of `number` has changed, what is the most likely cause?

```cpp
int number = 5;
cout << number;
char letters[]="ABCD";
changeLetters(letters);
cout << number;
```

- a) `number` is a global variable instead of a local variable as it should be
- b) Although `number` is not passed to function `changeLetters()`, function `changeLetters()` itself calls a second function which changes `number`
- c) There is some ASCII control characters that are present in the code even though they are not visible
- d) Function `changeLetters()` overwrites the end of array `letters`

7. What is the output from the code segment shown at right below, called with `start();`?
   
   a. 4
   b. 5
   c. 6
   d. 7

```cpp
int x = 1; // global variable
void s1( int y)
{
    cout << x+y;
}
void s2( int y)
{
    x = y++;
    s1( y);
}
void start()
{
    x = 2;
    s2( ++x);
}
```

8. Consider the following array of numbers to be sorted:

```
7 6 12 2 9 4 3
```

How many swaps are made when using Selection Sort as compared to Bubble Sort to put the elements into ascending order, as done in class. Which of the statements below best describes the result?

- a) Selection Sort does 5+ fewer swaps than Bubble Sort
- b) Selection Sort does 2 to 4 fewer swaps than Bubble Sort
- c) Selection Sort and Bubble Sort are within 1 swap of each other
- d) Bubble Sort does 2 to 4 fewer swaps than Selection Sort
- e) Bubble Sort does 5+ fewer swaps than Selection Sort
9. What numbers are in the \textit{values} array after running the code segment shown at right below?
   \begin{itemize}
     \item a. 1 3 4 7 9
     \item b. 9 7 4 3 1
     \item c. 1 3 4 3 1
     \item d. 9 7 4 7 9
   \end{itemize}

   \begin{verbatim}
   const int Max = 5;
   int values[Max] = {1,3,4,7,9};
   for (int i=0; i<Max; ++i) {
     values[i] = values[Max-i-1];
   }
   \end{verbatim}

10. What is the output of the following C++ program segment?

\begin{verbatim}
int s=1, y=3;

void confuse1(int y, int s)
{
    s++;
    y++;
}

void confuse2(int b, int &s)
{
    y = ++(s);
    s = b;
}

void confuse3(int &a, int &s)
{
    a = s + 1;
    s++;
}

void confuseDriver()
{
    int s=2;
    confuse1( s, y);
    confuse2( s, y);
    confuse3( s, y);
    cout << "s + y = " << s+y << endl;
}
\end{verbatim}

   \begin{itemize}
     \item a) s + y = 3
     \item b) s + y = 6
     \item c) s + y = 8
     \item d) s + y = 10
   \end{itemize}

11. Consider trying to find a particular number within an unsorted array of 130 unique random numbers. On average how many numbers will have to be examined before the number you are searching for is found?

   \begin{itemize}
     \item a) 0 to 6
     \item b) 7 or 8
     \item c) 9 to 10
     \item d) 11 to 50
     \item e) 51 to 100
   \end{itemize}
12. Consider using binary search to find a particular number within a sorted array of 130 unique random numbers. On average how many numbers will have to be examined before the number you are searching for is found?

   a) 0 to 6
   b) 7 or 8
   c) 9 to 10
   d) 11 to 50
   e) 51 to 100

13. What is the output of the code segment below when called with:

   char aString[] = "One.Two.Three" ;
   f13( &aString[ 0], '.');

```
void fc( char *pC)
{
   *pC = '\0';
}

void f13( char *pString, char c)
{
   char *pChar1 = strrchr( pString, c);
   fc( pChar1++);
   char *pChar2 = strrchr( pString, c);
   fc( pChar2++);
   cout << pChar2 << " " << pChar1 << endl;
}
```

   a) One Two
   b) Two Three
   c) One.Two Three
   d) One Two.Three

14. What is the output of the code segment shown at right when function testf1() is called?

```
void f1( int y)
{
   static int x=0;
   x++;  
   cout << x;
}

void testf1()
{
   int x = 2;
   for( int x=0; x<3; x++) {
      f1( x);
   }
}
```

   a) 0 0 0
   b) 1 1 1
   c) 0 1 2
   d) 1 2 3
15. Consider the following function declaration:

```c
void setValues( int values[ ]);
```

Note that there is no value inside the square brackets to specify the array size. Which of the following statements is the best description of this situation?

a) This will cause a compiler error and will not run  
b) This will compile, but will cause a run-time error  
c) Having no number will allow writing past the end of the array, which would be disallowed if a number value were supplied.  
d) Having no number is not a problem.

16. Consider the following function declaration:

```c
void displayTable( int values[ ][ ]) ;
```

Note that there is no value inside either the first or second set of square brackets to specify the array size. Which of the following statements is the best description of this situation?

a) Values are not required in either set of brackets  
b) You must have a value in the first set of brackets, but not necessarily the second  
c) You don't need a value in the first set of brackets, but do in the second  
d) You must supply values for both sets of brackets

17. Consider the Artificial Intelligence example of the 0/1 guessing game, done in class and given as a programming assignment. What is the best description of what makes the program appear smart?

a) It counts the number of 0s and 1s that are entered  
b) It always guesses the opposite of the previous guess  
c) It does a better job of being random than a human does  
d) It does pattern matching to forecast what the user will likely do

18. Consider the various sorting algorithms discussed in class. What characteristic of a sorting algorithm is most important in making it efficient?

a) It is fast  
b) It minimizes the number of repetitions  
c) While it may do more comparisons, it does fewer swaps.  
d) It moves elements close to their final position as soon as possible
19. Consider the code shown below:

```c
char *foo(char text[], char c) {
    int index = 0;
    while( text[index] != NULL) {
        if( text[index] == c) {
            return &text[ index];
        }
        index++;
    }
    return NULL;
}
```

What string function does this emulate?

a) strcpy
b) strchr
c) strrchr
d) strlen

20. Which of the following is the best description of *objects* and *classes*?

a) *Classes* are a general category, while *objects* are particular instances.
b) *Objects* are a general category, while *classes* are particular instances.
c) Both *objects* and *classes* are synonyms that describe a general category.
d) Both *objects* and *classes* are synonyms that describe a particular instances.

21. A C++ Date class that has private data members and that is used by other sections of code *at a minimum* to have it compile and run must have:

a) Private data members and public *get* and *set* member functions
b) Private data members, public *get* and *set* functions and a constructor
c) Private data members, public *get* and *set* functions, a constructors and a copy constructor
d) Private data members, public *get* and *set* functions, constructors and destructors

22. Imagine we create a Date class with the following single constructor:

```c
Date( int theMonth, int theDay, int theYear) {
    month = theMonth; day = theDay; year = theYear;
}
```

The driver code then has the following, which generates an error:

```c
Date d1;
```

What is the likely reason for this error?

a) There is no default constructor for the Date class
b) The Date class is declared *after* the declaration of d1
c) There is already a declared Date object with the name d1
d) This is a declaration and is not calling the Date class constructor
23. Imagine we are using one of the later versions of the Date class that we developed. The driver code then has the following, which doesn't work correctly:

```java
Date d2();
```

What is the likely reason for this error?

a) There is no default constructor for the Date class  
b) The Date class is declared after the declaration of d2  
c) There is already a declared Date object with the name d2  
d) This is a declaration and is not calling the Date class constructor

24. Imagine we create a Date class compareTo member function that is defined as:

```java
bool isSameAs( Date otherDate) {
    return day == otherDate.day &&
    month == otherDate.month &&
    year == otherDate.year;
}
```

This might be called in a situation such as:

```java
if( d1.isSameAs( d2)) {
    cout << "They are equal " << endl;
}
```

In the above example how does the isSameAs() function connect the day, month and year variables in the isSameAs() function with those values for d1?

a) d1 must be declared within the Date class  
b) There must be a set of braces { … } providing enclosing scope for both d1 and the isSameAs() function  
c) d1 must be declared as static within the Date class  
d) d1 is sent as an implicit this parameter to the isSameAs() function

25. In class we saw an example where Employee e2 was created as a copy of Employee e1. When we later changed the startDate for e2, the startDate for e1 ended up being changed as well. How were we able to fix this?

a) We had the Employee copy constructor call the Date copy constructor  
b) We had the Employee copy constructor make a new Date and used it with the Date copy constructor  
c) We overloaded the Employee assignment operator  
d) We created Destructors for both the Date and Employee classes