This test is worth 10% of your final grade. This test is open notes (anything on paper), but no electronic resources may be used. When only a program segment is given, you can assume it is otherwise placed in the context of a program that is otherwise correct and includes all declarations and system libraries needed to make it work.

For the multiple-choice questions with a bubble next to the answers, you must fill in only one bubble next to the best answer. Some questions have an indicated rectangle where you must write down your answer. Any writing outside of these indicated areas will not count towards your grade. For some problems you will need to know that ASCII ' ' is 32, '0' is 48, 'A' is 65 and 'a' is 97.

There are 14 multiple-choice problems worth 3 points each (14 x 3pts. = 42pts.), 10 free-response problems worth 5 points each (10 x 5pts. = 50pts.), and a final free-response question worth 8 points, for a total of 42 + 50 + 8 = 100 points.

Multiple-choice problems are 3 points each:

1. What is the point of the video shown in class of a man eating a bicycle?
   - To solve a problem try working backwards from the end
   - Some problems cannot be solved by a computer
   - Bigger problems should be broken down into smaller problems
   - When stuck on a problem, take a break, then come back to it

2. In what sort of situation might a switch-case statement be preferred over multiple if-else statements?
   - When assigning a letter grade based on a score range
   - When assigning a tax percentage based on an hourly income in dollars and cents
   - When selecting among menu options
   - When translating row and column inputs into a board index position

3. What is true about all binary numbers that end in the right-most digits 11₂?
   - They are even
   - They are odd
   - They are multiples of three
   - They are prime

4. What is the result of executing the following program statement, which is part of an otherwise correct program?
   ```
   cout << INT_MAX + 1;
   ```
   - It causes a compiler error
   - It displays the largest positive integer
   - It displays an error message
   - It displays a negative number
5. Consider a C++ program that uses `rand()` to display random numbers, but does not use any version of `srand()`. What might we expect from running the program multiple times?
   - The first random number will always be 0
   - The numbers that are displayed will be random, but always increasing
   - Each time the program is run it will display the same sequence of numbers
   - Each time the program is run it will display different sets of numbers

6. Of the options shown, which of the following approaches would be the best to use in generating random values in the range 0..7 for use each move as part of a chess game?
   - Get and store a large random integer number using `rand()` and successively retrieve individual digits using integer division and the mod operator.
   - Generate enough random numbers using `rand() % 8` for the whole game, and store them into an array for retrieval one at a time.
   - Get a random number and use the mod function to check if it is odd or even
   - Get a random number and use integer division to get a number each turn

7. What is the effect of the `break` statement in a loop?
   - It bypasses the rest of the code in the loop and does the next loop iteration
   - It first jumps out of the loop and then exits the program
   - It reruns the current loop iteration
   - It bypasses the rest of the code in the loop and resumes execution after the loop

8. What is the effect of the `continue` statement in a loop?
   - It bypasses the rest of the code in the loop and does the next loop iteration
   - It first jumps out of the loop and then exits the program
   - It reruns the current loop iteration
   - It bypasses the rest of the code in the loop and resumes execution after the loop

9. Consider code that processes a set of integer test scores in the range 0..100 that are typed in by a user. How many of the following situations would be best implemented using an array?
   - Find the min and max scores
   - Display the scores in ascending order
   - Count how many scores are within each grade range of 'A' and 'B'
   - Count how many there are of each score
   - 1
   - 2
   - 3
   - 4

10. If the words in a dictionary were sorted using ASCII table order, how would the dictionary fundamentally be different?
    - It would be in reverse alphabetical order
    - All words with symbols would be at the end of the dictionary
    - Words beginning with vowels would be listed first
    - Words beginning with capital letters would be listed first
11. Consider the two function definitions shown below:

```c
int sum( int a, int b)
{
    return a+b;
}

int sum( int a, int b, int c=0)
{
    return a+b+c;
}
```

What would be the result of attempting to compile and run this code when calling it with:
```
cout << sum(3,5) << endl;
```

- It would not compile correctly
- It would compile correctly, however at run time would give an error
- It would compile correctly and run correctly in some cases but not in others
- It would compile correctly and run correctly

12. Consider a section of code that finds the min and max value from a set of numbers in the range 0..100. How should min and max be initialized?

- min=0; max=0;
- min=100; max=0;
- min=50; max=50;
- min=100; max=100;

13. Two functions are considered to have the same argument signature as long as they have the same:

- Function name
- Function name and number of parameters
- Function name, number and types of parameters
- Function name, number and types of parameters, and return type

14. What is the output from the following code?

```c
char c = 'A';
cout << 1.2 + true + c;
```

- There is no output because of a compiler error.
- 'B'
- 'C'
- 67.2
Free-response problems are 6 points each:

15. What is the equivalent decimal value for the binary number 10101001? Write down your answer in the rectangle below. Print legibly.

16. What is the equivalent binary value for the decimal number 57? Write down your answer in the rectangle below. Print legibly.

17. What is output from running the program segment shown below at left? Write down your answer in the box shown at right below. Print legibly.

```cpp
int row;
int col;
int sum = 0;
for (row = 2; row < 4; row++) {
    for (col = 4; col <= 5; col++) {
        sum = sum + (row * col);
    }
}
cout << sum << endl;
```

18. What is output from running the program segment shown below at left? Write down your answer in the box shown at right below. Print legibly.

```cpp
// Which comes first, the chicken
// or the egg?
string theChicken = "chicken";
string theEgg = "Egg";
if (theChicken < theEgg) {
    cout << "chicken";
} else {
    cout << "egg";
}
```
19. What is output from running the program segment shown below at left? Write down your answer in the box shown at right below. Print legibly.

```
int age = 19;
if( 20 <= age <= 30) {
    cout << "Yes";
} else {
    cout << "No";
}
```

Write answer in this box:

20. Consider the program segment shown at left below. What is the output? Write down your answer in the rectangle at right below. Print legibly.

```
char grade = 'B';
char values[3] = {'C','D','E'};
for( int i=0; i<9; i++) {
    values[ i] = 'A';
}
cout << grade;
```

Write answer in this box:

21. Carefully do a trace of the code shown at left below. What is the output from calling function getScores() if the inputs are the values: 70 80 90? Write down your answer in the rectangle at right below. Print legibly.

```
void getScores()
{
    const int Max = 4;
    int scores[ Max];
    int sum=0;

    cout << "Enter scores: ";

    for( int i=1; i<Max; i++) {
        cin >> scores[i];
        sum = sum + i;
    }

    cout << "Sum is: "
    << sum << endl;
}
```

Write answer in this box:
22. Consider the code shown at left below. What is the output of the following C++ program segment, called with `confuseDriver()`?
Write down your answer in the rectangle at right below. Print legibly.

```cpp
int s = 1, y = 3;

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

void confuse2(int b, int &s)
{
    y = ++(s);
    s = b + 2;
}

void confuse3(int &a, int &s)
{
    a = s + 2;
    s++;
}

void confuseDriver()
{
    int y = 1;

    confuse1( s, y);
    confuse2( s, y);
    confuse3( s, y);
    cout << s + y << endl;
}
```

Write answer in this box:

23. Consider the code segment shown at left below. What is the output when function `scope()` is called? Write down your answer in the rectangle at right below. Print legibly.

```cpp
int x = 4;  // global variable

void s1(int y)
{
    cout << x + y << endl;
}

void s2(int y)
{
    x = y++;
    s1(y);
}

void scope()
{
    x = 2;
    s2(x);
}
```

Write answer in this box:
24. What is the output from calling function useValues() shown at left below? Write down your answer in the rectangle at right below. Print legibly.

```cpp
void swap( int &x, int &y)
{
    int temp = x;
    x = y;
    y = temp;
}

void useValues()
{
    const int Max = 5;
    int values[Max] = {2,4,6,8,10};
    int i=0;

    for (i=0; i<Max; ++i) {
        swap( values[i], values[Max-i-1]);
    }

    cout << values[0] << " " << values[Max -1] << endl;
}
```
This final free-response problem is worth 8 points:

25. What is the output from calling function `changeValues()` shown below?
Write down your answer in the rectangle at right below. Print legibly.

```cpp
const int Max = 6;

void swap( int &x, int &y)
{
    int temp = x;
    x = y;
    y = temp;
}

void changeValues()
{
    int values[Max] = {5, 2, 6, 9, 3, 7};
    int i, j;

    for( i=1; i < Max; i++) {
        for( j=0; j < Max - i; j++) {
            if( values[ j] > values[ j+1]) {
                swap( values[j], values[j+1]);
            }
        }
    }

    cout << values[0] << " " << values[Max -1] << endl;
}
```

Write answer in this box: