1. (5 Points) What is the output of the following program segment? (All variables are of type `int`.)

```cpp
i = 1;
while (i <= 3)
{
    sum = 0;
    j = 1;
    while (j <= i)
    {
        sum = sum + j;
        j++;
    }
    cout << sum << ' ';
    i++;
}
```

2. (5 Points) Which of the following is an infinite loop?

(a) `for ( int k=0 ; !(k==10) ; k++)
   cout << "Go Navy" << endl;`

(b) `int number=101;
   while ( number<=100 )
   {
       cout << "Go Navy" << endl;
       number--;
   }`

(c) `int number=101;
   do
   {
       cout << "Go Navy" << endl;
       number--;
   }while ( number<=100 );`

(d) all of the above

3. (4 Points) Which would be the proper way to write the character 7 in C++

(a) `7`

(b) `"7"`

(c) 7

(d) seven
4. (5 Points) Consider the following loop, in which the line "........" represents a series of statements:

```cpp
do
{
    ........
    cin >> prompt;
}while(......);
```

If we would like the loop to stop when the user types a 'q' or 'Q' for input to the variable prompt, then which of the following boolean expressions would be appropriate for the while loop?

(a) (prompt == 'Q') || (prompt == 'q')
(b) (prompt != 'Q') || (prompt != 'q')
(c) (prompt == 'Q') && (prompt == 'q')
(d) (prompt != 'Q') && (prompt != 'q')

5. (5 Points) I am writing a program which computes PRT grades. The portion of the program that calculates grades is given below.

```cpp
double push_grade, curl_grade, run_grade, tot_grade;

    cin >> push_grade;
    cin >> curl_grade;
    cin >> run_grade;

    tot_grade = push_grade+curl_grade+run_grade / 3;
```

Why do I get incorrect results when I run the program, and how would you correct the program?
6. (4 Points) Which of the following for loops matches this while loop:

```c
int i=1;
int sum = 0;
while(i<10)
{
    sum = sum + i;
    i = i + 2;
}
```

(a) int sum = 0;
    for( int i=1 ; i<10 ; i++)
    {
        sum = sum + i;
    }

(b) int sum = 0;
    for( int i=1 ; i<10 ; i++)
    {
        sum = sum + i;
        i=i+2;
    }

(c) int sum = 0;
    for( int i=1 ; i<10 ; i=i+2)
    {
        sum = sum + i;
        i=i+2;
    }

(d) int sum = 0;
    for( int i=1 ; i<10 ; i=i+2)
    {
        sum = sum + i;
    }

(e) None of these

7. (6 Points) What is wrong with the following statements (if anything)? Which statements produce compile-time errors?

(a) cout << ++(x + y);

(b) if (x = 5)
    cout << "Got a 5" << endl;

(c) cin >> a, b, c;
8. (5 Points) Explain why the following program does not compile, and explain what needs to be done to fix it.

```cpp
#include <iostream>
using namespace std;
int main()
{
    int k;
    cin >> k;
    if (k < 0)
    {
        int n = -1 * k;
    }
    else
    {
        int n = k;
    }
    cout << "|" << k
    << "| is " << n
    << endl;
    return 0;
}
```

9. (14 Points) For the following,

```cpp
int n = 3, k = -1;
double x = 3.3;
string s = "find";
```

Give the type and value of each expression:

<table>
<thead>
<tr>
<th>Expression</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>x / n</td>
<td></td>
<td></td>
</tr>
<tr>
<td>x &gt; n &amp;&amp; n % 2 == 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 / n * x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>x != 5.0</td>
<td></td>
<td>s == &quot;find&quot;</td>
</tr>
<tr>
<td>k = x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cin &gt; x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>k++</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
10. (4 Points) Why doesn’t the following code fragment compile?

```cpp
string s;
cin >> s;
if (s == "down" || "up")
{
    cout << "horizontal";
    cout << endl;
}
```

11. (4 Points) What does the following code print:

```cpp
char c1,c2;
c1 = 'K';
c2 = c1/2;
cout << c2 << endl;
```

12. (6 Points) With supervision you look into your computer's memory at a particular byte, and you see that it is 01011000. What is the value of this byte as

(a) a number in binary?
(b) a char?
(c) a bool?

13. (8 Points) Fill in the last row of the following table, which shows a fragment of code that reads input and writes output, shows the user input, and (when you’re done) will show the output produced by each code fragment.

<table>
<thead>
<tr>
<th>Code</th>
<th>double f; cin &gt;&gt; f; cout &lt;&lt; f;</th>
<th>int k; cin &gt;&gt; k; cout &lt;&lt; k;</th>
<th>char c; cin &gt;&gt; c; cout &lt;&lt; c;</th>
<th>string s; cin &gt;&gt; s; cout &lt;&lt; s;</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Input</td>
<td>-112.53% +/-6</td>
<td>-112.53% +/-6</td>
<td>-112.53% +/-6</td>
<td>-112.53% +/-6</td>
</tr>
<tr>
<td>Program Output</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
14. (10 Points) The following rule is used to define leap years:

A leap year is a year that is:

• divisible by 4, but not divisible by 100, or
• divisible by 400.

So note, for instance, that 1900 was not a leap year, but that 2000 is, and 2004 will be. Write a C++ program that accepts as input a year (as an integer), and informs the user of whether or not that year was a leap year.
15. (15 Points) Times for marathon runners are kept in the following format: \text{h:mm:ss}. So for example, my time might be 8:34:08. Write a program that reads in a list of one or more such times, separated by commas and terminated by a semicolon, and prints out the average time in seconds. Typical input might look like: