This worksheet is for your use during and after lecture. It will not be collected or graded, but I think you will find it a useful tool as you learn C++ and study for the exams. Explain all false answers for the "True or False" questions; in general, show enough work and provide enough explanation so that this sheet is a useful pre-exam review. I will be happy to review your answers with you during office-hours, via Email, or instant messaging.

1. Which of the following are true of C++ classes?

   A. A class is a variable that may be assigned values. **False, classes are not variables.**

   B. `int` and `double` are examples of C++ classes. **False, they are fundamental data types.**

   C. `string` is an example of a C++ class. **True.**

   D. A C++ class is a special data type. **True.**

   E. A C++ class is a special type of variable. **False, classes are not variables.**

2. Consider the snippet at the right and answer the following questions.

```
4 double GPA(3.8), course_grade;
5 string firstName;
```

   (a) `string` is to `double` as `firstName` is to ???

   **Solution:** `GPA` or `course_grade`, variables of type double.

   (b) `GPA` is to `double` as `firstName` is to ???

   **Solution:** `string`

   (c) How many `double` variables are declared? What are the name(s)?

   **Solution:** Two, `GPA` and `course_grade`.

   (d) How many class instances are declared? What are the name(s)?

   **Solution:** One, `firstName`.

   (e) Explain the difference between symbols `double` and `course_grade`.

   **Solution:** `double` is a fundamental data type, `course_grade` is a variable of type `double`. `course_grade` has a value and takes up memory to hold that value.

   (f) Explain the difference between symbols `string` and `firstName`.

   **Solution:** `string` is a C++ class, `firstName` is an instance of the `string` class. `firstName` has a value (perhaps the empty string `""`) and takes up memory to hold that value.

3. Is `cout` the `ostream` class or an instance of an `ostream` type?

   **Solution:** `cout` is an instance of the `ostream` (short for output stream) class.

4. Is `cin` an `istream` class or an object (variable) of the `istream` class?

   **Solution:** `cin` is an object (or "instance") of the `istream` (short for input stream) class.

5. Why is this C++ statement nonsensical?

```
bool b( int > double);
```

**Solution:** `int` and `double` are data types. They don't have any *values* associated with them, so comparing them with a relational operator doesn't make sense.

6. Suppose a user types the following sequence of characters at the keyboard (there are several whitespace characters, and the final character is the digit 4):

```
a␣4.23-2.500␣-3,e-100␣4
```

And the keyboard is read by a program running the code sequence to the right.

```
32 char a, b, c;
33 double m, n, p;
34 int x, y, z;
35
36 cin >> a;
37 cin >> m;
38 cin >> x;
39 cin >> b;
40 cin >> n;
41 cin >> y;
42 cin >> c;
43 cin >> p;
44 cin >> z;
```

(a) Complete the table below: provide the value of all variables that are successfully read by `cin` before it encounters a failure state. **Leave any variables that are not valued by `cin` blank**. Note that the variable order in the table is identical to the order of input operations in the code snippet.

| Variable | a | m | x | b | n | y |
|---|---|---|---|---|---|---|
| Value | 'a' | 4.23 | -2 | '.' | 500 | -3 |

| Variable | c | p | z | | | |
|---|---|---|---|---|---|---|
| Value | ',' | | | | | |

(b) In a sentence, explain why `cin` entered a failure state.

**Solution:** After `c` is read as a comma (`','`), a `double` read for `p` is attempted. `p` fails because `double`s must start with a number (`1e-100` is OK, but `e-100` is not).

7. Consider the snippet of code at the right, think about how each equation is simplified and reduced by the compiler. Then, answer the questions below.

```
11  b = ( 1 == 1 ) && false;
12  x = 3 + 4 - 6*2;
13  cout << b << "␣" << x;
```

(a) i. Which operation is performed first in line 11?

**Solution:** The `==` equality test.

ii. What *type* of value does it return? What is the value returned?

**Solution:** It returns a `bool` type with value `true`.

iii. What variable type do you expect `b` to be? Why?

**Solution:** Probably a `bool`, since it will hold a logical value.

(b) i. Which operation is performed first in line 12?

**Solution:** The `6*2`

ii. What *type* of value does it return? What is the value returned?

**Solution:** Both are `int`s, so it will return an `int` type with value 12.

iii. What variable type do you expect `x` to be? Why?

**Solution:** An `int`, since the result of the expression will be an `int`.

(c) i. How many operations are performed in 13?

**Solution:** Three.

ii. What is the left hand side and right hand side argument for the second operation?

**Solution:** lhs is `cout`, rhs is `"␣"`.

iii. What do all the operations return?

**Solution:** The `<<` operator return its lhs, `cout`.

iv. Does each operation have a side-effect? What is it?

**Solution:** Yes, something is displayed on the console.

8. Write a snippet of code that:

   (a) Opens a file named `"the_file.txt"` for writing.

   **Solution:**

   ```
   ofstream outFile( "the_file.txt" );
   ```

   (b) Using the file stream object as a predicate, prints an error message to the console if part a failed.

   **Solution:**

   ```
   if( !outFile ) {
       cout << "Error␣opening␣'the_file.txt'" << endl;
   }
   ```

9. True or False: After `cout.precision(x);` is used, you are guaranteed `x` decimal points will be used for printing any float or double.

   **Solution:** False, C++ won't print more decimals than there is accuracy in the number.

10. True or False:

    ```
    cout.width(10); cout << 3 << 4 << endl;
    ```

    Prints numbers 3 and 4 with a field width of 10.

    **Solution:** False, only the first term printed, 3, will be in a field width of 10.

11. True or False: After `cout.setf( ios::scientific );` is used, all double values will be printed in scientific notation.

    **Solution:** False, C++ seems to have a mind of its own in this regard.

12. True or False: After `cout.setf( ios::right )` is used, output lines are right justified in the console window.

    **Solution:** False, they are right justified in the field width used for printing.

13. Write an application that reads a file consisting of three columns of integers and called `DATA.DAT`. The file does not contain column labels, and your application should meet these requirements:

    1. An error message is displayed if the file cannot be opened.
    2. When the value of the second column is zero, display the value read for the third column, and stop reading data from the file.
    3. The input file stream is closed before the program ends.
    4. If a 0 is not found in second column of data, the program ends without printing anything to the console.
    5. The program should use only one `ifstream` class member function, namely `.close()`.

**Solution:**

```
#include <fstream>
#include <iostream>
#include <string>
#include <cstdlib>
using namespace std;
int main()
{
    ifstream infile( "DATA.DAT" );
    if( !infile ) {
        cout << "Error␣opening␣file." << endl;
        exit(1);
    }

    int i1, i2, i3;
    while( infile >> i1 >> i2 >> i3 ) {
        if( i2 == 0 ) {
            cout << i3 << endl;
            break;
        }
    }

    infile.close();

    return 0;
}
```