Sheet 1 – Numbers and Objects

(A) Review Questions

1. Write the following mathematical expressions in C++.

$$s = s_0 + v_0 t + \frac{1}{2} g t^2$$

$$G = 4\pi^2 \frac{a^3}{p^2 (m_1 + m_2)}$$

$$\mathrm{FV} = \mathrm{PV} \cdot \left(1 + \frac{\mathrm{INT}}{100}\right)^{\mathrm{YRS}}$$

$$c = \sqrt{a^2 + b^2 - 2ab\cos\gamma}$$

2. Write the following C++ expressions in mathematical notation.

a. dm = m * (sqrt(1 + v / c) / sqrt(1 - v / c) – 1);
b. volume = PI * r * r * h;
c. volume = 4 * PI * pow(r, 3) / 3;
d. p = atan2(z, sqrt(x * x + y * y));

3. What is wrong with this version of the quadratic formula?

a. x1 = (-b - sqrt(b * b - 4 * a * c)) / 2 * a;
b. x2 = (-b + sqrt(b * b - 4 * a * c)) / 2 * a;

4. Let n be an integer and x a floating-point number. Explain the difference between

n = x; and,
n = (int)(x + 0.5);

For what values of x do they give the same result? For what values of x do they give different results? What happens if x is negative?

5. Find at least five *syntax* errors in the following program.

```
#include iostream
int main();
{
        cout << "Please enter two numbers:"
        cin << x, y;
        cout << "The sum of << x << "and" << y
        << "is: " x + y << "\n";
        return;
}
```

6. Find at least three *logic* errors in the following program.

```
#include <iostream>
using namespace std;
int main()
{
        int total;
        int x1;
        cout << "Please enter a number:";
        cin >> x1;
        total = total + x1;
        cout << "Please enter another number:";
        int x2;
        cin >> x2;
        total = total + x1;
        float average = total / 2;
        cout << "The average of the two numbers is "
        << average << "\n";
        return 0;
}
```

7. Explain what each of the following program segments computes:

   a. x = 2; y = x + x;
   b. s = "2"; t = s + s;

8. Suppose a C++ program contains the two input statements

```
cout << "Please enter your name: ";
string fname, lname;
cin >> fname >> lname;
```

and

```
cout << "Please enter your age: ";
int age;
cin >> age;
```

What is contained in the variables fname, lname, and age if the user enters the following inputs?

a. James Carter
   56

b. Lyndon Johnson
   49

c. Hodding Carter 3rd
   44

d. Richard M. Nixon
   62

9. What are the values of the following expressions? In each line, assume that:

```
double x = 2.5;
double y = -1.5;
int m = 18;
int n = 4;
string s = "Hello";
string t = "World";
```

a. x + n * y - (x + n) * y
b. m / n + m % n
c. 5 * x - n / 5
d. sqrt(sqrt(n));
e. static_cast<int>(x + 0.5)
f. s + t;

g. t + s;
h. 1 - (1 - (1 - (1 - (1 - n))))
i. s.substr(1, 2)
j. s.length() + t.length()

(B) Programming Exercises

1. Write a program that prompts the user for two integers and then prints

    - The sum
    - The difference
    - The product
    - The average
    - The distance (absolute value of the difference)
    - The maximum (the larger of the two)
    - The minimum (the smaller of the two)

2. Write a program that prompts the user for a radius and then prints

    - The area and circumference of a circle with that radius
    - The volume and surface area of a sphere with that radius

3. Write a program that asks the user for the lengths of the sides of a rectangle. Then print

    - The area and perimeter of the rectangle
    - The length of the diagonal (use the Pythagorean Theorem)

4. Write a program that prompts the user for

    - The length of a side of a triangle
    - The sizes of the two angles adjacent to that side (in degrees)

Then the program displays

    - The lengths of the other two sides
    - The size of the third angle

Hint: Use the law of sines.

5. Write a program that reads a number greater than or equal to 1,000 from the user and prints it *with a comma separating the thousands*. Here is a sample dialog; the user input is in boldface:

Please enter an integer >= 1000: **23456**

23,456

6. Write a program that asks for the due date of the next assignment (hour, minutes). Then print the number of minutes between the current time and the due date.