Problem 1. (10 points.) What are the possible values of a boolean?

True or False

Problem 2. (10 points.) What is a case where you should use a while loop instead of a for loop?

When the number of loop iterations is determined by the user.
(e.g., while (user_input != 1))

Problem 3. (10 points.) What does the break statement do in C++?

This will break out of a loop or a switch-case code block.

Problem 4. (10 points.) What is the difference between a call-by-value and call-by-reference function.

In call-by-value the actual value of the parameter is passed into the function and copied into a new local variable, whereas in a call-by-reference function the memory address of the variable given as a parameter is passed so that the function can modify the value of the variable directly.
Problem 5.(10 points.) What will this program output?

```cpp
#include <iostream>
using namespace std;

int main() {
    int x = 0;
    int y = 0;

    do {
        cout << "x = " << x << endl;
    } while (++x < 3);

    while (y++ < 3) {
        cout << "y = " << y << endl;
    }

    return 0;
}
```

x = 0, x = 1, x = 2, y = 1, y = 2, y = 3

Problem 6.(10 points.) What will this program output?

```cpp
#include <iostream>
using namespace std;

int do_something(int x, int& y) {
    int temp = y;
    y += 10;
    return x+temp;
}

int main() {
    int x = 5, y = 5, z = 0;

    z = do_something(x,y);

    cout << "x = " << x << endl;
    cout << "y = " << y << endl;
    cout << "z = " << z << endl;

    return 0;
}
```

x = 5, y = 15, z = 10
Problem 7 [Testing Input]. (10 points.) What should this program do? Where is the bug, and what effect will it have? Fix it.

```cpp
#include <iostream>
#include <string>

using namespace std;

int main() {
    int print_count = 0;
    string the_string = "CS16";

    cout << "How many times should we print the string?";
    cin >> print_count;

    if (!print_count <= 0) {
        for (int i = 0; i != print_count; i++) {
            cout << the_string << endl;
        }
    } else {
        cout << "You must enter a number greater than 0!";
    }

    return 0;
}
```

This program should print "CS 16" the number of times that the user specifies. However, !print_count <= 0 should be !(print_count <= 0) or, even better, print_count > 0. The bug will accept any negative value and result in an infinite loop.
Problem 8 [Switch-case]. (10 points.) What should this program do? Where is the bug, and what effect will it have? Fix it.

```cpp
#include <iostream>
#include <cs16> // Library for checking and changing grades
using namespace std;

const int professors_perm = 12345;
const int student1_perm = 11111;
const int student2_perm = 11112;

int main() {
  int perm_number;
  cout << "Please input your perm number: ";
  cin >> perm_number;
  switch (perm_number) {
    case student1_perm:
      case student2_perm:
        cout << "Hello student. " << endl;
        // Tell the student their grade
        cout << "Your grade is: ";
        cout << cs16::get_grade(perm_number) << endl;
        break;
    case professors_perm:
      cout << "Hello professor. " << endl;
      cs16::admin_console(); // Open admin console
      break;
    default:
      cout << "I don't know you! " << endl;
      break;
  }
  return 0;
}
```

The program should give students their grades, and open and admin console for the professor. However, because there is no `break` statement, the students will also get an admin console. To fix this, add a break after the last `cout` in the student’s case.
Problem 9.(10 points.) What will this program do (i.e., what is the high-level, human, interpretation of the values in A,B,C and what are more appropriate names for Output1, Output2, and Output3)?

```cpp
#include <iostream>
using namespace std;

int main() {
    int count = 0;
    int A = 100;
    int B = 0;
    int C = 0;

    cout << "How many students are in the class?";
    cin >> count;

    for (int i = 1; i <= count; i++) {
        int grade = 0;
        cout << "Student " << i << "'s grade: ";
        cin >> grade;

        if (grade < A) {
            A = grade;
        }
        if (grade > B) {
            B = grade;
        }
        C += grade;
    }

    cout << "Output1: " << A << endl;
    cout << "Output2: " << B << endl;
    cout << "Output3: " << static_cast<double>(C)/count << endl;
    return 0;
}
```

It will calculate the minimum (Output1), maximum (Output2), and average (Output3) of the grades for the number of students entered.
Problem 10. (10 points.) What will this program do (Brief description)?

#include <iostream>
using namespace std;

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

int main() {
    int a, b, c, d;

    cout << "Input 4 numbers: ";
    cin >> a >> b >> c >> d;

    swap(a, d);
    swap(b, c);

    cout << "The output is: ";
    cout << a << b << c << d << endl;

    return 0;
}

It will take in 4 integers and output them in reverse order.