1. All review from Exams 1 and 2, and all relevant reading as listed on the course webpage, along with all practice problems in the textbook.

2. Describe the difference between a member variable and a static member variable.

3. What is a friend function?

4. When is a copy constructor called? When is an overloaded assignment operator called? What is the difference between the two?

5. What is the behavior of the implicit copy constructor and assignment operators used by C++ compilers? When and why do they need to be overloaded or explicitly defined?

6. What is the difference between a try block and a catch block?

7. Suppose a class called ArrayIndexOutOfBoundsException is defined with the public attribute std::string message.
   Write a C++ code snippet to demonstrate both when it is thrown and when it is caught.

8. What happens if an exception is thrown but not caught?

9. What error and potential error are in the following code:

   ```cpp
template <class T>
   T square(T number) {
       return T * T;
   }
```

10. Suppose you have the following class defined:

    ```cpp
class Time{
        public:

            // Should take values 0-59
            int minutes;

            // Should take values 0-23
            int hours;

            // Adds two Time objects to get a new Time object
            // with appropriate attributes
            Time operator+(const Time&) const;

            // Compares two Time objects to see if the left operand
Write the definitions of the two overloaded operators.

11. Modify the following function to use a template for the arguments and return value

```cpp
// Computes the max value of an int array
// size is the number of elements of the array
// and is assumed to be > 0
// arr is the array of ints
int max(int size, int* arr){
    int max = arr[0];
    for(int i = 1; i < size; i++ ){
        if( arr[i] > max ){
            max = arr[i];
        }
    }
    return max;
}
```

In the template version of the function, what are the requirements of the datatype used? Can you make the function more efficient? (Hint: think about the cost of the assignment statements).

12. What is the difference between a protected class member and a private class member?

13. Which constructor is called first, that of the derived class or the base class?

14. Describe as concretely as you can, the term polymorphism. Give an example with C++ code.

15. What is a statically bound function versus a dynamically bound function? What keywords in C++ make this distinction to the compiler?

16. What makes a class an abstract class?

17. Describe the effects of access specifiers for derived classes. If a method/attribute is public/private/protected in the base class, what will it be in the derived class when the inheritance is public/private/protected?

18. What is the purpose of the override keyword? Give a small C++ example that demonstrates its proper usage.

19. Complete the following:

   (a) Write the prototype for a `BinarySearchTree` class, to hold integer values.
   (b) Fully define the `Insert` function, and the `preOrder`, `inOrder`, and `postOrder` traversal functions.
   (c) Sketch the binary tree of integer values after inserting the numbers 5, 2, 3, 6, 10, 4. During a pre-order traversal, in what order are the nodes visited?
   (d) How might you define an overloaded assignment operator or copy constructor for a binary tree class?