Final Exam Questions (20 points)

Each question is equally worth 4 points.

General requirements:

- All data members must be declared as "private"
- No global variable is allowed to be declared and used (constants are ok)
- Methods within the class and the requested functions cannot have "cin" or "cout" but it should make use of parameters and return value instead unless it is stated explicitly.
- "cin" and "cout" should be used in main() or any testing functions
- Please make sure that you clearly show how the C++ class, its methods and all the functions are being called and print out its return value and its results properly

Please answer the following questions.

1. Define a class named "**Var4Bool**" that manages a variable name (string) and a boolean value (true or false). It should not have default constructor.
   The class must at least provide the following methods:
   - toString() method that can return a string in the following format:
     variable-name(variable-boolean-value) such as isSuccessful(true)
   - searchIgnoreCase() that accepts a search string and it will return true if its variable name contains that string (case-insensitive) and false otherwise.

   Show how this class being used to create objects and call all its methods and show how they work.

2. Define a new exception class named "**VarException**" that must inherit from the C++ **runtime_error** class. This class will capture the error case for a variable name when it is empty, only blanks or starting with a number.
   For example, if the user tries to create with a variable name of "", " ", or "1name", it will generate an exception and this class should capture the reason and the error value.

3. Write a new class named "**Var4Int**" that must inherit from and make use of the "**Var4Bool**" class. This class manages a variable name (string) and a value (integer). Please note that this class must make use of inheritance.

   The class must at least provide the following methods:
   - toString() method that can return a string in the following format:
     variable-name(variable-integer-value) such as count(100)
   - isGreater() method that accepts another Var4Int object and returns true if its own integer value is greater than the integer value of the given object and false otherwise.
   - Its constructor will generate exception with the right error information using the VarException class whenever it is given a variable name that can be empty, all blanks or starting with a number.

   Show how this class being used to create objects and call all its methods and show how they work.

4. Write a function named "**searchIgnoreCase**" that accepts a vector of Var4Bool object pointers and a search string. It will return the list of Var4Bool objects that have the variable names containing that given search string (case-insensitive). In addition, it will also return the count of all the variable objects that have the exact match (equal to the search string). Please note that the list can contain pointers to Var4Bool objects as well as any of its derived class objects such as Var4Int objects.

5. Write a function named "**createNewVar**" that will read in the variable name and a value (either "true" or "false" or an integer) from the user and create a dynamic Var4Bool or Var4Int object (using new) depending the value that the user entered and return its pointer. You can assume the user will enter "true" or "false" or correct integer value. No error handling for the value is required.

   Please note that this function can use cin and cout.

   This function must handle all error cases for invalid variable names entered by the user: empty, all blanks or starting with a number by **handling exception using try-catch**. It will print out proper error message and continue to ask the user for the new value until it is correct name.

   Please show how this function is being tested and
   print out the correct variable information.