CPP final-term Exam Simulation

Year: 2
Semester: 1 (Fall)
Exam date: (12:30pm) Tuesday, 31 Dec 2024

Daily assignment

1. Write a C++ program with a function named “add” that takes two numbers as input. If both numbers are integers, return the sum as an integer. Else if one number is a floating-point number, return the sum as a floating-point number. Use C++ built-in functions to simplify the program.

2. Design a C++ program with an object-oriented Box class. The class should have a private variable width to store the width. Implement the plus operator (+) to add two Box objects of the same type and generate a new Box object with the sum of their widths. Implement the insertion operator (<<) to display the width of a Box object using cout. Use a template function to accept widths of different types, but ensure the added Box objects are of the same type. Provide an example output that correctly displays the added width of the Box objects.

3. (Part 1) Please refer to the attached file vector_template_1.cpp and rewrite the two member functions "add()" and "print()" outside the class, leaving only the function declaration within the class.

   (Part 2) Please refer to the attached file vector_template_2.cpp. This time, please add a new element to the vector with a char data type. When the data type of the vector is char, add one to the value of the added element, that is, add the element g. It will become h; if it belongs to other data types, just add it according to the value of the added element unchanged. Please rely on the comments in the attached file to complete the code in this attached file so that it can operate normally according to the comments in main().

4. Please write a C++ program and design a template class Calculator. This class should include the following functions:
   - The member function add accepts two template type parameters and returns the sum of the two.
   - The member function multiply accepts two template type parameters and returns the product of the two.

   Next, use template specialization to specialize when the template type is std::string:

- The add function concatenates two strings and appends a space after the concatenation result;
- The multiply function accepts a string and an integer and returns the result of repeating the string that integer number of times.

In the main program, create an integer version of the Calculator class that calculates the sum and product of two integers and outputs the result. Create a specialized string version of the Calculator class to calculate the concatenation result of two strings and the repeated result of one string, and output the results.

For example:
If the input integers 3 and 5 are input, the sum of the output is 8 and the product is 15;
If the strings "Hello" and "World" are input, the concatenation result is "Hello World", and the repeated result (repeated 3 times) is "HelloHelloHello".

5. (Part 1) Please create a Template class Car and design a function show. This function accepts a std::list of Car object pointers as a parameter and displays the pos attribute of each Car object.

   First, define a Template class Car, which should contain a data member pos to store the location of the vehicle. The data type of pos may be int, float, double, etc.

   Next, in the main function, create three Car object pointers and set their pos values to 1.2, 2.3, and 3.5 (assuming pos is a double type). Store these three Car object pointers in a std::list and pass the list to the show function. In the show function, use a loop to traverse the list and display the pos of each vehicle.

   (Part 2) Modify the above question and change std::list to std::map.Each element in the map is {ID, Car indicator}, In addition to the show function in the previous question displaying the pos of each Car, In addition, design a find function, input a coordinate value, output which Car has the coordinate, and return its ID value. If it cannot be found, it returns -1.

6. Please write a C++ program to define a template class Car. It contains a member variable pos, which is used to represent the position of the vehicle, and pos can be of int or double type. Use this category to create a std::map<int, Car> container, add 10 Car objects to the map, with key values from 0 to 9, and set the pos of each Car to any value (such as 0.0, 1.1, 2.2 wait). Then write a function searchCar that accepts a target value as a

parameter and searches the map to see if there is a pos of Car equal to this value. If found, return the key value of the Car, otherwise return -1. Finally, in the main function, let the user enter a target value, Call searchCar to perform a search and print the results.

Class discussion

7. Complex number operations and operator multi-loading and template.
   A complex number (Complex Number) contains a real part (Real) and an imaginary part (Imaginary), and the real part and imaginary part of this complex number may be int or double at the same time according to different usage requirements. Suppose we want to add two such complex numbers, please use operator overloading to achieve the following virtual code in main.

   ia = (3.5, 2.4)
   ib = (4.5, 2.3)
   ic = ia + ib;
   show(ic);

   (The above virtual code needs to be rewritten to confirm to C++ syntax)

8. (Part 1) Please design an STL Array container that can accept common types of data types such as int, double, and float as its element content. Please design an external function for this container. This function is used to calculate the sum of elements. and show it.

   (Part 2) Continuing on from the above, please use the container of STL List instead and use iterator.

   (Part 3) Use the container of STL Vector instead of the container of List. Change the function to SearchVector. If the element exists, display it in Vector. Otherwise, display -1.

   (Part 4) Following the first question, if the data type is char, please display these characters in order to form a string. (Only shown, not necessarily stringed together).

   (Part 5) Create an STL Map with key-value pairs. Design a function that displays the corresponding key for a given value. If the value doesn't exist, display -1.

9. Design a character system, including the abstract category Player and two subcategories Enemy and Knight, the abstract category Player has protected variables string name (character name) and int health (blood volume)

   Pure virtual function void attack() for action subcategories for different characters to perform attacks Enemy and Knight have public constructor: used to initialize the character's name and health

   The void attack() function is used to perform the attack actions of Enemy and Knight. Enemy's attack has 10 points of damage, and Knight's attack has 20 points of damage. Suppose we have the following code to simulate attacks and injuries between game characters. Please refer to the following main() code.

   ```
   int main(){
   Player \*player = new Enemy( "Alice" , 100):
   player-›attack();

   Player *player2 = new Knight ( "Bob", 100%;
   player2-›attack();

   return 0;
   }
   ```

   Example output:
   Enemy attacks Alice, inflicting 10 damage!
   Alice's health is now 90.

   Knight attacks Bob, inflicting 20 damage!
   Bob's health is now 80.

10. Write three categories, namely Polygon (polygon), Rectangle (rectangle), and Triangle (triangle). Polygon is an abstract category, The area of Rectangle (area()) is calculated by multiplying both sides. The area of Triangle (area()) is calculated by multiplying both sides and dividing by two. Please complete the categories of Polygon, Rectangle and Triangle so that the following maip() The code can be executed smoothly, And calculate the area of ppoly1 and ppoly2.

    ```
    int main {
    double a=2.5, b=6;

    Rectangle<double> r;
    Triangle<double> t;
    ```

```
Polygon<double> *ppolyl = &r;
Polygon<double> *ppoly2 = &t;
poly2 -> setValues (a, b);
cout << poly-›areal) < endl;

return 0;
}
```

11. (Part 1) STL Write an estimate std::queue, and input a sequence, in order. Enter each input of this array into this queue, but if the number is the 4th multiple, the frontmost number will be pop() out. For example, if our array is 1 2 3 4 5 6 7, then according to the above After the rules are added sequentially, this number will be 3 4 5 6 7.

    Example input 1
    1234567

    Example output 1
    234567

    Example input 2
    5678956789

    Example output 2
    78956789

    (Part 2) Use STL to write a std::set, input a sequence, and output the sum of the set. Note that set ignores duplicates.

    Example input 1
    1.2
    3.4
    5.6
    3.4

    Example output 1
    10.2

    Example input 2
    3.3. 4.44.4 5.5

    Example output 2
    13.2

12. (Part 1) Please create a Template class Car and design a function show, This function accepts a std::list of Car object pointers as a parameter and displays the pos attribute of each Car object. First, define a Template class Car, which should contain a data member pos to store the location of the vehicle. The data type of pos may be int, float, double, etc.

    Next, in the main function, create three Car object indicators and set their pos values to 1.2, 2.3 and 3.5 (assuming pos is of double type). Store these three Car object pointers in a std::list and pass the list to the show function. In the show function, use a loop to traverse the list and display the pos of each vehicle.

    (Part 2) Modify the above question, change std::list to std::map, each element in the map is {ID, Car indicator}, In addition to the show function in the previous question displaying the pos of each Car. Also design a find function, input a coordinate value, output which Car has the coordinate, and return its ID value. If it cannot be found, it returns -1.

13. Use STL Map and let the user enter 3 sets of numbers and save them as Map Three sets of data (each set of data contains two numbers). The data types in each set of numbers are int and double, and int is key (key value), double is the corresponding value. Next, let the user enter an integer, if the integer exists in the key value, the data belonging to the key value will be deleted. If it does not exist, it will not be changed.

14. There are three categories: Animal, Rabbit, and Turtle. Rabbit and Turtle inherit from the Animal class. They each have pos variables to indicate their location and are initialized in their respective constructors. Turtle moves by 1 step and Rabbit moves by 3 steps.
    In the compiler, test two objects and compare their locations. If the first object is closer, return 1. Otherwise, return 0. Please complete these declarations so the code executes correctly.

    ```
    Int main() {
    Turtle t(10.5):
    Rabbit r (8.5);
    Animal &al = t;
    Animal &a2 = r;
    al. move (3); a2. move (2);
    if(compare(al, a2)){
    cout « "The turtle wins!" « endl;
    } else {
    cout < "The rabbit winsl" < endl;
    ```

```
}
return 0;
}
```