Row	Seat

Final Exam CSCI 135 Version 3: Programming Design and Analysis

Hunter College, City University of New York

Final Exam Date and Time:19 May 2022, 11:30 – 1:30 PM

Exam Rules
- Show all your work. Your grade will be based on the work shown.
- The exam is closed book and closed notes.
- When taking the exam, you may have with you pens and pencils, and the cheat sheet provided.
- You may not use a computer, calculator, tablet, phone, earbuds, or other electronic device.
- Do not open this exam until instructed to do so.

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I understand that all cases of academic dishonesty will be reported to the Dean of Students and will result in sanctions.
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Initial:

1. Short answer questions (3-point each).

   (1) Suppose class Dog is derived from class Animal, which class is a superclass?

   (2) Declare an array of strings, call it **shapes**. Initialize with “Square”, “Triangle”.

   (3) Write code to print 1, 4, 16, …, 4^{15}, where the next item is four times of the previous one.

   (4) Given function bool isPrime(int n), which return true if n is a prime integer, false otherwise. Write code to find out **how many** prime integers are in [20, 100].

Initial:

(5) Given int arr[] = {1, 2, 97}; and int *p = arr; What is the value of *(p+1) + 2? Note that dereference operator * has higher precedence than plus operator +.

(6) Given a **struct** called Cat, which includes the following data members: breed as a string and weight as a double. Suppose mew is declared as a variable of Cat. **Write code** to set the breed of mew to be “Ragdoll”.

(7) What is output for the following code?

```
vector<int> nums;

for (int i = 0; i < 10; i++)
     nums.push_back(i);

for (int i = 0; i < nums.size(); i++)
     if (nums[i] % 3 == 0)
        cout << nums[i] << endl;
```

(8) Read the following code. What is the output?

```
int arr[] = {2, 5, 3, 1};
int size = sizeof(arr) / sizeof(arr[0]);

for (int i = 0; i < size-1; i++)
   if (arr[i] > arr[i+1])
      swap(arr[i], arr[i+1]); //function to exchange two given parameters
```

Initial:

```
for (int i = 0; i < size; i++)
   cout << arr[i] << endl;
```

(9) Declare and initialize a two-dimensional double array called arr with three rows. The first row is 1.6, 2.7, the second row is 3.0, 4.0, and the third row is 5.3, 6.9.

(10) Declare the **header** of a function called **sort**, which takes two float type numbers, if the first one is larger than the second one, swap them. Return type is **void**. No need to define the function, **just define the header of the function**.

Initial:

2. Declare an int variable called it size and initialize it to be 15. Create a **two**-dimensional dynamic allocated memory array, call it data, which has size rows, and row indexed at i has (i+1) columns, where i is the index of row and starts from 0.

Set each element of data to be a random int in [10, 100].

Release dynamically allocated memory of data and handle dangling pointer problem.

Initial:

3. Define a **class** called Date, which includes data members, year and month, both as ints.
    - Data member year is an astronomical year, where year 0 means 1 BC, and counts negative years from 2 BC backward (−1 backward), so 100 BC is −99 (per wiki). So, year can be negative.
    - Data member month is an integer between 1 and 12.

    Define a default constructor, set year to be 1900 and month to be 12.

    Define method nextTwoMonth, which forward two months from current date. You need to consider the case when current month is November, December, or other cases.

In main function, create a Date object using default constructor, and call its nextTwoMonth method.

4. Define a function, for a given array of ints, its size, and a target int, return the index of the **last** occurrence of that target if found, otherwise, return -1.

5. Define a function, for an array of integers and its size, return a vector of consisting of only negative integers in this array.

Initial:

6. Define class equilateral triangular prism.
   (1) Data member are side and height, both may contain decimal numbers.
   (2) Define non-default constructor which takes two formal parameters side and height, if this given parameter side is positive, use it to initialize data member side, otherwise, initialize data member side to be 1. If given parameter height is positive, use it to initialize data member height, otherwise, set data member height to be 1.
   (3) Define a method to reset data member side. If the given parameter is positive, then use it to reset data member side, otherwise, do not change the side of the current object.
   (4) Define a method to get data member side.
   (5) Define a method to get the volume of an equilateral triangular prism. The formula is $\sqrt{3}/4(side)^2 height$. To calculate the square root of a number, use sqrt function.

Name of a class cannot contain spaces. We shorten the name of equilateral triangular prism as Prism in the example, you can also use EquTriPrism or whatever meaningful name you like.

Note that if a formal parameter has the same name as a data member, to distinct data member from the formal parameter, add this-> before data member, where this is a keyword, which is a pointer to the current object. If a data member does not share the same name as a data member, there is no need to add this-> in front of a data member.

Initial:

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Initial:

7. Define a **recursive** function that test whether a given string contains only letters ‘x’ or ‘y’. Also, an empty string by definition is not a string contains only letter ‘x’ or ‘y’.
   Hint: for base cases, you may need to consider a string has no letter or a string has only one letter.

Note that if you do not use recursion, you will not get any point. No repetition statement is allowed in this function.

Here are the keys to solve this problem.

(1) If a string is empty, return false.
(2) If a string has only one letter, and that letter is either ‘x’ or ‘y’, return true.*
(3) Otherwise, either the string has only letter but that letter is not ‘x’ or ‘y’, or the string has two or letters. The string contains ‘x’ and ‘y’ if and only if the first letter is either ‘x’ or ‘y’ and the substring except the first letter contains ‘x’ or ‘y’ only.

*If a string has only one letter, and that letter is neither ‘x’ nor ‘y’, by (3), the return is false.