Row	Seat

Final Exam CSCI 135 Version 2: 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.

Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The College is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures.

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 Undergraduate is derived from class Student, which class is a subclass?

   (2) Declare an array of strings, call it **colors**. Initialize with “Red”, “Blue”, “Green”.

   (3) Write code to print 1, 3, 9, 27, 81, …, 3^{12}, where the next item is three 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 [100, 200].

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

Initial:

(6) Given a **struct** called Dog, which includes the following data members: breed as a string and weight as a double. Suppose diesel is declared as a variable of Dog. **Write code** to set the breed of diesel to be "bulldog".

(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] % 2 != 0)
      cout << nums[i] << endl;
```

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

```
int arr[] = {3, 2, 5, 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

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

Initial:

(9) Declare and initialize a two-dimensional int array called arr with three rows. The first row is 1, 2, the second row is 3, 4, and the third row is 5, 6.

(10) Declare the **header** of a function called **sort**, which takes two double 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**.

2. Declare an int variable called it size and initialize it to be 20. 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 [100, 200].

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 1970 and month to be 1.

    Define method prevMonth, which decrease one month from current date. You need to consider the case when current month is January or not.

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

Initial:

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 non-zero integers in this array.

Initial:

6. Define class Cone.
   (1) Data member are radius and height, both may contain decimal numbers.
   (2) Define non-default constructor which takes two formal parameters radius and height, if this given parameter radius is positive, use it to initialize data member radius, otherwise, initialize data member radius 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 height. If the given parameter is positive, then use it to reset data member height, otherwise, do not change the height of the current object.
   (4) Define a method to get data member height.
   (5) Define a method to get the volume. The formula is $1/3\pi(radius)^2 height$. To use π, you may use M_PI, which is define in cmath library.

Initial:

7. Define a **recursive** function that test whether a given string contains only letters ‘0’ or ‘1’. Also, an empty string by definition is not a string contains only letter ‘0’ or ‘1’.
   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.