

Row	Seat

Final Exam CSCI 135: Programming Design and Analysis

Hunter College, City University of New York

Final Exam Date and Time: 16 December 2021, 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) Declare class Undergraduate as a subclass of Student and inherits its public members.

- (2) Declare a vector of ints, call it **ages**. Initialize with 17, 36, 65.

- (3) Suppose `int arr[] = {2, 3, 4};` What is `*arr + *(arr+1)` ?

- (4) Write the **header** of a function `foo`, for given string **str** and an int representing **index**, if index is valid and the character at the index in str is a smaller letter, return true, otherwise, return false.

- (5) What is the possible values of `(1 + rand()) % 12 + 3` ?

Initial:

- (6) Declare a **struct** called Person, which includes the following data members: name as a string and age as an int.

- (7) What is output for the following code?

```
char numToLetter(int grade)
{
    char letter;
    if (grade >= 90)
        letter = 'A';
    else if (grade >= 80)
        letter = 'B';
    else if (grade >= 70)
        letter = 'C';
    else if (grade >= 60)
        letter = 'D';
    else letter = 'F';
    return letter;
}

int main()
{
    int grades[] = {20, 60, 89, 90, 100};
    int size = sizeof(grades) / sizeof(grades[0]);

    int value = 0;
    char letter;
    for (int i = 0; i < size; i++)
    {
        letter = numToLetter(grades[i]);
        if (letter == 'A' || letter == 'B')
            value++;
    }

    cout << value << endl;
    return 0;
}
```

Initial:

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

```
class Computer {
public:
    Computer()
    {
        id = id_generator;
        id_generator++;
    }

    int get_id() const
    {
        return id;
    }
private:
    static int id_generator;
    int id;
};

int Computer::id_generator = 1;

int main()
{
    Computer first;
    Computer second;

    cout << second.get_id();

    return 0;
}
```

(9) Declare and initialize a two-dimensional int array called arr with two row 1, 2, 3, 4, 5, the second row 6, 7, 8, 9, 10.

Initial:

(10) What is the output for the following code?

```
for (int i = 1; i <= 2; i++)  
{  
    for (int j = 1; j <= 3; j++)  
        cout << i * j << " ";  
  
    cout << endl;  
}
```

2. Fill in blanks (10 points)

(1) Write code for each requirement.

Declare an int variable called it size and initialize it to be 10. Create a one-dimensional dynamic allocated memory array, call it data, of ints whose capacity is size.

Set each element of data to be a random int in [60, 100].

Write code to find out the average of array data.

Initial:

- (2) Define a **recursive** function that takes an int, return its number of digits. For example, if input is 123, then return 3. If input is -2, then return 1.

Define function header. The function name is numDigits, the given parameter is num.

{

If num has only one digit (can be negative), return 1.

Now num has more than one digit. Write recursive code to find out number of digits of num. Hints: suppose num is 123, how to get 12? What is the relationship between number of digits of 123 and number of digits of 12? How to get 1 from 12? What is the relationship between number of digits of 12 and number of digit of 1?

}

In main function, print the number of digits of 123 applying numDigits function.

Initial:

- (3) Define a function `foo`, for a given array `arr` of ints and its size, return type is empty.
Define the function header.

For each adjacent pair `arr[i]` and `arr[i+1]` in `arr`, if `arr[i]` equals `arr[i+1]`, set `arr[i]` to be zero and replace `arr[i+1]` by twice of `arr[i+1]`.

After applying `foo` on array `{2, 2, 1, 1, 0}`, what does array looks like?

Initial:

3. (1) Define a function, for a vector of strings and a target string, find out whether the target string is in this vector or not. If yes, return true, otherwise, return false.
(2) Define function, for two vectors of strings vectA and vectB, find out all the strings that are common in vectA and vectB, put them in a vector. Return that vector. For simplicity, we assume that no two elements in vectA are the same, neither is vectB. For example, if vectA is {"aaa", "bbb", "ccc", "ddd"} and vectB is {"ddd", "bb", "aaa"}, then the vector with common elements is {"aaa", "ddd"}.
Hints: you may apply function in (1) when working the function in (2). You may need to use push_back and size methods of vector.

Initial:

4. Define class Circle.
 - (1) Data member is radius, which is a number that may contain decimal numbers.
 - (2) Define default constructor of class Circle, set radius to be 1.
 - (3) Define non-default constructor of class Circle which takes an input parameter radius, if this given parameter is positive, use it to initialize data member radius, otherwise, initialize data member radius to be 1.
 - (4) Define a method to reset data member radius. If the given parameter is positive, then use it to reset data member radius, otherwise, do not change the radius of the current object.
 - (5) Define a method to get data member radius.
 - (6) Define a method to get the area of a circle. The formula is πr^2 . To use π , you may use M_PI, which is define in cmath library.

Initial:

5. Define NUM_COLUMNS as a const with value 3. Define a method for a two-dimensional array of chars with NUM_COLUMNS columns, check whether there is a column with all 'O' characters. For example, if we have
- ```
char arr[][NUM_COLUMNS] = { {'X', 'O', 'X'}, {'O', 'X', 'O'}, {'X', 'O', ' '}, {'O', ' ', 'X'} };
```
- Illustrated as follows. Then the return would be false.

|     |     |     |
|-----|-----|-----|
| 'X' | 'O' | 'X' |
| 'O' | 'X' | 'O' |
| 'X' | 'O' |     |
| 'O' |     | 'X' |

Hints: for **each** column, count the number of 'O'. If a column has all 'O', what is the number of 'O'?

Define NUM\_COLUMNS as a const with value 3.

```
bool column_all_O(char arr[][NUM_COLUMNS], int numRows)
{ //Your code goes here.
```

```
}
```