

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.

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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:								

Initial:

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

(1) Declare that class Dog as a subclass of Animal and inherits its public members.

```
class Dog : public Animal
```

(2) Declare a vector of double numbers, call it **weights**. Initialize with 17.2, 36.1, 65.

```
vector<double> weights = {17.2, 36.1, 65}
```

(3) Suppose `int arr[] = {3, 2, 8, 9};` What is `*arr + *(arr+2)` ?

$3 + 8 = 11$

(4) Write the **header** of a function `foo`, for two given integers `m` and `n`, if `n` is not 0 and `m` is a multiple of `n`, returns true, otherwise, return false.

```
bool foo(int m, int n);
```

(5) What is the possible values of `(3 + rand()) % 6 + 2`?

Initial:

- (6) Declare a struct called TV, which includes the following data members: size as an int and model as a string.

```
struct Tv
```

- (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[] = {36, 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;
    Computer third;

    cout << second.get_id();

    return 0;
}
```

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

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 `size` and initialize it to be 20. 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 `[100, 200]`.

Find out the difference between the maximum and the minimum 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? Similarly, how to get 1 from 12? What is the relationship between number of digits of 1 and number of digits of 12?

```
}
```

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]`, replace `arr[i]` by twice of `arr[i]` and set `arr[i+1]` by 0.

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

Initial:

3. (1) Define a function, for a vector of strings, find out whether a string is in 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 in vectA but **not** in 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 returned vector is {"bbb", "ccc"}.
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 Square.
 - (1) Data member is side, which is a number that may contain decimal numbers.
 - (2) Define default constructor of class Square, set side to be 1.
 - (3) Define non-default constructor of class Square which takes an input parameter side, if this given parameter is positive, use it to initialize data member side, otherwise, initialize data member side to be 1.
 - (4) 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 data member side.
 - (5) Define a method to get data member side.
 - (6) Define a method to get the perimeter, which is four times side.

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 space 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 spaces. If a column has all spaces, what is that number equal to?

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

```
}
```