

## CS319 Class Test, 7 Feb 2024

### Instructions:

- Answer all three questions.
- Your solution of each question should be in the form of a C++ program which you upload to “Assignments... Class Test” on Canvas. You can upload a single file, or one file per question (as you prefer). Each of your files should include comments with your name, ID number, and email address.
- This is an “open book” test: you can use your lecture notes, and any other resource at <https://www.niallmadden.ie/2324-CS319>
- You may not communicate with anyone during the test.

.....

Q1 Here is a simple “Hello World” C++ programme.

```
1 #include <iostream>
3 int main(void)
4 {
5     std::cout << "Hello, world!" << std::endl;
6     return(0);
7 }
```

You can also download it from [niallmadden.ie/2324-CS319/ClassTest/HelloWorld.cpp](https://www.niallmadden.ie/2324-CS319/ClassTest/HelloWorld.cpp).

Compile and run this program. Modify it so that

- a variable of type **string** is declared;
- The user is prompted to enter their name;
- The user’s input is read and stored in the **string** declared in (a).
- A message is displayed using that name. For example, if the user enters “Catherine” as their name, it should output “**Hello Catherine**”.

*The goal of Q1 is to test if you can compile and run a C++ program, define a **string** variable, and do basic input and output. Pay special attention to ensuring that your code compiles without error or warning.*

.....

Q2 For this question, it helps to know that

- **int a[10];**  
creates an array (list) of 10 integers called  $a[0]$ ,  $a[1]$ , ...,  $a[9]$ .
- **x=rand()%n;**  
sets **x** to be a random int between 0 and  $n - 1$ .

Write a program that works as follows.

- the program has a function with header **int CountOccurrences(int list[], int len, int k);** which returns the number of times that **k** occurs in the array **list[]**, which is of length **len**.
- The **main()** part of the program uses a **for** loop to create an array of integers of length 10, and sets the entries to be a random number between 0 and 10 (inclusive).
- It then uses the **CountOccurrences()** function to report which entries in the list are unique (that is, occur exactly once).

*The goal of Q2 is to verify that you are competent writing **for**-loops and functions.*

.....

Q3 Write a recursive function with header

**int MyNchooseK(int n, int k);**

that takes a two integer arguments, **n** and **k**, and returns  $\binom{n}{k}$ , using the following algorithm.

- If  $n < k$ , other either  $n$  or  $k$  are negative, then  $\binom{n}{k} = 0$ .
- Otherwise, if  $k = 0$  or  $k = n$ , then  $\binom{n}{k} = 1$ .
- Otherwise  $\binom{n}{k} = \binom{n-1}{k-1} + \binom{n-1}{k}$

In your **main()** function, verify that **MyNchooseK()** works by

- Prompting the user to enter values of  $n$  and  $k$ ;
- reading in those values, using **std::cin**
- Outputting  $\binom{n}{k}$  for these values.

Note: for example,  $\binom{6}{-1} = 0$ ,  $\binom{6}{1} = 6$ , and  $\binom{6}{3} = 20$ .

*The purpose of Q3 is to verify that you can read input, write functions, and use **if** statements.*