CS319 **SAMPLE** test (Feb 2025)

Instructions:

- This is just a *sample* of the type and range of questions you can expect for the class test on Friday 21 Feb.
- The real test will also have 4 questions and you'll be expected to answer all of them.
- The solution of each question should be in the form of a C++ program. For the test, you'll upload thse "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.
- The test will be "open book": you can use your lecture notes, and any other resource at `https://www.niallmadden.ie/2425-CS319`
- You may not communicate with anyone during the test, use a search engine, or generative AI.
- Solutions to this sample test will be posted on Wednesday (19 Feb)

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Q1 Here is a simple "Hello World" C++ programme.

```
1 #include <iostream>

3 int main(void)
  {
5   std::cout << "Hello, world!" << std::endl;
    return(0);
7 }
```

You can also download it from `niallmadden.ie/2425-CS319/ClassTest/HelloWorld.cpp`.

Compile and run this program. Modify it so that

(a) a variable of type **`string`** is declared;

(b) The user is prompted to enter their name;

(c) The user's input is read and stored in the **`string`** declared in (a).

(d) 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.*

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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.

(a) the program has a function with header
`int CountOccurences(int list[], int len, int k);`
which returns the number of times that **`k`** occurs in the array **`list[]`**, which is of length **`len`**.

(b) 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).

(c) It then uses the **`CountOccurences()`** 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.*

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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 $n < k$, or 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.*