CISS240: Introduction to Programming
Assignment a00

Name: _____

Objectives

- Write a hello world program.
- Trace a hello world program.

File structure is

```
a01/
  main.tex
  makefile
  a01q01/ .... (example with LaTeX and code)
    question/
      doc/
        q01.tex
    answer/
      doc/
        q01s.tex
      skel/
        main.cpp
      src/
        main.cpp
  a01q02/ .... (example with LaTeX)
    question/
      doc/
        q02.tex
    answer/
      doc/
        q02s.tex
  a01q03/ .... (example with code)
    question/
      doc/
        q03.tex
    answer/
      skel/
        main.cpp
      src/
        main.cpp
```

Need not include files in `skel`.

Q1. What is 1 + 1? Write a C++ program that prints 1 + 1.

Answer:

a01q01/answer/doc/q01s.tex

$1 + 1 = 2$

a01q01/answer/skel/main.cpp

```
#include <iostream>

int main()
{
}
```

a01q01/answer/src/main.cpp

```
#include <iostream>

int main()
{
    std::cout << 1 + 1 << '\n';
    return 0;
}
```

Q2. Prove

$$1 + 2 + \cdots + n = \frac{n(n+1)}{2}$$

for $n \geq 0$.

Answer:

`a01q02/answer/doc/q02s.tex`

We will prove this by weak mathematical induction. Let $P(n)$ be the statement

$$P(n) = \left(1 + 2 + \cdots + n = \frac{n(n+1)}{2}\right)$$

for $n \geq 0$.

Base case. When $n = 0$,

$$\begin{aligned} 1 + 2 + \cdots + n &= 0 \\ &= \frac{0(0+1)}{2} \\ &= \frac{n(n+1)}{2} \end{aligned}$$

Hence $P(0)$ holds.

Inductive case. Let $n \geq 0$ and assume $P(n)$ holds, i.e.,

$$1 + 2 + \cdots + n = \frac{n(n+1)}{2}$$

Therefore

$$\begin{aligned} 1 + 2 + \cdots + n + (n+1) &= \frac{n(n+1)}{2} + (n+1) \\ &= (n+1)\left(\frac{n}{2} + 1\right) \\ &= (n+1)\left(\frac{n+2}{2}\right) \\ &= \frac{(n+1)((n+1)+1)}{2} \end{aligned}$$

i.e., $P(n+1)$ holds.

Therefore by weak mathematical induction, $P(n)$ holds for all $n \geq 0$, i.e.,

$$1 + 2 + \cdots + n = \frac{n(n+1)}{2}$$

for all $n \geq 0$. □

Q3. Write a C++ program that prints $1 + 1$.

Answer:

a01q03/answer/skel/main.cpp

```
#include <iostream>

int main()
{
}
```

a01q03/answer/src/main.cpp

```
#include <iostream>

int main()
{
    std::cout << 1 + 1 << '\n';
    return 0;
}
```