

CISS240: Introduction to Programming Assignment a00

Name: _____

File structure is

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

$1 + 1 = 2$

a01q01/skel/main.cpp

```
#include <iostream>

int main()
{
}
```

a01q01/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/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/skel/main.cpp

```
#include <iostream>

int main()
{
}
```

a01q03/src/main.cpp

```
#include <iostream>

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