NANYANG TECHNOLOGICAL UNIVERSITY
School of Electrical & Electronic Engineering

IE2108 Data Structures and Algorithms in Python

Tutorial No. 2 (Sem 2, AY2023-2024)

1. Suppose $\lg x = \log_2 x$. Find the value of each expression below without using a calculator.
   (i) $\lg 64$
   (ii) $\lg 2^{1000}$

2. The floor function $\lfloor x \rfloor$ returns the largest integer not greater than x while the ceiling function $\lceil x \rceil$ returns the smallest integer greater than or equal to x. Compute $\lfloor x \rfloor$ and $\lceil x \rceil$ for each of the following values of x:
   (i) 37.99
   (ii) 10/3

3. Determine if the following expression is true or false:
   $n! = n \times (n-1)!$

4. Prove that $\binom{n}{r} = \binom{n}{n-r}$, where $\binom{n}{r} = \frac{n!}{r!(n-r)!}$.

5. If i is an integer and $i \geq 1$, find a formula for $1 + 2 + 2^2 + \cdots + 2^{i-1}$. Write a Python program to justify your answer.

6. Use mathematical induction to prove that each equation is true for every positive integer n.
   (i) $\sum_{i=1}^{n} i \cdot (i!) = (n+1)! - 1$
   (ii) $(1+x)^n \geq 1 + nx$, where $x \geq -1$

Python Practice (This part is for your self-study. You can use the Python interpreter to check your predicted results)

```
print("I'm learning Python.")

print('I"m learning Python.')

print('I'm learning Python.')  # error
```

```
print("That's why it's true!")

print("Age: ", 20 + 5 // 2)

print("Age: ", 20 + 5 % 2)

print(4 + 5 >= 8 + 2)

print("5 - 12 = ", 5 - 12)


my_name = "John"

my_age = 60

x = f"{my_name}, you are too old in this class."

print(f"This is {my_name}.  I'm {my_age} years old.")  # f stands for format

print(x)


address = "{} {} {}"

print(address.format("Block 123", "NTU", 12))

print("2 * 4 = ", 2*4)  # another overloading example

print("test "*3)  # can you predict the result?
```