

**NANYANG TECHNOLOGICAL UNIVERSITY**  
**School of Electrical & Electronic Engineering**  
**EE2008/IM1001 Data Structures and Algorithms**

**Tutorial No. 1 (Sem 2, AY2021-2022)**

1. Determine whether each of the following sequences is increasing, decreasing, non-increasing or non-decreasing.
  - (i) 5, 55, 555, 555, 606, 1001, 2002, 2020, 2020
  - (ii) 5, -55, -555, -606, -1001, -2020, -2020, -3000
  - (iii) 10, 22, 35, 100, 201, 500, 2000
  - (iv) 5, 5
2. Find the value of each expression below without using a calculator.
  - (i)  $\lg 64$
  - (ii)  $\lg 2^{1000}$
3. Compute  $\lfloor x \rfloor$  and  $\lceil x \rceil$  for each of the following values of  $x$ :
  - (i) 37.99
  - (ii)  $10/3$
4. Determine if the following expression is true or false:
$$n! = n \times (n - 1)!$$
5. Prove that  $\binom{n}{r} = \binom{n}{n-r}$ .
6. If  $i$  is an integer and  $i \geq 1$ , find a formula for  $1 + 2 + 2^2 + \dots + 2^{i-1}$ .
7. Use mathematical induction to prove that each equation is true for every positive integer  $n$ .
  - (i)  $\sum_{i=1}^n i(i!) = (n+1)! - 1$
  - (ii)  $(1+x)^n \geq 1+nx$ , where  $x \geq -1$