

# CSC301 HW3

Alex Zhang

Jan 2023

## Question 1

(a)

Since  $n \geq n-1 \geq n-2 \geq n-3 \geq \dots$ , so that  $n \cdot n \geq n \cdot (n-1)$ . We can then apply this inequality with more numbers which

$$n \cdot (n-1) \cdot (n-2) \cdot (n-3) \dots 1 \leq n \cdot n \dots n$$

This inequality holds true because each element on the left side is smaller than elements on the right side. Simplifying the inequality,

$$n! \leq n^n$$

which shows that it is true. ■

(b)

To prove the inequality, we can transformed into

$$\log_{n/2} n! \geq \log_{n/2} (n/2)^{n/2}$$

which the left side and right side can also be written as,

$$\sum_{i=0}^{n-1} \log_{n/2} (n-i) \geq n/2$$

## Question 2

## Question 3