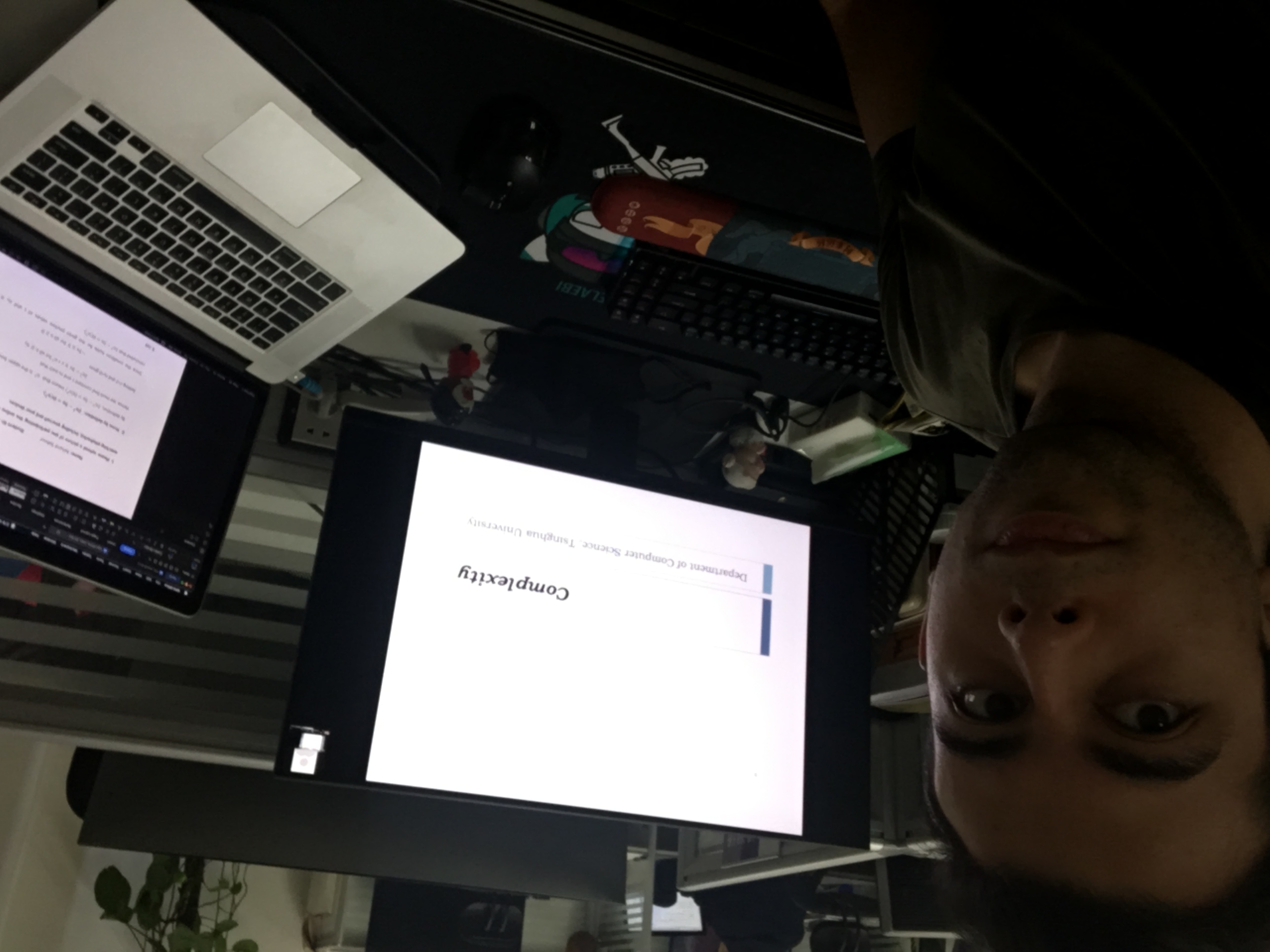
**Homework - Week 9**

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1. **Please upload a picture of you participating the online meeting of the course (or watching playbacks), including yourself and your devices.**



1. **Prove by definition: .**

By definition, means that is the upper bound for . Hence, we must find constant c and n0 such that

Setting c=2 and n0=0 gives

Since the condition holds for the given positive values of c and n0, it can be concluded that .

**3. Let**

**Where, be a degree- polynomial in , and let be a constant. Use the definitions of the asymptotic notations to prove:**

By definition, p(n)= O(nk) means that nk is the upper bound for p(n). Hence, we must find constant c and n0 such that

Accordingly, P(n) can be rewritten as

Therefore, it can be observed that the largest power in the sum would be -1 (when i=d-1) and the rest of the powers for n would be less than that. Hence, the values in this sum tend to move closer to zero as the value of n and/or its power increases, with . Setting the upper bound for this sum to 1, given that increases as fast or faster than since , gives

Setting and n0= 2 satisfies the above equation and therefore, these positive values could be used to prove the given statement.

1. **Show that the majority element problem can be reduced to the sorting problem, following the three steps of reduction.**

The input to the majority element problem is an array A of n numbers.

**Step 1:** The same array A could be used as the input to the sorting problem.

**Step 2:** Using any algorithm for the sorting problem sorts the array in ascending order and the output would be the array A’ which is the sorted version of A.

**Step 3:** Select the median of the new array A’ and check if it’s the majority element.