

# Quiz 1 Standard 1

Due Date ..... TODO  
 Name ..... **Tyler Huynh**  
 Student ID ..... **109603994**  
 Quiz Code (enter in Canvas to get access to the LaTeX template) ..... **PLQJR**

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## Instructions

- You may either type your work using this template, or you may handwrite your work and embed it as an image in this template. **If you choose to handwrite your work, the image must be legible, and oriented so that we do not have to rotate our screens to grade your work.** We have included some helpful LaTeX commands for including and rotating images commented out near the end of the LaTeX template.
- You should submit your work through **Gradescope** only. Please submit one PDF file, compiled using this LaTeX template.
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- You **may not collaborate with other students. Copying from any source is an Honor Code violation. Furthermore, all submissions must be in your own words and reflect your understanding of the material.** If there is any confusion about this policy, it is your responsibility to clarify before the due date.
- Posting to **any** service including, but not limited to Chegg, Discord, Reddit, StackExchange, etc., for help on an assignment is a violation of the Honor Code.
- You **must** virtually sign the Honor Code (see Section ). Failure to do so will result in your assignment not being graded.

## Honor Code (Make Sure to Virtually Sign)

**Problem HC.**     • My submission is in my own words and reflects my understanding of the material.

- Any collaborations and external sources have been clearly cited in this document.
- I have not posted to external services including, but not limited to Chegg, Reddit, StackExchange, etc.
- I have neither copied nor provided others solutions they can copy.

*I agree to the above, Tyler Huynh.*

□

## 1 Standard 1: Proof by Induction

**Problem 1.** Consider the sequence defined by:

$$T_n = \begin{cases} 0 & : n = 0 \\ 1 & : n = 1 \\ 2T_{n-1} + 1 & : n \geq 2 \end{cases}$$

Prove by induction that for every  $n \geq 0$ , we have:

$$\sum_{i=0}^n T_i = T_{n+1} - (n + 1).$$

$$T_n = \begin{cases} 0 & : n=0 \\ 1 & : n=1 \\ 2T_{n-1} + 1 & : n \geq 2 \end{cases}$$

Prove by induction that every  $n \geq 0$ ,

$$\sum_{i=0}^n T_i = T_{n+1} - (n+1)$$

Base Case: (Proof by weak induction)

For  $n=0$ :

(LHS)

(RHS)

$$\sum_{i=0}^0 T_i = T_0 = 0$$

$$T_{0+1} - (0+1) = 1 - 1 = 0$$

For  $n=1$ :

(LHS)

(RHS)

$$\sum_{i=0}^1 T_i = T_0 + T_1 = 1$$

$$T_{1+1} - (1+1) = T_2 - 2 = 3 - 2 = 1$$

$$\begin{aligned} T_2 &= 2T_1 + 1 \\ &= 2(1) + 1 \\ &= 3 \end{aligned}$$

Inductive Hypothesis:

For some  $k \geq 2$ , that  $\sum_{i=0}^k T_i = T_{k+1} - (k+1)$ , such that it will be true.

Proof.