

EECS3101 (Section E) Summer 2026  
Tutorial 5  
Proving or Disproving Properties of Trees and Graphs  
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**No Submission Required: Complete for Learning & Test Prep**

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# 1 A Property of Binary Trees

Given a binary tree, say  $T$ , that is both *nonempty* and *proper* (i.e., each *internal* node has two child nodes), prove or disprove the following claim:

*Sum of the number of internal nodes ( $n_I$ ) and the number of external nodes ( $n_E$ ) in  $T$  is an odd number.*

**Requirement.** If you decide to prove it, you **must** do so via a mathematical induction. If you decide to disprove it, you must suggest a witness.

## 2 Properties of Graphs

Given an *undirected* graph  $G = (V, E)$  with  $|V| = n$ ,  $|E| = m$ , prove or disprove the following claims:

$$\begin{cases} m = n - 1 & \text{if } G \text{ is a **spanning tree**} \\ m \leq n - 1 & \text{if } G \text{ is a **forest**} \\ m \geq n - 1 & \text{if } G \text{ is **connected**} \\ m \geq n & \text{if } G \text{ contains a **cycle**} \end{cases}$$

**Requirement.** For each claim, if you decide to prove it, you **must** do so via a mathematical induction. If you decide to disprove it, you must suggest a witness.