CSL202: Discrete Mathematical Structures

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Proof Strategies

- Forward reasoning: Use the premises, axioms, previous theorems in a sequence of steps to show that the conclusion follows. This also includes indirect proofs.
  - Issue: We might not know which premise, axiom, or theorem to use to derive the relevant conclusion.
- Backward reasoning: For proving a statement q, we try to find a statement p such that p is true and $p \rightarrow q$.
  - Example: Show that $(x + y)/2 > \sqrt{xy}$ when x and y are distinct positive real numbers.

- Forward and backward reasoning
- Adapting existing proofs: Adapting an existing proof to prove other facts.
  - Example: Show that $\sqrt{3}$ is irrational.

- Forward and backward reasoning
- Adapting existing proofs
- Proof vs counterexample: For a new statement, switching back and forth between trying to prove the statement of finding a counterexample.
  - Example: Prove or disprove: "*Every positive integer is the sum of squares of three integers.*"

Definition (Graph)

A graph $G = (V, E)$ consists of V, a non-empty set of vertices (or nodes) and E, a set of edges. Each edge has two vertices associated with it, called its endpoints. An edge is said to connect its endpoints. The degree of a vertex is the number of edges incident on this vertex.

- Prove or disprove the following:
  - For any graph there are two vertices that have the same degree.
  - For any graph the number of odd degree vertices is even.

End