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# Discrete Mathematics

## Inductive Proof

### Given and Introduction:

Given statement:
Proofs are used in this class to prove statements of the form $\forall n \in D, n \geq a, P(n)$ where $P(n)$ is a predicate.

### Step-by-Step Solution:

#### Step 1: Introduction to Inductive Proof

Inductive proof is a mathematical proof technique typically used to prove statements about natural numbers. It involves two main steps:

1. **Base Case:** Prove the statement for the initial value (usually $n=0$ or $n=1$).
2. **Inductive Step:** Prove that if the statement holds for an arbitrary case $n = k$, then it holds for the next case $n = k+1$.

Supporting Statement: Inductive proof is a method used to establish that a statement holds for all natural numbers or a specified set with an initial condition and an induction step.

#### Step 2: Identify Valid Domains for Inductive Proof

**D = ℕ (Natural Numbers):**
- The domain of natural numbers (ℕ) is the standard setting for inductive proofs because they have a well-defined base case (usually starting from $n=0$ or $n=1$) and can be incremented by 1.
*Explanation:* Natural numbers are used as they start from a base case and can incrementally build upon each successive case.

**D = ℤ (Integers):**
- Inductive proofs can also be applied to integers (ℤ) by starting at a base case and incrementing. For negative values, a similar methodology applies but usually involves proving a statement with decrements.
*Explanation:* Integers extend inductive proofs to negative values and include a zero base case.

**D = ℝ (Real Numbers):**
- Inductive proofs typically are not applied to real numbers (ℝ) because real numbers are continuous, and induction relies on discrete steps.
*Explanation:* Real numbers do not fit into the traditional increment-by-one property of natural integers.

**D = ℂ (Complex Numbers):**
- Inductive proofs do not apply to complex numbers (ℂ) because complex numbers do not have a natural ordering or increment structure necessary for induction.
*Explanation:* Complex numbers lack the discrete sequential nature required for induction.

Supporting Statement: Only discrete and ordered sets, which facilitate base cases and incremental steps, are suitable for inductive proofs.

#### Final Selection:

Valid domains for inductive proofs:

- D = ℕ (Natural Numbers)
- D = ℤ (Integers)

### Conclusion:

From the given options, the valid domains for applying inductive proofs are the set of natural numbers (ℕ) and the set of integers (ℤ).

Supporting Statement: The selection aligns with the requirement of having a discrete and ordered set to apply the inductive procedure.

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