Department of Computer Engineering, SVNIT, Surat.
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Course: Automata and Formal Languages (CS208)
Tutorial – 1
(Mathematical Induction)

Q1 Prove the following by mathematical induction.

1. Let $S(n) = 1 + 2 + 3 + \cdots + n, n\epsilon N$.
   Prove by mathematical induction the statement
   $P(n): S(n) = \frac{n(n+1)}{2}$, for all integers $n \geq 1$

2. Let $S(n) = 1 + 3 + 5 + \cdots + (2n - 1)$.
   Prove by mathematical induction the statement
   $P(n): S(n) = n^2$, for all integers $n \geq 1$

3. Prove by mathematical induction, that
   $(n+1)^2 + (n+2)^2 + (n+3)^2 + \cdots + (2n)^2 = \frac{n(2n+1)(7n+1)}{6}$ is true for all natural number n.

4. Prove by mathematical induction, that
   $1 \cdot n + 2(n-1) + 3(n-2) + \cdots + (n-1) \cdot 2 + n \cdot 1 = \frac{1}{6}n(n+1)(n+2)$ is true for all the natural numbers n.

5. Prove by mathematical induction, that $n(n+1)(n+2)(n+3)$ is divisible by 24 for all natural numbers n.

Q2 Prove the following by contradiction

1. The square root of 2 is irrational.

2. The cube root of 2 is irrational.

3. For every n, If $n > 2$ and n is prime then n is odd.

4. If n is a perfect square, then $n + 2$ is not.

5. If $m \cdot n$ is even, where m and n are integers, then either m is even or n is even.