Name: **Class ID:**

CSE 1400 Applied Discrete Mathematics
Fall 2013 Mathematical Induction

1. Use mathematical induction to show that $m(n) = 2^n - 1$ solves the recurrence equation $m_n = 2m_{n-1} + 1$ with initial conditions $m_0 = 0$ by
   (a) Establishing a basis for induction: $m(0) = m_0$.
   (b) Making a hypothesis that $m(n-1) = m_{n-1} = 2^{n-1} - 1$ for some $n \geq 1$.
   (c) Proving under these assumptions that $m(n) = m_n = 2^n - 1$.
2. Use mathematical induction to show that the geometric sum

$$\sum_{k=0}^{n-1} r^k = \frac{r^n - 1}{r - 1} \qquad \text{provided } r \neq 1.$$

3. Use mathematical induction to prove the sum of products consecutive pairs of natural numbers is the product of three consecutive number divided by 3, that is,

$$\sum_{k=0}^{n-1} k(k-1) = \frac{n(n-1)(n-2)}{3}$$

   Notice that this identity states

$$\sum_{k=0}^{n-1} \binom{k}{2} = \binom{n}{3}$$

Total Points: 0 Friday, October 4, 2013