CSE/IT 122: Homework 1

Homework 1

Use math induction to prove the following problems.

1. Show $1^2 + 2^2 + \cdots + n^2 = n(n+1)(2n+1)/6$, where n is any positive integer.
2. Show $1^3 + 2^3 + \cdots + n^3 = [n(n+1)/2]^2$, where n is any positive integer.
3. Show $1 \cdot 1! + 2 \cdot 2! + \cdots + n \cdot n! = (n+1)! - 1$, where n is any positive integer.
4. Show $2^n > n^2$ when $n > 4$
5. Show $1^3 + 3^3 + 5^3 + \cdots + (2n-1)^3 = n^2(2n^2 - 1)$
6. Show $\frac{1}{(1)(2)} + \frac{1}{(2)(3)} + \cdots + \frac{1}{n(n+1)} = \frac{n}{n+1}$
7. Show $S = \sum_{j=0}^{n} ar^j = \frac{ar^{n+1} - a}{r-1}$, $r \neq 1$
8. Show $S = \sum_{i=1}^{n+1} i \cdot 2^i = n \cdot 2^{n+2} + 2$, for all integers $n \geq 0$

Submission

For your proofs, clearly state the base case and for the induction step clearly indicate the assumption you are making and what you are trying to prove. Use k in the induction step, not n.

Type (use Latex or Office/Open Office Equation Editor, etc) your induction proofs and submit as a pdf, named `cse122_firstname_lastname_hw1.pdf`

Upload to Canvas before the due date.