1. Prove for all natural numbers $n$ that:

$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$$

This can be done in several different ways. One way to prove this is by induction on $n$:

**Base Case:** $n = 1$.
When $n = 1$, the left hand side evaluates to 1 as does the right hand side ($\frac{1(1+1)}{2} = 1$). So, the equation holds for $n = 1$.

**Inductive Step:** $n > 1$.
Assume true for $n$, and then show true for $n + 1$. Starting with the left hand side:

$$\sum_{i=1}^{n+1} i = (n + 1) + \sum_{i=1}^{n} i = (n + 1) + \frac{n(n+1)}{2} \quad \text{(by IH)}$$

$$= \frac{2(n+1) + n(n+1)}{2} = \frac{2n+2+n^2+n}{2} = \frac{n^2+3n+2}{2} = \frac{(n+1)(n+2)}{2}$$

So, the equation holds for $n + 1$, assuming it holds for $n$.

Thus, by the principle of induction, for all natural numbers $n$,

$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$$
2. Write (in pseudo-code) an algorithm that sorts a list of \( n \) numbers.

(More formally, design an algorithm for the following:
Input: A sequence of \( n \) numbers \( \{A[1], A[2], \ldots, A[n]\} \).
Output: A reordering \( \{A'[1], A'[2], \ldots, A'[n]\} \) of the input sequence such that \( A'[1] \leq A'[2] \leq \cdots \leq A'[n] \).

Again, there are many different answers to this question. One possible way to sort the list would be a bubble sort:

```plaintext
for (i = 0; i < n; i++)
{
    for (j=0; j < n-1; j++)
    {
        if (A[j] > A[j+1])
        {
            /* Swap the two elements */
            tmp = A[j];
            A[j] = A[j+1];
            A[j+1] = tmp;
        }
    }
}
```