Due date: Jan 30, 9:00AM

Submission Instructions:

• Each group must submit one solution to this assignment in class on the due date.

• Assignments must be neatly written or typed. If the grader cannot (easily) read an answer, she will give it a 0.

• Each group must submit only one solution. If multiple solutions are handed in, the grader will randomly discard all but one of them.

• Your submission must have the name of every group member clearly marked. If your name is not on it, you do not get credit.

• All arguments should be clear, concise, and (of course) correct. You will lose points for poor writing, bad grammar, etc...

• Use of the Internet for solving these problems is strictly forbidden, and will be treated as an honor code violation.

• Inter-group work: Members of different groups may discuss the questions. However:

  – With your submission you must provide a list of all non-group members with whom any member of your group discussed the assignment.

  – No written material may leave the inter-group discussion. If you talk with someone about the assignment, you must throw away and written notes at the end of the discussion.
Problem 1 (20 points): Consider the following pseudocode:

double pow(x, n):
(1) if n == 0:
(2) return 1
(3) else:
(4) r = floor(n/2)
(5) p = pow(x,r)
(6) v = p * p
(7) if n % 2 == 1:
(8) v = v * x
(9) return v

Prove that for any integer $n \geq 0$ and any number $x \geq 0$, $pow(x, n)$ returns the value $x^n$. 
Problem 2 (20 points): Consider the following sorting algorithm:

```c
void StoogeSort(Array A, int i, int j)
(1) if A[i] > A[j]
(2) swap(A[i], A[j])
(3) if i < j-1
    // t will be 1/3 the size of the array segment (rounded down)
(4) t <-- floor((j-i+1)/3)
(5) StoogeSort(A, i, j-t)
(6) StoogeSort(A, i+t, j)
(7) StoogeSort(A, i, j-t)
```

Prove that the call:

```
StoogeSort(A, 0, n-1)
```

sorts the array A (where A is an array of integers of size $n \geq 1$).
Problem 3 (20 points): Consider the following non-recursive sorting algorithm:

```c
void SelectionSort(Array A, int n) {
    for i = 1 to n,
        k = i
    for j = i+1 to n
        if a[j] < a[k]
            k = j
    end if
    end for
    swap a[i,k]
    end for
}
```

Prove using loop invariants and induction that the call:

```
SelectionSortSort(A, A.size())
```

sorts the array A (where A is an array of integers of size \( n \geq 1 \)).