Due date: Sept. 5

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:

```c
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 $x \geq 0$, $\text{pow}(x, n)$ 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): Queen Consolidated has developed a new inter-city transportation method to move products between its $n$ distribution centers scattered around Starling city. They have dug tunnels directly between every pair of centers. Tunnels never intersect, and are designated to carry goods in a single direction. So between any two centers $A$ and $B$, there is either a tunnel to carry goods from $A$ to $B$ or one to carry goods from $B$ to $A$ – but not both.

Prove that, regardless of the value of $n$ or how the tunnels are directed, there must be way to walk through tunnels in order to visit every distribution center without ever going the wrong direction in a tunnel.