Name:_____  Section:____  Andrew Id: _____

**15-110 Fall 2018 Quiz 8**
**\* 30 minutes  \* No calculators, no notes, no books, no computers.   \* Show your work when possible!**

1.  **Code Tracing [10 pts]** Indicate what the following program prints.  Place your answer in the box.

```
def ct1(n):
    if (n == 0):
        return 0
    else:
        return n**2 + ct1(n-1)
print(ct1(3))
```

2.  **Code Tracing [10 pts]** Indicate what the following program prints.  Place your answer in the box.

```
def ct2(L):
    if (L == [ ]):
        return [ ]
    else:
        first = L[0]
        rest = L[1:]
        return [first]*first + ct2(rest)
print(ct2([1,3,2]))
```

3.  **Free Response:  justABs(s) [40 points]**
    Without using any 'for' or 'while' loops, write recursive justABs(s), that takes a string s and returns another string that is made up of only the A's and B's in the same order they appear in s. For example:
        assert(justABs("ABC BC BAC!") == 'ABBBA')
    Case matters here, so 'a' does not match 'A', so:
        assert(justABs("abc bc abc!") == '')

4. **Short Answer: Koch Snowflake Side [20 points]**
   If a level-1 Koch snowflake side is just a horizontal straight line, carefully draw a level-3 Koch snowflake side. This is just one side at level-3, and not the entire 3-sided snowflake.




5. **LMC Short Answers [20 pts; 5 pts each]**
   These questions concern the LMC simulator and the following program:

   ```
   LDA 6
   SUB 5
   STA 4
   HLT
   DAT 1
   DAT 10
   DAT 100
   DAT 42
   DAT 0
   ```

   Hint: remember that the first instruction (LDA 6) will be stored in memory location 0 (not 1).

   1. Noting that the numeric code for 'LDA' is 5, what integer value is stored in memory location 0 when this program is loaded into memory?

   2. When the simulator does the decode part of the fetch-decode-execute cycle for the first instruction in this program, what value will be stored in the Instruction Register?

   3. What will be stored in memory location 4 after this program runs?

   4. Where are the results stored for any arithmetic operation, as well as for reading from memory or from input?

6. **Bonus/Optional: Code Tracing [2.5 pts each]:**
   Indicate what the following programs print.  Clearly circle your answers (and nothing else)..

```
def bonusCt1(n, m=None):
    if (m == None): m = n
    if (0 in [n, m]): return 0
    else: return n+m-1 + bonusCt1(n-1, m-1)
print(bonusCt1(20))
```

```
def bonusCt2(f, n):
    if (n <= 0):
        return n
    else:
        return n + bonusCt2(f, f(n))
def f(n): return n-3
print(bonusCt2(f, 10))
```