Name:_____ Section:___ Andrew Id: _____

15-112 Spring 2014 Quiz 7a

* 15 minutes. No calculators, no notes, no books, no computers.

* Do not discuss this quiz with anyone until after 5pm today. SHOW YOUR WORK, CIRCLE YOUR ANSWERS.

1. **Code Tracing** [50 pts]: Indicate what this will print, filling in the spaces provided on the right:

```
from structClass import Struct

class A(Struct):
    def __init__(self, x=0):
        print "I", self,
        self.x = x
        print self

    def __eq__(self, other):
        print "E", self, other
        try: return abs(self.x-other.x)<10
        except: return True

class B(A): pass

# Hint: The following 8 lines print 7 lines of output
a1 = A(x=5)
a2 = A(x=42)
a3 = B() # note this is B() and not A()
x = 0
if (a1 == a2): x += 1
if (a1 == a3): x += 10
if (a2 == "nope!"): x += 100
print x, (type(a1) == A), (type(a2) == A), (type(a3) == A)

##################################################

def r1(x):
    if (x < 5): return 3
    else: return 2*r1(x-2)+3
print r1(8)

def r2(x, y):
    if (x < y): return r2(y, x)
    elif (y == 0): return x
    else: return r2(x-1, y-1)
print r2(876, 888)

def r3(x):
    if (x < 10): return 1
    else: return 1 + r3(x/10)
print r3(876876)
```

_____

_____

_____

_____

_____

_____

_____

_____

2. **Free Response: recursive isPerfect(n)** [50 pts]
   Background: an integer is "perfect" if it is positive and it is the sum of its proper divisors (not including itself). For example, 6 is the first perfect number, because 6 = 1+2+3. The next perfect number is 28, because 28=1+2+4+7+14. Without using any iteration, write the function isPerfect(n) that takes a possibly-negative int n and returns True if it is perfect and False otherwise. Hint: you may want to write the recursive helper function sumOfFactors(n), though that is not required.

3. **Bonus/Optional: Code Tracing** [5 pts]: Indicate what this will print:

```
class Z(Struct):
    def z1(z2): return Z(z=2+z2.z/1)
    def z2(z1): return Z(z=1+z1.z/2)
    def zz(z1, z2, z3=None):
        if (z3): z1=z3
        if (z1.z + z2.z < 12): return Z(z=z1.z*z2.z)
        else: return z1.zz(z1.z2(), z2.z1())
print Z(z=10).zz(Z(z=5))
```