Emory ID Number: ________________________________

1. Multiple answer: Pick all the correct answers for each of the following questions. There may be a single correct answer or multiple correct answers.

(a) (1 point) Which of the following is not a requirement for a recursive function?

A. It has two base cases.
B. It has a base case.
C. It has a recursive call.
D. Its recursive call approaches a base case.
E. It somehow uses the solution to the recursive call.
F. The base case must return 0.

(b) (1 point) Which of the following is NOT true regarding recursion and iteration?

A. Recursion is an alternate form of program control and is essentially iteration without a loop.
B. Recursive calls take time and consumes additional memory
C. In general, recursive algorithms lead to better performance than iterative algorithms
D. A recursive method is a method that calls itself
E. To terminate, a recursive algorithm must have a base case

(c) (1 point) Which is a true statement given the following method:

```java
public static int fun(int a){
    if (a==0) {
        return 0;
    }
    else {
        return fun(a+1);
    }
}
```

A. The method has no recursive case.
B. The method has no base case.
C. The method may not terminate due to infinite recursion
D. The recursive case may not approach the base case.
E. The method will only return the correct result for numbers less than or equal to 0.
F. The method will only return the correct result for numbers greater than or equal to 0.
(d) (3 points) What does the following method calculate?

```java
int fun(int x, int y) {
    if (y == 0) {
        return 0;
    }
    return (x + fun(x, y-1));
}
```

A. $x + y$
B. $x + x \cdot y$
C. $x \cdot y$
D. $x^y$
E. $y^x$

2. (4 points) What value is returned from the following method given the method call `fun(4,3)`? For partial credit, show the series of recursive calls and returned values.

```java
public static int fun(int x, int y) {
    if (x == 0) {
        return y;
    }
    return fun( x-1, x+y );
}
```

**Solution:** 13

3. (5 points) What is the output from the following method given the method call `fun(25)`? For partial credit, show the series of recursive calls.

```java
public static void fun(int n) {
    if (n == 0) {
        return;
    }
    fun( n/2 );
    System.out.print( n%2 );
}
```

**Solution:** 11001
(binary representation of 25)