

**Algorithms: Practical 3 Recursion**  
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**Warm-up questions**

1. Base case, iteration
2. Recursion is theoretically powerful and often used in algorithms that could benefit from recursive methods
3. True
4. False
5. False
6. False
7. True

**8. Which of these statements is true about the following code?**

```
int mystery(int n)
{
    if (n>0) return n + mystery(n-1);
    return 0;
}
```

The base case for this recursive function is an argument with the value zero

**9. List common bugs associated with recursion?**

1. Base case is missing
2. Excessive memory requirements
3. Excessive recompilation
4. Recursive step doesn't reduce to a smaller subproblem.

**10. What method can be used to address recursive algorithms that excessively recompute?**

- Memoization

**Fibonacci**

**1.**

```
public class Fibonacci {

    public static int fib(int n) {
        if(n <= 1)
            return n;
        return fib(n-1) + fib(n-2);
    }

    public static void main(String args[]){
        int n = 12;
        System.out.println(fib(n));

    }

}
```

**2.**

The recursive approach is much more concise, however it is calling the function multiple times, so the calculation is done multiple times.

The iteration is faster with bigger numbers.

**3.**

Complexities

Iterative:  $O(n)$

Recursive:  $O(2^n)$

### **Hanoi - The Monks need your help!**

```
public class Hanoi {  
    public static void towersOfHanoi(int n, char source, char destination, char auxiliary) {  
        if (n == 0) {  
            return;  
        }  
  
        int x = n - 1;  
        towersOfHanoi(n - 1, source, auxiliary, destination);  
        System.out.println("Move the disk " + n + " from " + source + " to " + destination);  
        System.out.println("tower [" + x + ", " + auxiliary + ", " + destination + ", " + source +  
"]");  
        towersOfHanoi(n - 1, auxiliary, destination, source);  
    }  
  
    public static void main(String[] args) {  
        System.out.println("tower [3, 'A', 'C', 'B']");  
        towersOfHanoi(1, 'A', 'C', 'B');  
    }  
}
```