Lista 05

Nome: Arthur Rocha Amaral **Matricula**: 625034

Questão 01:

A classe StopWatch funciona como um cronometro e é utiliza para marcar o tempo de duração de determinada ação e pode ser pausado e zerado à qualquer instante.

Questão 02:

```java
package Questao02;

public class Fatorial {
    public static long fat(int n) {
        long soma = 1;
        if(n!=0) {
            for (int i = 1; i <= n; i++) {
                soma = i * soma;
            }
        }
        return soma;
    }

    public static long fatr(int n) {
        if (n==1||n==0) {
            return 1;
        } else {
            return n * fatr(n-1);
        }
    }
    public static void imprfat(int n) {
        long r = fat(n);
        System.out.println(n+"! = "+r);
    }

    public static void imprfatr(int n) {
        long r = fatr(n);
        System.out.println(n+"! = "+r);
    }

    public static void main(String[] args) {
        final int qnt = 20;
        StopWatchNano tmp = new StopWatchNano();

        for (int i = 0; i<=qnt;i++) {
            System.out.println("________________________________");
            tmp.start();
            imprfat(i);
            tmp.stop();
            System.out.println("time: "+tmp.getElapsedTime()+" nano
segundos");
            System.out.println("________________________________");
        }

        System.out.println();
        System.out.println("---------------------------------------------");
        System.out.println();

        for (int i = 0; i<=qnt;i++) {
            System.out.println("________________________________");
            tmp.start();
            imprfatr(i);
            tmp.stop();
            System.out.println("time: "+tmp.getElapsedTime()+" nano
segundos");
            System.out.println("________________________________");
        }
    }
}
```

Questão 03:

```
package Questao03;

import Questao02.StopWatchNano;

public class Fibonacci {
    private static long fibonacciRec(int n) {
        if (n < 2) {
            return n;
        } else {
            return fibonacciRec(n-1) + fibonacciRec(n-2);
        }
    }

    public static long fibonacciRec(int n, boolean imprime) {
        long r = fibonacciRec(n);
        if (imprime)
            System.out.println("Fibonacci("+n+") = "+r);
        return r;
    }

    private static long fibonacci(int n) {
        int f = 0;
        int ant = 0;

        for (int i = 1; i <= n; i++) {
            if (i == 1) {
                f = 1;
                ant = 0;
            } else {
                f += ant;
                ant = f - ant;
            }
        }
        return f;
    }

    public static long fibonacci(int n, boolean imprime) {
        long r = fibonacci(n);
        if (imprime)
            System.out.println("Fibonacci("+n+") = "+r);
        return r;
    }

    public static void main(String[] args) {
        final int MAX = 46;
        StopWatchNano tmp = new StopWatchNano();

        for (int i = 0; i < MAX + 1; i++) {
            System.out.println("________________________________");
            tmp.start();
            Fibonacci.fibonacci(i, true);
            tmp.stop();
            System.out.println("time: " + tmp.getElapsedTime() + " nano
segundos");
            System.out.println("________________________________");
        }

        System.out.println();
        System.out.println("---------------------------------------------");
        System.out.println();

        for (int i = 0; i < MAX + 1; i++) {
            System.out.println("________________________________");
            tmp.start();
            Fibonacci.fibonacciRec(i, true);
            tmp.stop();
            System.out.println("time: " + tmp.getElapsedTimeMili() + " mili
segundos");
            System.out.println("________________________________");
        }
    }
}

/** Maior fator para long Fibonacci(46) = 1836311903.
 *  Não aconteceu nenhum erro.
 *
 *      Recursivo
 *  ---------------------------
 *  Fibonacci(46) = 1836311903
 *  time: 8339 mili segundos
 *  ---------------------------
 *
 *      Iterativa
 *  ---------------------------
 *  Fibonacci(46) = 1836311903
 *  time: 57800 nano segundos
 *  ---------------------------
 */
```

Questão 04:

```
package Questao04;

import Questao02.StopWatchNano;

public class Multiplicacao {
    public static long multRec(long x, long n) {
        if (n==1) {
            return x;
        } else {
            return x + multRec(x,n-1);
        }
    }

    public static long mult(long x, long n) {
        long soma = 0;
        for (int i = 0; i<n;i++)
            soma += x;
        return soma;
    }

    public static void main(String[] args) {
        StopWatchNano tmp = new StopWatchNano();
        tmp.start();
        System.out.println("mult(3,715827881) = " + mult(3, 715827881));
        tmp.stop();
        System.out.println("tmp.getElapsedTime() = " +
tmp.getElapsedTimeMili());

        System.out.println();
        System.out.println();

        tmp.start();
        System.out.println("multRec(3,715827881) = " + multRec(3,
715827881));
        tmp.stop();
        System.out.println("tmp.getElapsedTime() = " +
tmp.getElapsedTimeMili());
    }
    /**     Iterativo
     * -----------------------------------
     * mult(3,715827881) = 2147483643
     * tmp.getElapsedTime() = 300
     *
     *
     *      Recursivo
     * -----------------------------------
     * Lança um erro de SrackOverflowError
     * ou seja estoura a pilha de execução
     */
}
```

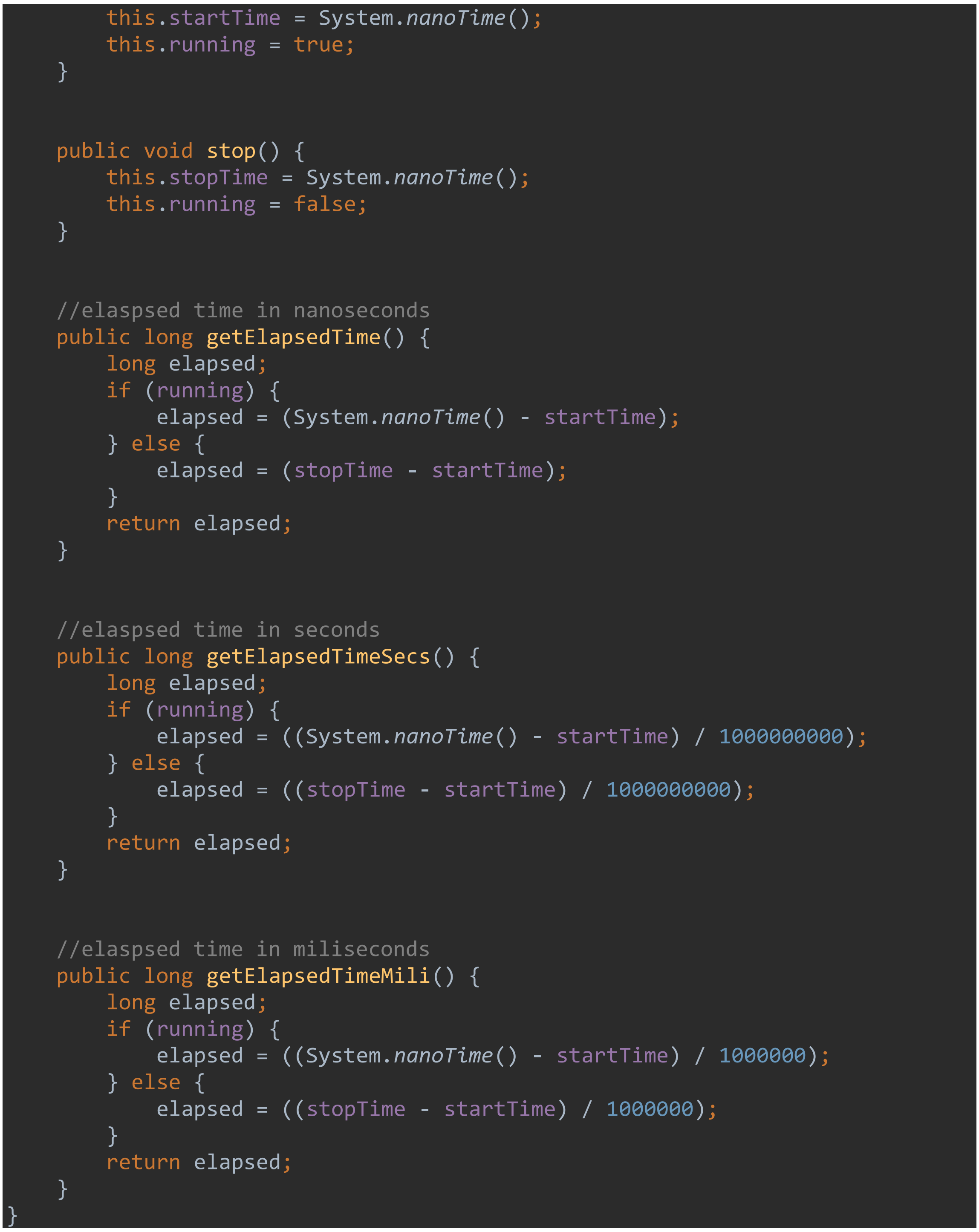
Classe adicional StopWatchNano:

```
package Questao02;

public class StopWatchNano {

    private long startTime = 0;
    private long stopTime = 0;
    private boolean running = false;


    public void start() {
```



```
        this.startTime = System.nanoTime();
        this.running = true;
    }


    public void stop() {
        this.stopTime = System.nanoTime();
        this.running = false;
    }


    //elaspsed time in nanoseconds
    public long getElapsedTime() {
        long elapsed;
        if (running) {
            elapsed = (System.nanoTime() - startTime);
        } else {
            elapsed = (stopTime - startTime);
        }
        return elapsed;
    }


    //elaspsed time in seconds
    public long getElapsedTimeSecs() {
        long elapsed;
        if (running) {
            elapsed = ((System.nanoTime() - startTime) / 1000000000);
        } else {
            elapsed = ((stopTime - startTime) / 1000000000);
        }
        return elapsed;
    }


    //elaspsed time in miliseconds
    public long getElapsedTimeMili() {
        long elapsed;
        if (running) {
            elapsed = ((System.nanoTime() - startTime) / 1000000);
        } else {
            elapsed = ((stopTime - startTime) / 1000000);
        }
        return elapsed;
    }
}
```