Documentation: assignment6

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1 Summary of Problem Specification

1.1 Abstract

Using a standard tuning frequency inputted by the user, as well as a range of values for capacitance, we calculate possible frequencies greater than the user inputted standard tuning frequency, writing the values to a random access, byte-based file.

We begin by grabbing user input, and then calculate capacitance using the formulae given in Section 2.We then find the inductance (L) using the standard tuning frequency. After that, we calculate our possible range of values for frequency (F_{min} and F_{max}), comparing each to the standard tuning frequency, writing only those that are greater to file. At this point, we calculate new values of F_{max} by incrementing C_{min} by 15 picofarad, again comparing and writing only values larger than the standard tuning frequency to file. We do this until C_{min} surpasses C_{max}. When this happens, we increment L by 2%, reset C_{min}, and again calculate values of F_{min} and F_{max} using the same process described above.

Each time we edit or do not edit the file, print out to console why. For example, if our F_{max} is larger than 16.7MHZ and we edit the file to include that new value, we should print to console that we have done so.

The program halts when the largest value of F_{max} is smaller than the standard tuning frequency. It should be noted that (conveniently) the first calculated value of F_{max} is the greatest (for our purposes at least), as it is strictly monotonic decreasing in nature, given a strictly monotonic increasing L and C_{min}, which is exactly what we have.

1.2 Assumptions

I use a pre-release version of Java 9. It is my assumption that the underlying changes in the language were nothing such that it would allow me to write something incompatible with the immediate previous release.

2 Formulae

Capacitance is denoted with C and measured in farads. Capacitance Minimum is denoted with C_{min}. Capacitance Minimum is denoted with C_{max}. Frequency is denoted with F and measured in hertz. Frequency Minimum is denoted with F_{min}. Frequency Minimum is denoted with F_{max}. Inductance is denoted with L and measured in henrys.

$$C = \sqrt{C_{min} * C_{max}} \tag{1}$$

$$F_{min} = \frac{2\pi}{\sqrt{L * C_{max}}} \tag{2}$$

$$F_{max} = \frac{2\pi}{\sqrt{L * C_{min}}} \tag{3}$$

$$L = \frac{(\frac{2\pi}{F})^2}{C} \tag{4}$$

3 Explanation of Components

3.1 Main.class

3.2 TuningCircuit.class

4 Notes

Equations (1–4) relate everything in terms of base units. That means we must convert F from megahertz to hertz (multiply by 10^6), and C from picofarad to farad (multiply by 10^{-12}).

Additionally, one can note that due to the structure of our formula for F_{max}, our values will shrink as we increment C_{min} (since we begin to divide by increasingly large numbers). This means that our first calculated F_{max} will be our largest. If we were looking for just the largest value, we would not calculate any other but the first, and save CPU cycles. However, we must calculate all F_{max} larger than our initial value of 16.7MHZ and store it in the random access file.

5 References

http://download.java.net/java/jdk9/docs/api/