

LAB2: SQUARE ROOT APPROXIMATION

OVERVIEW

For this project you will write an assembly code subroutine to approximate the square root of an argument using the bisection method (see following Wikipedia article for details: http://en.wikipedia.org/wiki/Bisection_method). All maths is done with integers, so the resulting square root will also be an integer.

HARDWARE

Once you have setup the firmware (see Getting Started document), you simply need to connect the Nucleo F401RE board to your PC via a USB cable, then use Keil MDK to start programming and debugging

In this lab, the program will be loaded to the Nucleo F401RE MCU, and then tested using the debugger in Keil MDK. No other hardware is needed.

REQUIREMENTS

Your code must approximate the square root of an integer between 0 and $2^{31}-1$. Using integer maths is sufficient (no floating point or fractions are required); your code will return the truncated (integer portion) of the square root.

Your code must be in an assembly language subroutine which is called by a C function for testing. Be sure to use registers according to the ARM calling convention.

SOFTWARE DESIGN

Base your software on the following pseudocode:

```

Approximate square root with bisection method
INPUT: Argument x, endpoint values a, b, such that a < b
OUTPUT: value which differs from sqrt(x) by less than 1

done = 0
a = 0
b = square root of largest possible argument (e.g.  $\sim 2^{16}$ ).
c = -1
do {
    c_old <- c
    c <- (a+b)/2
    if (c*c == x) {
        done = 1
    } else if (c*c < x) {
        a <- c
    } else {
        b <- c
    }
} while (done == 0)
  
```

```
    }  
} while (!done) && (c != c_old)  
return c
```

TESTING

In the main function, write code to test that your subroutine works correctly.