

EE445L - Lab 1: Fixed-Point Output

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1.0 Objectives

The lab was used to familiarize students with fixed point numbers and how to format output for the ST7735 LCD screen.

The primary goals are to display fixed-point decimal numbers, unsigned binary fixed-point numbers, and plot two shapes on the screen.

2.0 Analysis and Discussion

2.1) In what way is it good design to minimize the number of arrows in the call graph for your system?

Minimizing the number of arrows in the call graph means reducing the function calls in our system, which keeps it as close to real-time as possible.

2.2) Why is it important for the decimal point to be in the exact same physical position independent of the number being displayed? Think about how this routine could be used with the ST7735_SetCursor command.

It's good for the decimal point to be in the same place for readability purposes. Also, since the range of the numbers that can be represented is known and fixed, and the widths of the integer part and fraction part are always the same, when we use the SetCursor command, we know exactly where to set the cursor at for each number, if we keep the decimal point at the same position.

2.3) When should you use fixed-point over floating point? When should you use floating-point over fixed-point?

Fixed-point is used when you know what resolution you need ahead of the time. Since fixed-point can save you both space and calculation time compared to floating-point, we should opt to use fixed-point when the numbers to be represented are known and small. Fixed-point is also generally easier to read. Floating-point has a wider dynamic range and precision. So when we don't what numbers we possibly need to represent, use floating-point.

2.4) When should you use binary fixed-point over decimal fixed-point?

When should you use decimal fixed-point over binary fixed-point?

When the fixed-point number is used by computer computations, it is better to use binary fixed-point. When the number is to be printed out and read by humans, it is better to use decimal fixed-point.

2.5) Give an example application (not mentioned in the book) for fixed-point. Describe the problem, and choose an appropriate fixed-point format. (no software implementation required).

If you made an electronic scale, you would want to use fixed point. It would only have to measure from 0 pounds to a couple hundred, so you don't need to have a large range. This means fixed point is perfect. You would want to output the number in decimal fixed-point for readability and would probably round to maybe 2 decimal places.

2.6) Can we use floating point on the ARM Cortex M4? If so, what is the cost?

Yes, we can use floating point on ARM Cortex M4. The performance cost is huge.