Kettering University

Microcomputers I

Developing and Conducting Appropriate Experimentations

Validating Experimental Results

RTI Cycle-Time Measurement

Spring 2022

Prelab (10%): Go over this handout rigorously, do Assignment **1**, and then upload one handout (prelab) per group to Blackboard in **.pdf format** by **11:59 pm** on the **Tuesday** before your lab day.

Lab report: Upload one lab handout (report) per group to Blackboard (in **.pdf**) by **11:59 pm** on the **Sunday** following the lab day and **after** you have done all the assignments, answered all the questions, and shown your lab work to the lab instructor **individually**.

In the lab report, please correct your prelab incorrect answers, if any.

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Objectives
- Strengthen your ability to develop and conduct experiments to obtain the required data and measure variables.
- Develop skills to validate experimental data, analyze the results, use engineering judgment and draw conclusions.
- Improve your programming skills.
- Better understand how Real-Time Interrupt (RTI) works.

What to hand in
- Upload this handout (report) in **.pdf**, and after you have done all the assignments and answered all the questions.
- Show your functional system in Assignment Error! Reference source not found. to the lab instructor *individually*, and before you turn in your report.
- Also be prepared to *individually* answer the lab instructor's questions regarding today's lab exercise and what your group did.

Note
- **When single-stepping, reduce the delays, if any, to almost zero, or use breakpoints.**
- Press the reset button on the trainer board before you upload your code.
- Close the "True-Time Simulator & Real-Time Debugger" window, *before* you run the debugger again if you use the microcontroller.
- Take Code Warrior to HCS12 Serial Monitor mode when you wish to use the trainer board.
- Use single-stepping (F11) for troubleshooting/testing purposes.
- Write your programs with proper *indentation* as well as *explanatory* and *short* comments.
- In your comments, use *meaningful/descriptive* names for the register and memory locations that you use.
- Your flowchart (the *formulation* of the project) should not be too close to the word description of the problem, nor too close to the assembly program.

During your presentation, suppose that you are selling your product (software). When I ask you if your product works, please do not tell me you don't know; this is one of the worst possible answers! If you are ready to demo, you should be able to prove that your product does work!

You should work closely with your lab partner, as this will enhance your performance. You are also urged to talk to other students; teach them or learn from them; however, do NOT copy from them!

Assignments

Note: The members of each group should work on the prelab *independently* and then compare their results.

<mark>Prelab starts here:</mark>

1. Clearly, briefly, and *qualitatively* propose a method to *measure* the RTI cycle time:

I would measure the RTI cycle time by counting clock cycles between the interrupts. I would have two counters, counter A would be temporary, and probably stored in a register. Counter B would be a memory location. Here is some pseudocode to show how I would use them:

```
Loop:
        If( Counter A > Counter B )
                A -> B
        A++
        If ( Interrupted )
                A = 0
loop
```

With this, B would contain the greatest value ever held by A. We could then multiply that value by the amount of time it takes to run one loop, which would give us the amount of time between each interrupt.

We would determine the amount of time it takes to run a single loop by counting the amount of clock cycles per loop and multiplying by the CPU's frequency.

<mark>Prelab ends here.</mark>