# EE 3171 Final Exam Review

The Stuff That Might Be On the Final

# Lecture 11

- Timers
  - General purposes (scheduling events, counting pulses, measuring duration)
- The Tiva C timers
  - Half-width vs. full-width
- Configuring the timers for different modes of operation using TivaWare functions
- Enabling interrupts and writing good interrupt handlers for the timers
- Using the prescalers to slow down the clock
- Determining the correct kind of timer to use for a specific application
  - And then maybe configuring it thusly

# Lecture 12

- Analog to Digital Conversion
- Why?
- Basic Methods (Up-Counter, Successive Approximation)
    - And their respective pros/cons.
- Running calculations
    - Calculating resolution, binary value for input voltage (and *vice versa*)
- Using the Tiva C ADC system.
    - Including writing code.

# Lecture 15

- Basic Serial Communications
- Definitions (Duplex, Simplex, Collision Detection, UART)
- The important parameters:
    - Bit-clock period τ
    - Endian ordering of the data
    - Number of bits per word
    - Parity Mode
    - Framing bits to identify start of a data word
    - Idle or quiescent state of the line
- Draw transmission waveforms.
- Write some code to control the Tiva UART.

# Lecture 16

- Serial Peripheral Interface
- Differences between RS-232 and SPI.
- The rotational data transfer idea.
- What are the most appropriate applications for SPI vs. RS232?
- Maybe sketching waveforms

# Lecture 17

- I2C
- Signaling conventions
- Sketch simple waveforms
- Flow control options (`SCL` vs. `NACK`)

# Lecture 6

- C Programming for Embedded Systems
  - Basic Constructs (`for`, `if`, `while`, `int main`)
  - Pointers, Pointer Arithmetic
  - Embedded Keywords:
    - `static`, `extern`, `volatile`

# Lecture 7

- TivaWare
    - Define terms: Direct Register Access, Software Driver Access
    - Naming conventions for registers
    - When to use DRA vs. SDA
    - Using GPIO functions
        - All documentation provided

# Lecture 8

- I/O Programming
  - The four difficulties (Analog vs. Digital; Speed of Processor vs. Speed of Device; Throughput vs. Response Time; Asynchronous vs. Synchronous) and the Parallel vs. Serial design decision.
  - The 3 parts of a port
  - Memory-mapped I/O vs. isolated/separate/port-mapped I/O
  - Tiva C ports and registers to configure them
    - I will NOT ask specific questions about what devices share pins — that's just pointless trivia

# Lecture 9

- I/O Synchronization — Polling, Interrupts, DMA
  - Be able to describe the basic operation
    - Advantages and disadvantages of each method
    - Interrupt behaviors (pushing process state, finding interrupter, finding ISR)
    - The four steps to creating an interrupt-based program

# Lecture 10

- Pulse Width Modulation
  - Definition of duty cycle
  - Calculating duty cycle/period/etc.
  - Generic PWM implementation
  - Using the Tiva PWM hardware
    - Mainly using TivaWare, but some register behavior too.

# To Bring

- Writing Implements
- A calculator
    - For calculating ADC, Timer, PWM values
- Beverages (caffeinated)
- A Song in your Heart

# Format

- Some short-answer, some problem-solving, some coding.
    - Syntax does not have to be 100% accurate, but make every attempt to be as close as possible.
    - When in doubt, write lots of comments!
        - LOTS.
    - Arranged by topic rather than problem type.
- Written to be done in about 90 minutes
    - But you'll have 120.
- Wednesday, 8:00 AM, 12/20. EERC 100.

# Various and Sundry

- Leave the textbook home.
- Leave your notes home.
  - You may bring two (2) pieces of 8½ x 11 paper, both sides, ***handwritten***, with any notes of your choice.
  - You may reuse previous note sheets if you wish.
- If you need something from the Tiva C Reference Manual, I'll give it to you.
- Random Fact on the next slide...

# IQ

- The notion of an *Intelligence Quotient* has only been around since about 1912.
    - William Stern coined the term when he was at the University of Breslau (now called the University of Wrocław, in Wrocław, Poland).
    - It was originally a German term: *Intelligenzquotient*.
- Originally, you would take some form of intelligence test, yielding a “mental age score”, which was then divided by your age and multiplied by 100. The median raw score of modern tests is 100, with 2/3 of the population falling between 85 and 115.
- The earliest attempt to quantify intelligence came from an English statistician, Francis Galton, in the 1880’s. He attempted to show a correlation between measurable traits (reflexes, head size) and intelligence. He couldn’t, so he gave up.
- Most of our modern IQ testing came from a French psychologist, Alfred Binet. Binet attempted to quantify the types of tasks that a person of a given age should be able to do.
- The most common modern IQ test is the Wechsler Intelligence Scale. Instead of one number, it gives 6: Verbal Comprehension Index; Perceptual Reasoning Index; Working Memory Index; Processing Speed Index; and the broad “Full Scale IQ”; and General Ability Index.
- You can take a Wechsler Test for free at wechslertest.com. (Detailed results cost $$.)