Midterm 2 Review

Materials

- straight edges and templates,
- scientific calculators,
- pens,
- pencils,
- erasers
- A sheet of notes, worth 10 actual points on the exam.

Time

- Maximum of 75 minutes to do the exam.
- Partial credit: Depends on the problem
- Read through the test first and strategize your time!

Points Breakdown

- Notes Sheet: 10 points
- Sequential Logic: 30 points
- Datapath: 20 points
- Factoring Finite State Machines: 15 points
- Timing Constraints: 25 points

Notes Sheet

- One page of notes, handwritten
- On the front page, upper right hand corner, draw a 1-inch square
  - Has your name
  - Has your section
  - Has EXAM 2
- On the front page, upper left hand corner, draw a 1-inch square
  - Leave BLANK

Chapter 14: Sequential Logic

- Given:
  - States and outputs with binary labels
- Find:
  - Understand the state machine
  - Create the truth table
  - Solve for the next state equations and output equations
  - Draw the circuit

Chapter 16: Datapath

- Given a problem, be able to solve it
- Work out the datapath through the circuit. *How does the next state refer to an equation.*
- Examples included using registers with counters, timers, registers, multiplexers, decoders and the like.
- But a mixture of boxes and combinational logic with registers
- If you can walk through the chapter 16 circuits with a pencil, you should be able to draw them.

Chapter 16: Datapath

- Given: A mathematical problem with a description, including the reset state.
- Find:
  - Draw the Datapath Diagram
  - Fill out an output table based on the datapath

Chapter 17: Factoring Finite-State Machines

- Splitting a larger, complex FSM
  - Into two or more smaller, less complex FSM
- Each state of the sub-machine represents one dimension or factor of the larger machine
- One portion can be data, the other can be control

Chapter 17: Factoring Finite-State Machines

- Not finding the reduced state of the state machine, breaking it into TWO state machines.
- Then, having to work out how to tell each machine to “start” and “finish” To acknowledge the next step
  - Go and Done
  - Go and Ready

Chapter 17: Factoring Finite-State Machines

- If the data machine has functionality, control it.
- Loads for counters and timers
- Selections for sequences
- Once the pattern of two machines is recognized…
- The hard part is working out the controls!
    - Look for when a sequence begins
    - Look for when a sequence ends
    - Look for when a sequence changes

Chapter 17: Factoring Finite State Machines

- Given a state diagram, factor it
  - Draw the Control Diagram *with all labels*
  - Draw the Data Diagram *with all labels*
  - Draw the top level diagram *with all labels*

Chapter 15: Timing Constraints

- Between clock cycles, the signal can go through an arbitrary number of transitions
- How long does output retains its initial stable value from the last clock cycle *after* the input arrives with a new value. This is the *contamination delay.*
  - The minimum delay for a path for a particular input
- How long does it take for the output to become the value of the input. This is the *propagation delay*.
  - The maximum delay for a path for a particular input

Chapter 15: Timing Constraints

- The *overall contamination delay* is the minimum contamination delay over all paths
- The *overall propagation delay* is the maximum propagation delay over all paths.

Chapter 15: Timing Constraints

- Let t_{cy} be the time of a clock cycle. It must be long enough to work.
- $t_{cy} \geq t_{dcq} + t_{dMax} + t_s$
- Where t_{dMax} is the maximum propagation
- $t_h \leq t_{cCQ} + t_{cMin}$
- Where t_{cMin} is the minimum contamination
- If these constraints are not met, the flip-flop cannot have a stable state.

Chapter 15: Timing Constraints

- Circuit of logic gates
  - Find the propagation delay for each input
  - Find the contamination delay for each input
  - Find the overall propagation delay
  - Find the overall contamination delay
- Circuit with Flip Flops
  - Find the propagation delay
  - Find the contamination delay
  - Solve the constraints
  - Could be Hazard, could be Clock Frequency

Bonus

- Yeah, Right, Whatever.
- Not gonna tell you.
- Nyah-Nyah-Nyah-Nyah