Review Stuff – 2nd Exam

• General information
  – Tri state stuff
  – Driving stuff
  – Basic 4-event protocol stuff

• Information representation
  – 2C, UB, Fixed Point, Excess
  – Floating point

Review Topics

• Clocked sequential design
  – System functionality
    • Logic determines next step
    • Logic decodes PSR for work
    • Mealy/Moore machine differences
  – Design of hardware to do work
    • State diagram creation
    • Implementation techniques (classical, one-hot, VHDL case)
  – Limitations and speeds
Review Topics

- How to do math
  - Sequential activities: multiply, divide
  - Floating point math (add/subtract, multiply)
  - Handling the extra bits
  - High speed vs ‘normal’ implementations

Algorithms/Data Paths

- Multiply
  - Gradeschool (simple, fewest parts)
  - Modified Gradeschool A,B (time data depen)
  - Booth Algorithm (signed numbers)
- Divide by shift-and-subtract
- High Speed Multiply
- High Speed Divide
- Exotic (sort-of)
  - Sine/Cosine/Series expansion
  - CORDIC
Multiplication – Simple Gradeschool Algorithm for 8 Bits (16 Bit Result)

Implement the Modified Gradeschool Multiplication Algorithm
\[
\sin(x) \cdots = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \cdots
\]
CORDIC Equations

\[ z_{i+1} = z_i \pm \alpha_i \quad \alpha_i = \tan^{-1} 2^{-i} \]  
\[ x_{i+1} = x_i \pm y_i \times 2^{-i} \]  
\[ y_{i+1} = y_i \mp x_i \times 2^{-i} \]
CORDIC: Solution A (Pipeline)

CORDIC: Solution B (Sequential) Block Diagram (1)
Review Topics

• Asynchronous sequential systems
  – Creation of state diagram
  – Implementation techniques
  – Reason for covering all minterms
  – Steps for synthesis/analysis