ECE 220 Honors Lab Section

Lab2: LC3 Assembly

Working on Lab

- Simplification
  - svn cp https://subversion.ews.illinois.edu/svn/sp16-ece220/_shared/honors_lab2 https://subversion.ews.illinois.edu/svn/sp16-ece220/<netid>/honors_lab2/ -m "Copying"
  - svn co https://subversion.ews.illinois.edu/svn/sp16-ece220/<netid>/honors_lab2/
- Lab structure
  - lab(_x)
    - Instr.txt
    - Makefile
    - src directory
    - tests directory
    - obj directory
    - bin directory
  - lecture
    - labX.pdf
    - examples directory

- Makefile
  - What is it
  - Why to use it
  - Demo

XOR

- What does it do?
- How to implement it?

- Solution
  - Iterate through each bit
  - $NAND\left(NAND(A, NOT(B)), NAND(NOT(A), B)\right)$

Right Shifting

- Left shift
  - 0101 → 1010
  - ADD Rx, Rx, Rx

- Right shift
  - 0101 → 0010
  - ?!?

- Solution
  - Use two masks
  - Code demonstration!

Printing Decimal

- Know how to print numbers in hex but how to print in decimal?
  - Alternatively: how to convert base 16 to base 10 in LC3

- Solution
  - Store powers of 10. For each power subtract from hex digit and increment a count.
    - 0x24 – 0xA = 0x1A – 0xA = 0x10 - 0xA = 0x6; count = 3
    - 0x6 – 0x1 = …; count = 6
    - Gets digits from most to least significant
  - Division method
    - 0x24 / 0xA = 0x3 R 0x6
    - 0x3 / 0xA = 0x0 R 0x3
    - Gets digits from least to most significant

Functions

- Differences between BR, JSR (JSRR), JMP, TRAP?
    - BR, JMP
    - JSR (JSRR), TRAP

- MP2 Subroutines
    - Which one should be used?

Recursion

- What is recursion?
  - https://www.google.com/search?q=recursion
- Examples?
  - Fibonacci
    - $F(0) = 0$
    - $F(1) = 1$
    - $F(n) = F(n-1) + F(n-2)$
  - GCM
    - $(v \mathbin{!}= 0)?\, \gcd(v, u\%v) : u$
  - Sudoku

- Problems in LC3?

GDB

- Similar to lc3sim!
- Navigate to honors_lab2/lecture/right_shift
- Run *gdb ./bin/right_shift*
  - Commands
    - List
    - Break
    - Info
    - Delete
    - Run
    - Continue
    - Next
    - Step
    - Print
    - Quit