Recitation 2:
Datalab + More C

Thursday, January 28th, 2015

Datalab (1/3)

- Step
  - Download and extract handout
  - Develop 13 functions for 13 puzzles in bits.c file
  - Check your work: btest, dlc, and **driver.pl**
  - Each puzzles has a 2 point penalty for exceeding its maximum operation count.
  - Submit bits.c file **(see Submission Instructions)**
- You may use your own machine but we will not troubleshoot any issues you encounter

Datalab (2/3)

- Need to do:
  - Each time you open a terminal on the CSELABS, run:
    - `module unload soft/gcc`
  - If dlc fails to run with a permission error, run:
    - `chmod 700 dlc`

- Testing:
  - `make ; make btest`
  - `./btest ; ./btest -g`
  - `./driver.pl`

Datalab (3/3)

- Grading:
  - **driver.pl** must run **successfully.**
    - If it fails, **NO points will be awarded!**.

Correctness Points:
=> Btest Points * 69 / 29

Style Points:
=> 5

Performance Points:
=> 2 (2 per puzzle)

Final score:
=> Correctness points + performance points + Style Points

Datalab demo

- datalab-handout (compiling and execution)
- Solving **<u>minusOne</u>** and **<u>tmin</u>** puzzles (solved in recitation; Answer will not be posted!)

```
/*
 * minusOne – return a value of -1
 *    Legal ops: ! ~ & ^ | + << >>
 *    Max ops: 2
 *    Rating: 1
 */

int minusOne() {
  return 2;
}
```

```
/*
 * tmin – return minimum two's
 * complement integer
 *    Legal ops: ! ~ & ^ | + << >>
 *    Max ops: 4
 *    Rating: 1
 */
int tmin() {
  return 2;
}
```

Datalab Tricks (1/5)

- Basics
  - $>>$, $<<$
  - | vs. ||
  - & vs. &&
  - ! vs. ~
- What is x?
  - int x = (9 | 12) << 1;
  - x = ([1001]b | [1100]b) << 1
    = [1101]b << 1 = [11010]b = 26

Datalab Tricks (2/5)

- Trick #1: Signed-ness
  - The MOST significant bit
    - 0 -> positive or zero
    - 1 -> negative

- What is…
  - int y = (10 >> 31);
  - int z = (-10 >> 31);
  - (y = 0, z= -1)
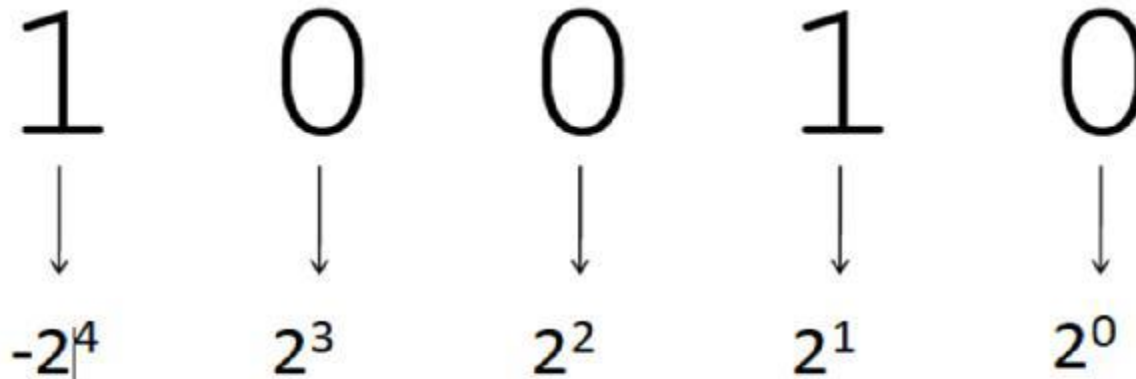
Datalab Tricks (3/5)

- Trick #2: Properties of Zero
  - Masking
    - 0 & (something) == 0
    - 1 & (something) == something

- Positive zero vs. negative zero
  - int x = 0; int y = -x;
  - Neither x nor y is negative (MSB is 0 for both)

Datalab Tricks (4/5)

- Trick #3: Negation
  - Review: take a 5-bit twos compliment

$$1 \quad 0 \quad 0 \quad 1 \quad 0$$

$$-2^4 \quad 2^3 \quad 2^2 \quad 2^1 \quad 2^0$$

$$-16 + 2 = \underline{-14}$$

Datalab Tricks (5/5)

- Trick #3: Negation
  - In general: **-x == (~x + 1)**

- Does this always work?
  - Tmin?
    - No!
  - Tmax?
    - Yes!
  - Zero?
    - Yes!
  - Everything else? Yes!

Questions?

More C Demo

- typedef (i.e. bool) – for basic datatypes
- Functions (i.e. add)
- Header files
- Constants (const, #define, enum)

References

- http://www.cs.cmu.edu/afs/cs/academic/class/15213-f10/www/recitations/08302010.pdf