CSE3030 (Introduction to Computer System)

Lab Assignment #1
Bit Lab

Department of Computer Science and Engineering

Sogang University

Preliminary: Linux & CSPRO

- Linux tutorial is uploaded in *Cyber Campus*
- If you are familiar with Linux, take it as a brief review
- If you haven’t used Linux before, read it carefully
- In both cases, don’t forget to change the password of your account

General Information

- **There will be three lab assignments in this semester**
  - The total point of each programming lab assignment is 100 points.
  - But in the final score, each lab will be reflected with different weight

We Use *Cyber Campus*

- **Check “*Lab Assignment #1*” posted in *"Assignments"* tab in Cyber Campus**
  - Skeleton code (`Lab1.zip`) is attached in the “*Lab Assignment #1*” post
  - Deadline: **4/4** Tuesday 23:59
  - Late submission deadline: **4/5** Wednesday 23:59 (-20% penalty)
  - Late submission penalty will be applied uniformly (not problem by problem)

- **Submit/upload your completed work on the same “*Lab Assignment #1*” post**
  - Please read the **last two slides** carefully!
  - The last two slides will let you know how to submit your work**:**
    - Which file to submit, what should be the name of file
    - What happens if you make a mistake in the submission

Outline

- **Task: Warm-up exercise to review basic C programming**
  - Four small programming tasks (25 points each, total 100 points)
  - Puzzles using **bit-level operations** (a.k.a. *DataLab* in *CSAPP*)

- **Problems themselves are not so difficult, but it can take you some time to get familiar with the skeleton code and scripts**
  - Read the slide carefully and follow the instructions

Task: C Programming Exercise

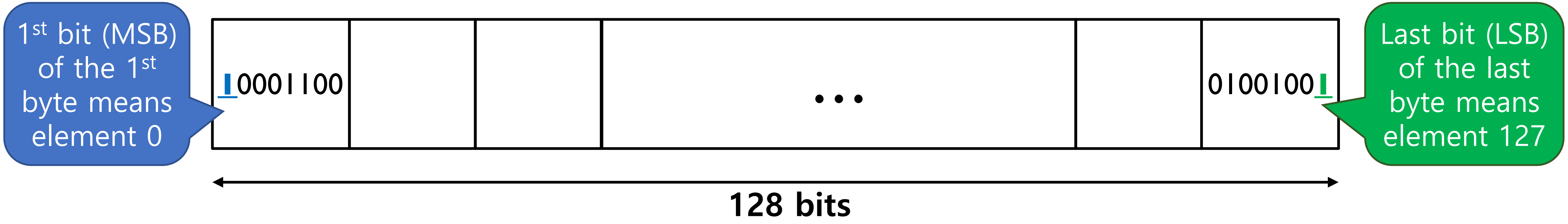
- **From 1-1 to 1-3, there are several constraints that your code must satisfy (failing to do so will result in 0 point)**
  - Allowed operators: `! ~ & ^ | + << >>`
    - Don't use other operators such as `&& || - == < > ?`
  - Write straight-line code
    - Don't use any control constructs such as `if`, `do`, `while`, `for`, `switch`, etc.
  - Do not include any additional header file
  - Do not declare or call any function in your code

Task: C Programming Exercise (Cont')

- **From 1-1 to 1-3, you must implement the following functions**
  - **Provided code does not satisfy the constraints, so you should rewrite it**
  - **Problem 1-1 (`copyLSB.c`):**
    - copyLSB(x): return an int with all bits set to the least significant bit of x
    - Ex) copyLSB(5) = 0xFFFFFFFF, copyLSB(6) = 0x00000000
  - **Problem 1-2 (`absVal.c`):**
    - absVal(x): return the absolute value of x (assume –SMAX ≤ x ≤ SMAX)
    - Ex) absVal(-1) = 1
  - **Problem 1-3 (`conditional.c`):**
    - conditional(x, y, z): return the result of ternary operation “x ? y : z” in C
    - Ex) conditional(2,4,5) = 4

Task: C Programming Exercise (Cont')

- **For 1-4, there is *no constraint* on the code; just focus on the functionality**
  - **Problem 1-4 (`bitset.c`):**
    - Cf. Chapter 2 Data representation - "**Exercise: Representing & Manipulating Sets**"
    - addNumber(set, x): Add 'x' to the *bitset* represented by 'set'; do nothing if 'x' already exists in 'set'
    - Assume that 0 <= x <= 127 and 'set' is a pointer to a 16-byte array as below


1st bit (MSB) of the 1st byte means element 0
10001100
…
01001001
Last bit (LSB) of the last byte means element 127
128 bits

Execution (Grading) Environment

- **Assume that `int` is 4-byte data type**
- **Byte ordering won't matter in this assignment**
  - But if you think it matters, then assume little endian system
- **If you are not sure, we recommend you to use CSPRO server instead of your machine.**

Directory Structure & How to Build

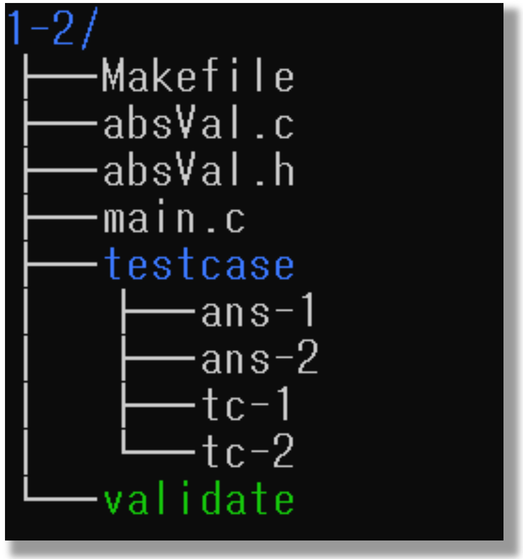
- **Each directory (1-1, 1-2, …) has the following structure**
  - `Makefile` allows you to build the program with '`make`' command
  - `main.c` is the driver code that calls your function (don’t change this file)
  - `validate` checks whether your code satisfies the requested constraints

    ```
    $ ./validate absVal.c
    ```

    (If nothing is printed, it means your code passed the check)
  - `main.bin` executable file will be created upon the build
  - `testcase` contains test cases and their expected outputs

    ```
    $ ./main.bin testcase/tc-1
    ```

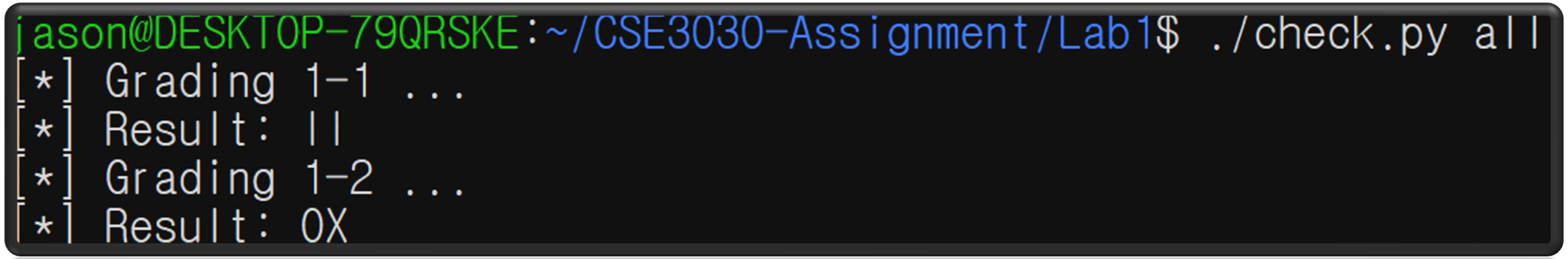
    (The output must match with `testcase/ans-1`)



```
1-2/
├──Makefile
├──absVal.c
├──absVal.h
├──main.c
├──testcase
│   ├──ans-1
│   ├──ans-2
│   ├──tc-1
│   └──tc-2
└──validate
```

Testing (Self-Grading) Your Code

- **You can find `check.py` script in the top-level directory (Lab1)**
  - `"./check.py 1-1"` will grades problem 1-1 with the test cases
  - `"./check.py all"` will grade all the problems from 1-1 to 1-4
  - Each character in the result has following meaning
    - `'O'`: Correct output / `'X'`: Wrong output / `'C'`: Compile error / `'T'`: Timeout
    - `'I'`: Invalid (failed to pass the validator) / `'E'`: Runtime error (e.g., crash)



```
jason@DESKTOP-79QRSKE:~/CSE3030-Assignment/Lab1$ ./check.py all
[*] Grading 1-1 ...
[*] Result: II
[*] Grading 1-2 ...
[*] Result: OX
```

Test Cases for Real Grading

- On top of the provided test cases, I will use additional test cases to grade your code

- In other words, even if you pass all the test cases in the skeleton code, that does not guarantee that you will get 100 points.

- So you are encouraged to test your own code with various inputs

ChatGPT?

- **In fact, Programming Assignment #1 is not a difficult challenge at all**

- **You can easily solve them by asking *ChatGPT* (*or* with *Googling*)**

- **But remember: if you start relying on *ChatGPT* from now on, it will eventually limit your capability**

- **On the other hand, if you continue working on these challenges on your own, you will surpass *ChatGPT* one day**

Submission Guideline

- **Don’t forget the deadline**
  - Deadline: **4/4** Tuesday 23:59
  - Late submission deadline: **4/5** Wednesday 23:59 (-20% penalty)

- **You should submit the following four files:**
  - `copyLSB.c` (Problem 1-1)
  - `absVal.c` (Problem 1-2)
  - `conditional.c` (Problem 1-3)
  - `bitset.c` (Problem 1-4)

Submission Guideline (Cont')

- **Please strictly follow the specified submission format below:**
  - DO NOT zip four files, just upload four files directly to *Cyber Campus*
  - DO NOT change the file name (e.g., do not add any suffix)
  - If your submission format is wrong, you will get -50% penalty
- **If the submitted file doesn't compile with the "make" command, we cannot give you any point for that problem**
- **If you submit a wrong file for each problem, we cannot give you any point for that problem**
  - E.g., If you submit `absVal.h` instead of `absVal.c`, you will get zero point