CSE 140 Lab/HW#3 – Due: in 2 weeks (see below)

RISC-V Decoder (80pts)

Form a group of two members and do the following tasks.

* Note that this programming assignment is closely related to the project so work with the team member who you want to do the project together.

* We will carefully check plagiarism. While you will earn partial credit for the incomplete solution of yours, you will get zero point if the solution is copied from somebody else's.

1. Write a C program that decodes an input machine code. Your program should be able to decode the R, I, S, SB, and UJ type instructions listed below. We will only test the following instructions. You can find these instructions from the RISC-V Reference Data sheet (download from CatCourse).

add	addi
and	andi
beq	bge
blt	bne
jal	jalr
lb	lh
lw	
or	ori
sb	sh
sll	slli
slt	slti
sltiu	sltu
sra	srai
srl	srli
sub	sw
xor	xori

When the program is started, your program will print "**Enter an instruction:**" and receive one 32-bit machine code from user. Then, the program will decode the machine code and print the information (type and values of individual fields of the instruction format) of the instruction. The following is the example execution of the program. Your program must produce the following sample results in the exact same format.

Enter an instruction:

00000000001100100000010101100011

Instruction Type: R
Operation: add
Rs1: x4
Rs2: x3
Rd: x5
Funct3: 0
Funct7: 0

Enter an instruction:

00000000101001100111011010010011

Instruction Type : I
Operation: andi
Rs1: x12
Rd: x13
Immediate: 10 (or 0xA)

Enter an instruction:

11111110001100100000100000100011

Instruction Type : S
Operation: sb
Rs1: x4
Rs2: x3
Immediate: -16 (or 0xFF0)

Enter an instruction:

00000001111000101001001101100011

Instruction Type : SB
Operation: bne
Rs1: x5
Rs2: x30
Immediate: 6

```
Enter an instruction:

00000000101000000000000011101111

Instruction Type : UJ
Operation: jal
Rd: x1
Immediate: 10 (or 0xA)
```

As a group, discuss how to read and interpret the instructions from user. Once this step is done, split the task among your group so that each member will implement different instructions individually.

Assume that your program will always receive a machine code in correct formats. So, you do not need to implement invalid input handling function. All test cases will follow the correct machine code format.

Demo : You will have two weeks to finish this lab. In the week of the submission deadline, we will have a demo time at the lab. Show a demo to your TA one instruction per type (R, I, S, SB, and UJ type). When demoing and submitting your program, indicate which portion of the code was your implementation. "Working on the code together" means someone did not implement individually.

Instructions (10pts)

2. (zyBook) Participation Activity in 2.2-2.3, and 2.5-2.7

Single-cycle RISC-V Architecture (10pts)

3. (zyBook) Exercise 4.19.1 (a).
4. (zyBook) Exercise 4.19.1 (a) but for `sw x12, 8(x10)`

Submission Guideline

- Submit your code under a name "first-member-name_second-member-name.c", and your solutions for the problems 3 and 4 in a separate MS Word or a pdf format to the CatCourse. Do problem 1 directly on zyBook.

- Deadline: **Before the lab in two weeks** (If this lab is assigned on 2/18 1:30PM, the deadline is 3/4 1:29PM)