

# 2190250 Comp Arch and Org

work sheet for week 2:

RISC-V assembly language programming

using this page

<https://www.cp.eng.chula.ac.th/~prabhas//teaching/comparch/2024/Programming-RISC-V-assembly.htm>

1) run the following assembly programs in venus, observe the result. Check that the result is correct.

## 1.1 move data from register to register

write your answer, what is the value in register x3 when program terminate?

```
addi x2,x0,11
add  x3,x2,x0
```

## 1.2 move data from register to/from memory

write your answer, what is the value in memory 0x104 when program terminate?

```
addi x5,x0,0x11      # set x5 to 0x11
sw x5, 0x100(x0)      # store at address 0x100
lw x6, 0x100(x0)      # get from mem
addi x6,x6,1
sw x6, 0x104(x0)      # store to mem 0x104
```

1.3 simple arithmetic, write the answer what is the value of memory at 0x100 when the program terminate?

```

lw  x5, 0x104(x0)    # get b
lw  x6, 0x108(x0)    # get c
add x4, x5, x6
sw  x4, 0x100(x0)    # store to a

```

#### 1.4 accessing an array data

using offset, base address points to the beginning of the array

ax[20] ax starts at 0x100 base address, size 20 bytes

to get an element at ax[1], each element is 32-bit

let x3 -index, x4 -base, x5 -effective address, x6 -value

```

addi x3,x0,4          # offset to index 1, 4 bytes
addi x4,x0,0x100       # base
add  x5,x3,x4          # compute effective address
lw   x6,0(x5)          # get from memory

```

write your answer, what is the value of the effective address?

#### 1.5 loop

run the following program, what is the value of x3 when the program terminate?

```

    addi x3,x0,0    # i = 0
    addi x4,x0,10   # const 10
loop:
    bge x3,x4, exit
    addi x3,x3,1
    j loop
exit:

```

2) compiling high level language to assembly language

using "Compiler Explorer" ([godbolt.org](https://godbolt.org))

input language is C,

output language is "RISC\_V rv32gc clang"

compile and explain the output assembly code (no need to run)

### 2.1 simple one line program

```

int main(){
    int a;
    a = 11;
}

```

### 2.2 program with if..then

```

int main(){
    int a,b;
    if(a > 0){
        b = 22;
    }
}

```