实验七—RISCV 汇编程序设计

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课程名称：计算机系统 1 同组学生姓名：/

实验时间：2021.5.12 实验地点：紫金港东 4-509 指导老师：吴磊

一、 实验目的和要求

理解并运用 RISCV 汇编指令
能够用 RISCV 汇编指令编写简单的汇编程序。

二、 实验内容和原理

2.1 实验内容

利用 RISC v 实现冒泡排序。

2.2 设计模块

Load word 模块：输入学号数字至 0x40 内存处。
Main：开始实现冒泡排序。
Swap：设置一个 tmp，将条件判断后的两个数值分别对换，通过 lw 指令和 sw 指令进行对换.
Initi initj：初始化 i 和 j。
Loadi：加载数组至函数栈中。
Actioni actionj：实现 i++和 j++操作，并且对排序后的数组输出。

三、 主要仪器设备

RISC v 在线编译网站

四、 操作方法与实验步骤

4.1 操作方法

无

4.2 实验步骤

实验代码：

```
#load word
        addi x5,x0,3
        addi x6,x0,3
        addi x7,x0,0
        addi x8,x0,0
        lui x6, 0x40
        sw x5, 0(x6)
        addi x5,x0,2
        sw x5, 4(x6)
        sw x7,8(x6)
        sw x7,12(x6)
        addi x7,x0,1
        sw x7,16(x6)
        sw x8,20(x6)
        addi x5,x0,5
        sw x5,24(x6)
        addi x5,x0,7
        sw x5,28(x6)
        addi x5,x0,8
        sw x5,32(x6)
        addi x5,x0,7
        sw x5,36(x6)
        #bubble sort begin
main:
        #create stack
        lui sp,0x80；赋地址值
        #save s0
        sw    s0,60(sp)
        #update s0
        addi s0,sp,64

        #init arr[] to memory
```

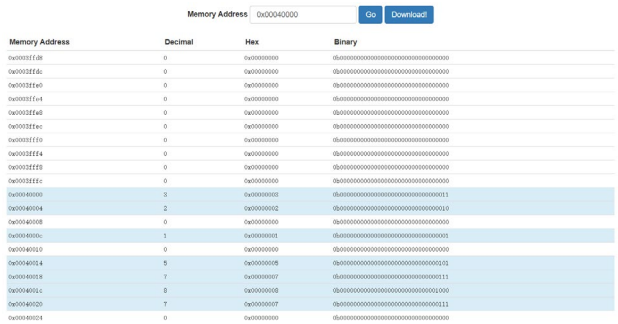
```
        lw a0 0(x6）
        lw a1 4(x6)
        lw a2 8(x6)
        lw a3 12(x6)
        lw a4 16(x6）
        lw a5 20(x6)
        lw a6 24(x6)
        lw a7 28(x6)
        lw a8 32(x6)
        lw a9 36(x6)

        #init i to memory
        sw    zero,-16(s0)
        j     checki
        lw
initj:
        #init j to memory
        sw    zero,-20(s0)
        j     actioni
loadi:
        #load arr[ j ] to a4
        lw    a5,-20(s0)
        slli  a5,a5,2
        addi a4,s0,-16
        add  a5,a4,a5
        lw    a4,-28(a5)

        #load arr[j+1] a5
        lw    a5,-28(s0)
        addi a5,a5,1
        slli  a5,a5,2
        addi a3,s0,-16
        add  a5,a3,a5
        lw    a5,-36(a5)

        #if arr[j + 1] > arr[j]
        bge  a5,a4,actionj

# arr[j+1] < arr[j]
Swap:
        #load arr[j] a5
        lw    a5,-28(s0)
        slli  a5,a5,2
        addi a4,s0,-16
```

```
        add  a5,a4,a5
        lw   a5,-36(a5)
        #store arr[j] to tmp
        sw   a5,-32(s0)

        #load arr[j+1] to a4
        lw   a5,-28(s0)
        addi a5,a5,1
        slli a5,a5,2
        addi a4,s0,-16
        add  a5,a4,a5
        lw   a4,-36(a5)

        #arr[j] = arr[j+1]
        lw   a5,-28(s0)
        slli a5,a5,2
        addi a3,s0,-16
        add  a5,a3,a5
        sw   a4,-36(a5)

        #store tmp to arr[j+1]
        lw   a5,-28(s0)
        addi a5,a5,1
        slli a5,a5,2
        addi a4,s0,-16
        add  a5,a4,a5
        lw   a4,-32(s0)
        sw   a4,-36(a5)
actionj:
        #j++
        lw   a5,-28(s0)
        addi a5,a5,1
        sw   a5,-28(s0)
actioni:
        #check (j - i) < 7
        li   a4,4
        lw   a5,-24(s0)
        sub  a5,a4,a5
        lw   a4,-28(s0)
        blt  a4,a5,loadi

        #i++
        lw   a5,-24(s0)
        addi a5,a5,1
```

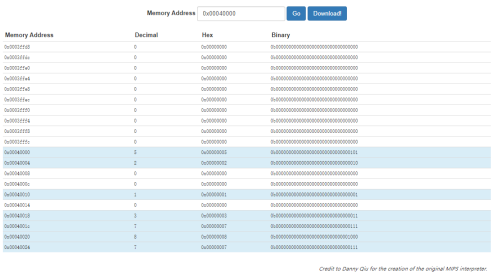
```
        sw    a5,-24(s0)
checki:
        #check i < 7
        lw    a4,-24(s0)
        li    a5,3
        bge   a5,a4,initj

        #return
        li    a5,0
        mv    a0,a5
        lw    s0,40(sp)
        addi sp,sp,60
        jr    ra
#end
#DetailsOmitt
```

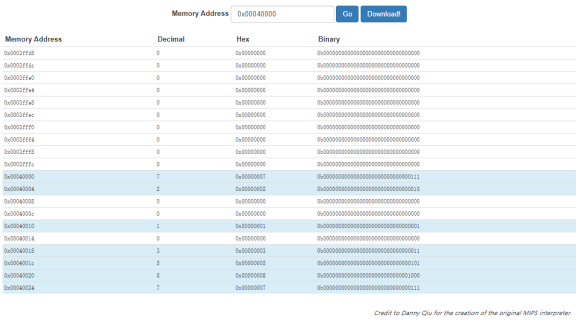
五、 实验结果与分析

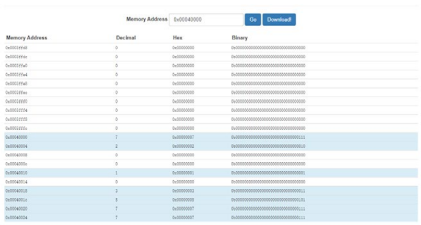
数据输入：



开始排序：







Memory Address 0x00040000

Memory Address	Decimal	Hex	Binary
0x0003ffd8	0	0x00000000	0b00000000000000000000000000000000
0x0003ffdc	0	0x00000000	0b00000000000000000000000000000000
0x0003ffe0	0	0x00000000	0b00000000000000000000000000000000
0x0003ffe4	0	0x00000000	0b00000000000000000000000000000000
0x0003ffe8	0	0x00000000	0b00000000000000000000000000000000
0x0003ffec	0	0x00000000	0b00000000000000000000000000000000
0x0003fff0	0	0x00000000	0b00000000000000000000000000000000
0x0003fff4	0	0x00000000	0b00000000000000000000000000000000
0x0003fff8	0	0x00000000	0b00000000000000000000000000000000
0x0003fffc	0	0x00000000	0b00000000000000000000000000000000
0x00040000	7	0x00000007	0b00000000000000000000000000000111
0x00040004	2	0x00000002	0b00000000000000000000000000000010
0x00040008	0	0x00000000	0b00000000000000000000000000000000
0x0004000c	0	0x00000000	0b00000000000000000000000000000000
0x00040010	1	0x00000001	0b00000000000000000000000000000001
0x00040014	0	0x00000000	0b00000000000000000000000000000000
0x00040018	3	0x00000003	0b00000000000000000000000000000011
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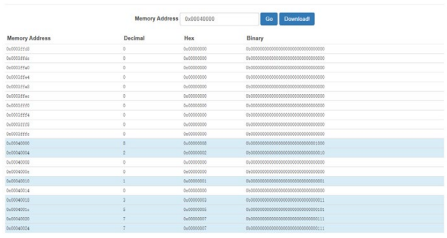
Credit to Danny Qiu for the creation of the original MIPS interpreter.



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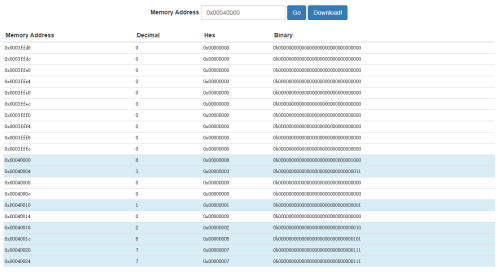

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0x0003fff8	0	0x00000000	0b00000000000000000000000000000000
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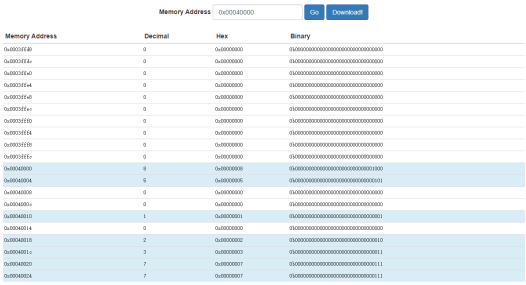

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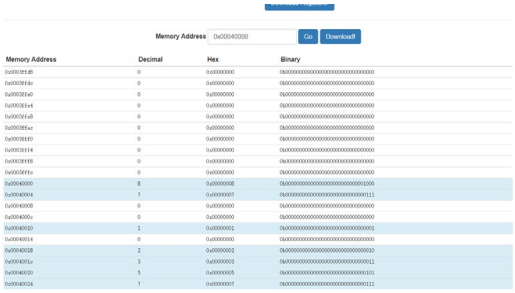

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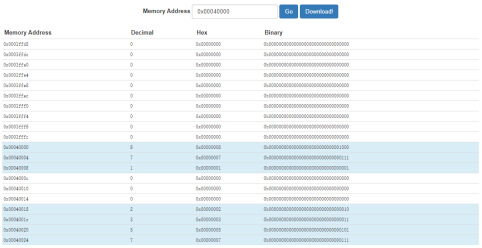

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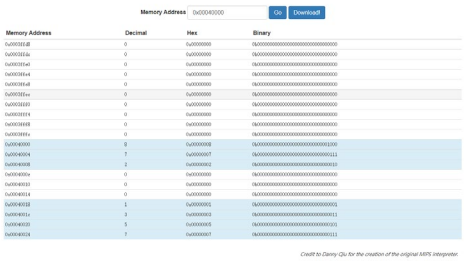

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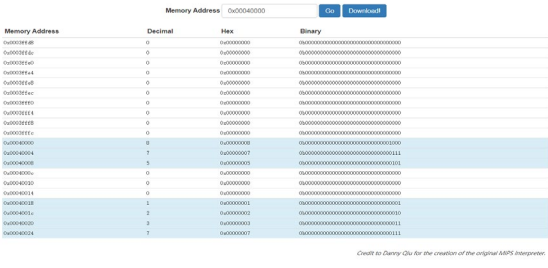

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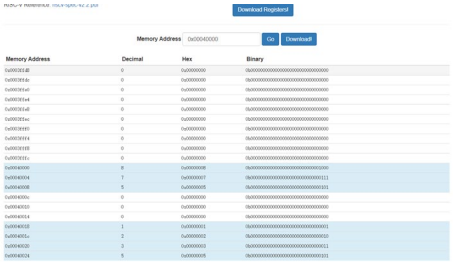

RISC-V Reference: riscv-spec-v2.2.pdf

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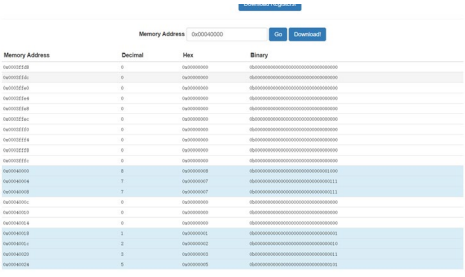

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Memory Address 0x00040000 Go Download!

Memory Address	Decimal	Hex	Binary
0x0003ffd8	0	0x00000000	0b00000000000000000000000000000000
0x0003ffdc	0	0x00000000	0b00000000000000000000000000000000
0x0003ffe0	0	0x00000000	0b00000000000000000000000000000000
0x0003ffe4	0	0x00000000	0b00000000000000000000000000000000
0x0003ffe8	0	0x00000000	0b00000000000000000000000000000000
0x0003ffec	0	0x00000000	0b00000000000000000000000000000000
0x0003fff0	0	0x00000000	0b00000000000000000000000000000000
0x0003fff4	0	0x00000000	0b00000000000000000000000000000000
0x0003fff8	0	0x00000000	0b00000000000000000000000000000000
0x0003fffc	0	0x00000000	0b00000000000000000000000000000000
0x00040000	8	0x00000008	0b00000000000000000000000000001000
0x00040004	7	0x00000007	0b00000000000000000000000000000111
0x00040008	7	0x00000007	0b00000000000000000000000000000111
0x0004000c	5	0x00000005	0b00000000000000000000000000000101
0x00040010	0	0x00000000	0b00000000000000000000000000000000
0x00040014	0	0x00000000	0b00000000000000000000000000000000
0x00040018	0	0x00000000	0b00000000000000000000000000000000
0x0004001c	1	0x00000001	0b00000000000000000000000000000001
0x00040020	2	0x00000002	0b00000000000000000000000000000010
0x00040024	3	0x00000003	0b00000000000000000000000000000011

Credit to Danny Qiu for the creation of the original MIPS interpreter.

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0x0004000c	5	0x00000005	0b00000000000000000000000000000101
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0x00040014	2	0x00000002	0b00000000000000000000000000000010
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0x00040020	0	0x00000000	0b00000000000000000000000000000000
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六、 讨论、心得

这次写 riscv，感觉和 x86 的确有所不同，但就像是用 typora 和 word 来码字一样，本质上没多大区别，不过 riscv 是真的很省力，很多指令做的都比较有趣且使用便捷欸。