Solutions for Exercise 2.3 2.4, 2.6, 2,10, 2.11, 2.14, 2.15, 2.20, 2.22

Disclaimer:

1. The solution is just for your reference. They may contain some mistakes. DO TRY to solve the problems by yourself. Please also pay attentions to the course website for the updates.

2. Try not to use pseudoinstructions for any exercises that ask you to produce MIPS code. Your goal should be to learn the real MIPS instruction set, and if you are asked to count instructions, your count should reflect the actual instructions that will be executed and not the pseudoinstructions.

2.3

$s0	**$s1**	**$s2**	**$s3**	**$s4**
f	**g**	**H**	**I**	**j**

```
sub $t0, $s3, $s4
sll   $t0, $t0, 2     # multiply 4
add $t0, $s6, $t0   #address of A[i-j]
lw    $t1, 0($t0)     #
sw    $t1, 32($s7)   #store B[8]
```

2.4

Solution

$s0	**$s1**	**$s2**	**$s3**	**$s4**
F	**G**	**H**	**i**	**J**

$s6: address of A, $s7, address of B

```
    sll     $t0, $s0 , 2        #   $t0 = f * 4
    add    $t0, $s6 , $t0     #   $t0 = &A[ f ]
    sll     $t1, $s1 , 2        #   $t1 = g * 4
    add    $t1, $s7 , $t1     #   $t1 = &B[ g ]
    lw    $s0, 0($t0)          #   f= A[ f ]
    addi $t2, $s0 , 4
    lw    $t0, 0($t2)          # load A[f+1]
    add    $t0, $t0 , $s0      # A[f]+A[f+1]
    sw    $t0, 0($t1)
```

B[g] = A[f] + A[1+f];

2.6.1 temp = Array[0];
temp2 = Array[1];
Array[0] = Array[4];
Array[1] = temp;
Array[4] = Array[3];
Array[3] = temp2;

2.6.2 lw $t0, 0($s6)
lw $t1, 4($s6)
lw $t2, 16($s6)
sw $t2, 0($s6) # Array[0] = Array[4]
sw $t0, 4($s6) # Array[1] = temp
lw $t0, 12($s6)
sw $t0, 16($s6)
sw $t1, 12($s6)

2.10

$s0	**$s1**	**$s2**	**$s3**	**$s4**
F	**G**	**h**	**i**	**j**

$s6: address of A, $s7, address of B

addi $t0, $s6, 4 #temp0 = &A[1]
add $t1, $s6, $0 #temp1= &A[0]
sw $t1, 0($t0) #A[1]=temp1
lw $t0, 0($t0) #temp0 = temp1 = &A[0]
add $s0, $t1 , $t0 #f = &A[0]+ &A[0]

Therefore, the C statements are:
A[1] = &A[0]
f = &A[0]+ &A[0]

2.11

	type	**Opcode**	**Rs**	**rt**	**rd**	**immed**
addi $t0, $s6, 4	I-type	**8**	**22**	**8**		**4**
add $t1, $s6, $0	R-type	**0**	**22**	**0**	**9**	
sw $t1, 0($t0)	I-type	**43**	**8**	**9**		**0**
lw $t0, 0($t0)	I-type	**35**	**8**	**8**		**0**
add $s0, $t1, $t0	R-type	**0**	**9**	**8**	**16**	

2.14

R-type, add $s0, $s0, $s0

https://www.eg.bucknell.edu/~csci320/mips_web/

2.15

I-type, 0xAD490020

more instructions → larger opcodes → larger code size

2.20

```
srl   $t2, $t0, 11
sll   $t2, $t2, 26
sll   $t1, $t1, 6
srl   $t1, $t1, 6
or    $t2, $t2, $t1
```

2.22

```
lw $t3, 0($s1)
sll $t1, $t3, 4
```