JOINT INSTITUTE
交大密西根学院

Ve370 Introduction to Computer Organization

Homework 1

Assigned: September 15, 2020

Due: 2:00pm on September 22, 2020

Submit a PDF file on Canvas

1. Computer A has an overall CPI of 1.5 and can be run at a clock rate of 500MHz. Computer B has a CPI of 2.3 and can be run at a clock rate of 850 Mhz. We have a particular program we wish to run. When compiled for computer A, this program has exactly 100,000 instructions. How many instructions would the program need to have when compiled for Computer B, in order for the two computers to have exactly the same execution time for this program? (5 points)

2. Following table shows instruction-type breakdown for different programs. (5 points)

	Instructions				
	Arithmetic	Load	Store	Branch	Total
Program 1	1100	200	150	120	1570

   Assuming that arithmetic instructions take 1 cycle, load and store 7 cycles and branch 3 cycles, what is the execution time of the program in a 2 GHz MIPS processor? What is the CPI?

3. The table below shows the instruction type breakdown of a given application executed on 1, 2, 4, or 8 processors. (5 points)

	Processors	No. Instructions per Processor			CPI		
		Arithmetic	Load/Store	Branch	Arithmetic	Load/Store	Branch
b.	1	2560	1280	256	1	4	2
	2	1280	640	128	1	6	2
	4	640	320	64	1	8	2
	8	320	160	32	1	10	2

Given the CPI values on the right of the table above, find the total execution time for this program on 1, 2, 4, and 8 processors. Assume that each processor has a 3 GHz clock frequency.

4. Write the following arithmetic equation in MIPS assembly: x = x - y + z - 72; Assume that x, y, z are stored in registers $s0-$s2. (5 points)

5. (10 points) Translating from C statement to MIPS assembly instructions. Assume i and j are assigned to registers $t0 and $t1, the base address of the arrays A and B are in registers $s5 and $s6, respectively. Assume that the elements of the arrays A and B are 4-byte words:

```
B[8] = i + A[j];
```

6. Given the following MIPS assembly:

```
addi $t0, $s6, 4
add $t1, $s6, $0
sw $t1, 4($t0)
lw $t0, 0($t0)
add $s0, $t0, $t1
```

What is the corresponding C statement? (10 points)

For the MIPS assembly above, assume that the registers $s0, $s1, $s2, and $s3 contain the values 0x0000000a, 0x00000014, 0x0000001e, and 0x00000028, respectively. Also, assume that register $s6 contains the value 0x00000100, and that memory contains the following values. Find the value of $s0 at the end of the assembly code. (10 points)

Address	Value
0x00000100	0x000011f0
0x00000104	0x0000F1a4
0x00000108	0x000025c8

7. Following memory location has address 0x10000000 and content 0x27546693.

	0	1	2	3
0x10000000	27	54	66	93

Write MIPS assembly instructions to load the byte 66 to register $s2, then show the content of $s2 after the operations. (10 points)

8. (10 points)

```
$t0 = 1101 1111 0110 1110 0100 0000 0000 0000
$t1 = 1111 0101 1111 1000 0000 0000 0000 0000
```

What is the value of $t2 after the following instructions?

```
slt $t2, $t0, $t1
beq $t2, $0, ELSE
j DONE
ELSE: addi $t2, $0, -2
DONE: ……
```

9. (30 points) Given the following C code:

```
int positive(int a, int b) {
     if (addit(a, b) > 0)
          return 1;
     else
          return 0;
}
int addit(int a, int b) {
     return a+b;
}
```

Implement the C code in MIPS assembly following function call conventions.

For each function call, show the contents of the stack after the function call is made. Assume the stack pointer is originally at address 0x7ffffffc, and follow the register conventions.