



## CS 220 Computer Architecture

### HW 06 - MIPS Model and SPIM Program

Fall 2023

DEPARTMENT OF COMPUTER SCIENCE AND INFORMATION SYSTEMS

#### PART 0: READING AND STUDYING

[MIPS Reference Sheet](#) [This is a link]

**Study** the following Tutorials on MIPS

- [First SPIM Program](#) [This is a link]
- [A MIPS Programming Model](#) [This is a link]

#### PART 1: QUESTIONS ON SPIM PROGRAM [50 PTS]

**Note:** for each of the Quiz questions, provide your answer with Justification.

##### QUESTION 1

Q1	<p>What character, in SPIM assembly language, starts a comment? [5 PTS]</p> <p>A. #</p> <p>B. %</p> <p>C. \$</p> <p>D. //</p>
	<p><b>Answer:</b> A</p>
	<p><b>Justification:</b> // is the way to write comments in high level language, % is modulo, and \$ is for assigning addresses.</p>

**QUESTION 2**

Q2	<p>How many bits are there in each MIPS machine instruction? [5PTS]</p> <p>A. 8</p> <p>B. 16</p> <p>C. 24</p> <p>D. 32</p>
	<p><b><u>Answer:</u></b> D</p>
	<p><b><u>Justification:</u></b> 32, because that is the maximum amount 5 bits can display</p>

**QUESTION 3**

Q3	<p>When you open a source file from the SPIM file menu, what two things happen? [5 PTS]</p> <p>A. The file is loaded into memory and execution starts.</p> <p>B. SPIM is booted and the file is opened in the editor.</p> <p>C. The file is assembled into machine instructions, and the machine instructions are loaded into SPIM's memory.</p> <p>D. The program is run, and the results are saved to disk.</p>
	<p><b><u>Answer:</u></b> C</p>
	<p><b><u>Justification:</u></b> The assembly has to be converted into machine instructions before it can load into the SPIM memory</p>

## QUESTION 4

Q4	<p>What is a directive, such as the directive .text? [5 PTS]</p> <ul style="list-style-type: none"> <li>A. An assembly language statement that results in one machine language instruction.</li> <li>B. one of the menu choices in the SPIM menu system.</li> <li>C. a machine language instruction that causes an operation on data.</li> <li>D. a statement that tells the assembler something about what the programmer wants but does not itself directly correspond to a machine instruction.</li> </ul>
	<p><b><u>Answer:</u></b> D</p>
	<p><b><u>Justification:</u></b> Directive are rules that the computer must follow when assembling and doesn't have to affect the code</p>

## QUESTION 5

Q5	<p>What is a symbolic address? [5 PTS]</p> <ul style="list-style-type: none"> <li>A. a location in memory containing symbolic data.</li> <li>B. a byte in memory that holds the address of data.</li> <li>C. the symbol given as the argument for a directive.</li> <li>D. a name used in assembly language source code for a location in memory.</li> </ul>
	<p><b><u>Answer:</u></b> D</p>
	<p><b><u>Justification:</u></b> The names symbolize the addresses so they are easier to read for people</p>

## QUESTION 6

Q6	<p>At what address does the SPIM simulator put the first machine instruction when it is running with the Bare Machine option turned ON? [5 PTS]</p> <p>A. 0x00000000 B. 0x00400000 C. 0x10000000 D. 0xFFFFFFFF</p>
	<p><b>Answer:</b> B</p>
	<p><b>Justification:</b> Because it has to be a multiple of 64kb, and it helps prevent collision as it is so low in the command, but high enough for priority over created calls</p>

## QUESTION 7

Q7	<p>How many general-purpose registers does MIPS have? [5 PTS]</p> <p>A. 2 B. 4 C. 16 D. 32</p>
	<p><b>Answer:</b> D</p>
	<p><b>Justification:</b> 32 is the maximum amount that 5 bits can show</p>

## QUESTION 8

Q8	<p>What is a general-purpose register? [5 PTS]</p> <ul style="list-style-type: none"> <li>A. any register that is displayed in the SPIM register display section.</li> <li>B. a register that is directly available to assembly language statements.</li> <li>C. a register used for both floating point and integer arithmetic.</li> <li>D. any 32-bit register</li> </ul>
	<b><u>Answer:</u></b> B
	<b><u>Justification:</u></b> A general purpose register can be manipulated and used by the assembly statement in real time

## QUESTION 9

Q9	<p>A MIPS address consists of how many bits? [5 PTS]</p> <ul style="list-style-type: none"> <li>A. 1</li> <li>B. 2</li> <li>C. 4</li> <li>D. 32</li> </ul>
	<b><u>Answer:</u></b> D
	<b><u>Justification:</u></b> MIPS needs to hold lots of addresses

**QUESTION 10**

Q10	<p>What algorithm does MIPS use for 32-bit addition? [5 PTS]</p> <ul style="list-style-type: none"> <li>A. the Binary Addition Algorithm</li> <li>B. the two's complement addition algorithm</li> <li>C. the unsigned addition algorithm</li> <li>D. a proprietary addition algorithm</li> </ul>
	<b><u>Answer:</u></b> A
	<b><u>Justification:</u></b> It is working with binary and wants to do the fastest addition possible

**PART 2: QUESTION ON MIPS PROGRAMMING MODEL [50 PTS]**

**Note:** for each of the Quiz questions, provide your answer with Justification.

**QUESTION 1**

Q1	<p>When a register is cleared what happens? [5 PTS]</p> <ul style="list-style-type: none"> <li>A. The bits of the register are set to all zeros.</li> <li>B. The bits of the register are set to all ones.</li> <li>C. A bit pattern at a memory location is copied to the register. The memory is set to all zeros.</li> <li>D. A bit pattern at a memory location is copied into the register. Memory is not changed.</li> </ul>
	<b><u>Answer:</u></b> D
	<b><u>Justification:</u></b> Load and store copy bit patterns from the source to the destination, leaving the register unchanged

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**QUESTION 2**

Q2	By software convention, the machine instructions of a program are put in a designated section of memory. What is this section called? [5 PTS]
	<ul style="list-style-type: none"> <li>A. Data segment.</li> <li>B. Stack segment.</li> <li>C. Program segment.</li> <li>D. Text segment.</li> </ul>
	<b><u>Answer:</u></b> D
	<b><u>Justification:</u></b> The text segment stores the instructions to make it easier to be read

**QUESTION 3**

Q3	Where do the operands for an arithmetic machine instruction come from? [5 PTS]
	<ul style="list-style-type: none"> <li>A. Both operands are registers.</li> <li>B. Both operands come from memory.</li> <li>C. One operand must be a register, the other one may be a memory or a register.</li> <li>D. One operand must be a register, the other may be a register or may be part of the machine instruction.</li> </ul>
	<b><u>Answer:</u></b> D
	<b><u>Justification:</u></b> Operands use registers to function, but can also use

	machine instruction because they are not stuck with only using memory.
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**QUESTION 4**

Q4	What is the mnemonic name of a register? [5 PTS]
	<ul style="list-style-type: none"> <li>A. The part of an assembly language statement that designates the machine operation.</li> <li>B. A register number like \$0 or \$31.</li> <li>C. A name that helps you remember the hardware characteristics of the register.</li> <li>D. A name like \$s0 that helps you remember the conventional software used for the register.</li> </ul>
	<b><u>Answer:</u></b> D
	<b><u>Justification:</u></b> The letter is important to help call to memory

**QUESTION 5**

Q5	What is a mnemonic? [5 PTS]
	<ul style="list-style-type: none"> <li>A. The part of an assembly language statement that designates the machine operation.</li> <li>B. The part of a machine instruction that designates a machine operation.</li> <li>C. The part of an assembly language statement that designates a register.</li> <li>D. The part of a machine instruction that is used as data in an operation.</li> </ul>
	<b><u>Answer:</u></b> A



	<b><u>Justification:</u></b> A mnemonic is used as a way to shorten operations to make it readable for humans
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**QUESTION 6**

Q6	What is the address of the last byte of memory in a 32-bit machine? [5 PTS]  A. 0x00000000 B. 0x10000000 C. 0x00400000 D. 0xFFFFFFFF
	<b><u>Answer:</u></b> D
	<b><u>Justification:</u></b> F is the biggest symbol that can be in a hexadecimal system, so all the F's mean it is larger than A, B, and C.

**QUESTION 7**

Q7	How many floating-point registers does MIPS have? [5 PTS]  A. None. MIPS has only general-purpose registers. B. None. MIPS has only two complement registers. C. 8 D. 32
	<b><u>Answer:</u></b> D
	<b><u>Justification:</u></b> There are as many floating point registers as there are

	general registers
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**QUESTION 8**

Q8	<p>In the following instruction</p> <p style="padding-left: 40px;">subu \$25, \$16, \$17</p> <p>What register holds the result? [5 PTS]</p> <p>A. \$25</p> <p>B. \$16</p> <p>C. \$17</p> <p>D. \$0</p>
	<b><u>Answer:</u></b> A
	<b><u>Justification:</u></b> The instruction reads as $\$25 = \$16 - \$17$ .

**QUESTION 9**

Q9	<p>In the following instruction</p> <p style="padding-left: 40px;">subu \$25, \$16, \$17</p> <p>What register holds the operands? [5 PTS]</p> <p>A. \$25 and \$16</p> <p>B. \$16 and \$17</p> <p>C. \$25 and \$16</p> <p>D. \$25 and \$17</p>
	<b><u>Answer:</u></b> B

	<b><u>Justification:</u></b> The operands are the addresses that are being worked with, and the \$25 is the result.
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## QUESTION 10

Q10	What is the control point? [5 PTS]
	<p>A. the address of the first instruction of a program.</p> <p>B. the address of the first word of data for a program.</p> <p>C. the address in memory of the instruction being executed.</p> <p>D. The clock signals the control execution of the program.</p>
	<b><u>Answer:</u></b> C
	<b><u>Justification:</u></b> It is called the control point because it controls the point of the address called, it holds the control point for the operation.