**Homework 4 Answer Sheet**

Please state the name, SID and email of each member of your group.

|  |  |  |  |
| --- | --- | --- | --- |
| member | name | SID | email |
| #1 (contact person) |  |  |  |
| #2 |  |  |  |
| #3 |  |  |  |

Logisim Version: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

OS (Window/MAC/Linux):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Do all members make significant contributions to this homework? If not, please specify the details.
2. Please explain how many types of instructions are supported in your processor, and explain the format of each type of instructions (e.g., which bits are used as the operation or function code, which bits are used to index the 1st, 2nd or 3rd operand, and which bits are used to store the immediate number). You can draw figures to better explain your answer.
3. Please explain the format of each instruction (including the format of this instruction and its operation codes, and other information if needed).

|  |  |
| --- | --- |
| li |  |
| add |  |
| and |  |
| or |  |
| load |  |
| store |  |
| move |  |
| addi |  |
| andi |  |
| ori |  |
| ble |  |
| bne |  |
| jump |  |
| call |  |
| rtn |  |
| halt |  |

1. Fill the following tables with the machine codes of each instruction of the testing programs:

**Test program 1:**

|  |  |  |
| --- | --- | --- |
| instruction | machine code (binary) | machine code (hex) |
| li $r1, 1 |  |  |
| li $r2, 2 |  |  |
| li $r3, 10 |  |  |
| add $r2, $r1, $r2 |  |  |
| ble $r2, $r3, -1 |  |  |
| halt |  |  |

**Test program 2:**

|  |  |  |
| --- | --- | --- |
| instruction | machine code (binary) | machine code (hex) |
| li $r1, 6 |  |  |
| li $r2, 5 |  |  |
| andi $r3, $r1, 3 |  |  |
| ori $r4, $r3, 8 |  |  |
| halt |  |  |

**Test program 3:**

|  |  |  |
| --- | --- | --- |
| instruction | machine code (binary) | machine code (hex) |
| li $r1, 6 |  |  |
| li $r2, 5 |  |  |
| and $r3, $r1, $r2 |  |  |
| li $r8, 0 |  |  |
| store $r3, $r8 |  |  |
| or $r4, $r1, $r2 |  |  |
| li $r8, 1 |  |  |
| store $r4, $r8 |  |  |
| li $r8, 1 |  |  |
| load $r7, $r8 |  |  |
| halt |  |  |

**Test program 4:**

|  |  |  |
| --- | --- | --- |
| instruction | machine code (binary) | machine code (hex) |
| li $r1, 6 |  |  |
| li $r2, 4 |  |  |
| call 7 |  |  |
| move $r4, $r3 |  |  |
| li $r1, 7 |  |  |
| li $r2, 8 |  |  |
| call 3 |  |  |
| move $r5, $r3 |  |  |
| jump 3 |  |  |
| add $r3, $r1, $r2 |  |  |
| rtn |  |  |
| halt |  |  |