Lab. Practice 6 (Extra part)

MIPS multicycle: `exceptions - jal - sra1 - sll1`

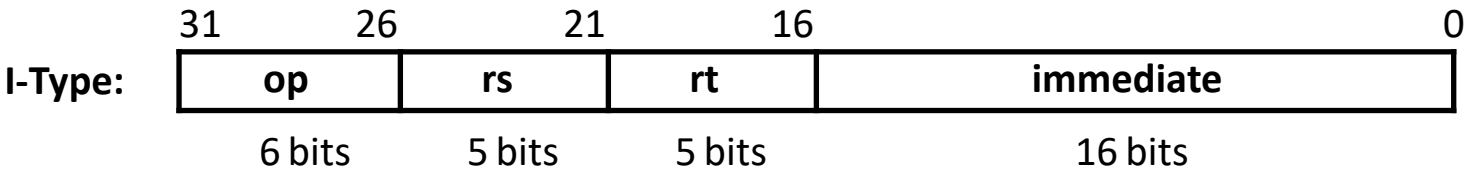
1- Exception control (0.5 pts)

- **If, at State S2, the opcode is unknown, go to a new exception state.**
  - If this situation happens, the FSM will stay in that state indefinitely.

- **Prove that it works by modifying the instruction `beq R0,R0,DONE` (or `j DONE`) with a wrong opcode.**

2- `jal` instruction (1.25 pts)

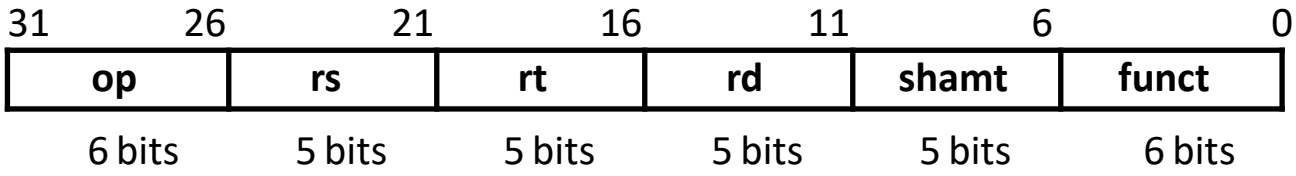
- **Add jal instruction (unconditional branch relative to PC):**
  - `jal dir:`
    - `PC <- PC + 4 + 4*SignExt(immediate)`
    - If `immediate` = 0, execution continues normally
    - If `immediate` > 0, it jumps forward
    - If `immediate` < 0, it jumps backwards (or it jumps to itself)
  - Opcode: `"000011"`



- **Modify your code to include this new instruction**
  - Replace the `x"08000006", -- j WHILE` in the code of the basic part (or `x"1000FFFC",-- beq R0, R0, WHILE`) with another `jal` instruction that is functionally equivalent

3- Shift instructions (1.25 pts)

- **Add instruction for shifting to the right:**
  - `sra1 rd, rs:`
    `rd <= rs>>1 (it makes an arithmetic shift)`
    `PC <= PC + 4`
  - funct: `"000000"`
  - shamt is not used
- **Add instruction for shifting to the left:**
  - `sll1 rd, rs:`
    `rd <= rs<<1 (it inserts a new 0 to the LSB)`
    `PC <= PC + 4`
  - funct: `"000010"`
  - shamt is not used



3- Shift instructions (1.25 pts)

- **Test these instructions with the new program that is available in the Campus Virtual (`blockRam2.vhd`)**
  - It is just another version of the multiplication algorithm that uses shifts instead of additions.
  - You don't have to modify it (just use it "as is")

Grading

- This lab has 3 questions, with grading 0,5+1.25+1.25 points, respectively.
  - You can make Questions 2+3 and get the full grading (2.5 points)
  - Or you can make Questions (2 or 3) + 1 to get 1.75 points (in case you run out of time)
  - If you make them all, I'll add +0.5 to your final TOC grading (as a reward)
  - They are independent, so you can solve them in any order.
- You have **2 chances per question** to call the professor and show him/her your solution.
  - If you don't show us anything in the lab, no grading will be assigned (unless something super extraordinary happens).
  - You can call us once for grading you one or several questions.
- You can implement them incrementally (starting from the homework) or by means of different projects for each question.
- For record purposes, once finished, upload the whole project in the assignment of the Campus Virtual, with the following format:
  - Format: LAB6-NAME_FAMILYNAME.ZIP
- Lab 6 is **NOT** recoverable.

Rules

- This lab starts at 11.00 and it finishes at 13.00.
- During the first 20 minutes, you can download your homework from the Campus Virtual, and use your projects (from a FLASH drive). After that, there will be no Internet and the use of any FLASH drive will be forbidden.
- It's strictly forbidden to talk to each other during the lab.
- Professors will only solve doubts about the specifications of the lab, and not about the solutions.
- Once you finish, you may leave the lab in silence.

Recommendations

- Punctuality.
- Bring a manuscript scheme of the datapath and control unit with the homework modifications that you made for the basic part of this lab.
- Test (just in case) the basic part before making any modification.