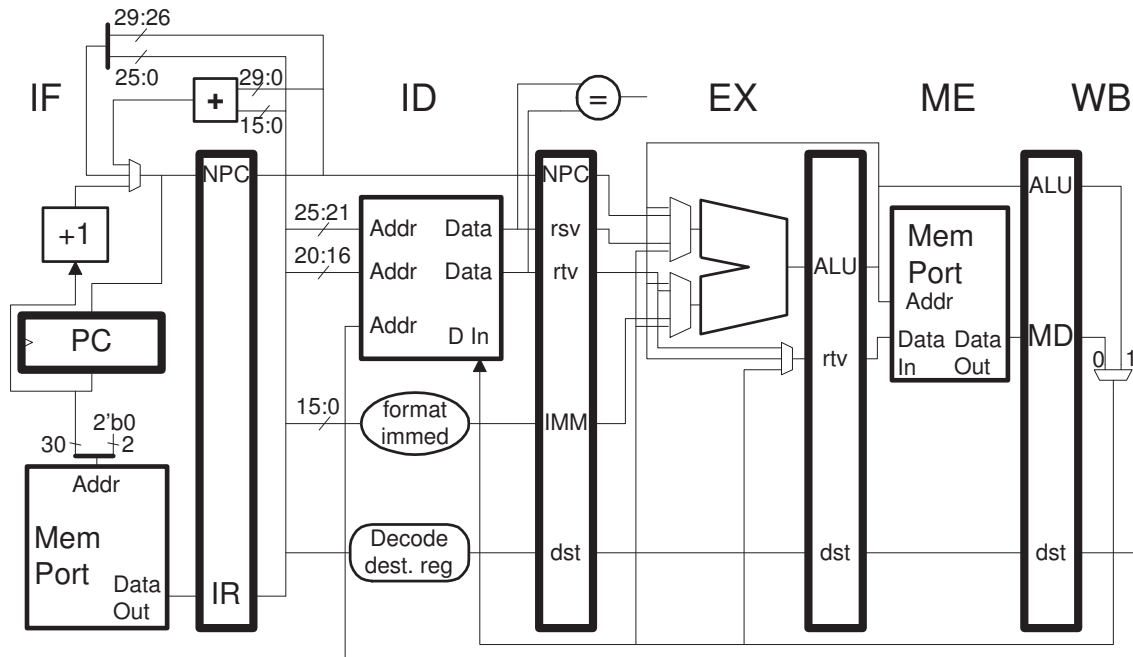


Problem 1: The SPARC `jmp1` (jump and link) instruction adds the contents of two source registers or a register and an immediate, and jumps to that address. It also puts the address of the instruction in the destination register (usually to be used to compute a return address). For more information, find the description of `jmp1` in the SPARC V8 ISA description from the references linked to the course home page.

In this problem a similar instruction (or instructions) will be added to MIPS. Like the SPARC `jmp1`, the MIPS variant can jump to a target determined by the sum of two registers or a register and an immediate, while the address of the instruction is saved in the destination register. (Note that the saved address is different than the address saved by MIPS' `jalr` and `jal` instructions. Be sure to save the address indicated by the SPARC definition.)

(a) Show how the MIPS version of these instruction(s) can be encoded. Show a format for the instruction, using the descriptions in the MIPS32 Architecture Volume II (linked to the references page) as an example. The format should show which instruction fields indicate each part of the instruction.

(b) Show datapath changes (that is, omit control) to the implementation below needed to implement this (these) instruction(s). The changes must fit in naturally with what is present and should not risk lowering clock frequency. Do not forget about any changes needed to save a return address.



(c) As discussed in class, a SPARC-style `jmp1` on something like our 5-stage pipeline would have to be resolved in EX. However, a higher-cost implementation might resolve a `jmp1` in ID if no addition were necessary.

Identify which of the following cases is the least trouble to detect (shown with SPARC assembler), and explain why it is the least trouble:

```

jmp1 %g1, %g0, %o7    ! g0 is the zero register.
jmp1 %g1, 0, %o7      ! The immediate is zero.
jmp1 %g1, %g2, %o7    ! Contents of g2 is zero.
    
```

Problem 2: Without looking at the solution, do Fall (November) 2007 Midterm exam Problem 1. Use the Statically Scheduled MIPS study guide, <http://www.ece.lsu.edu/ee4720/guides/ssched.pdf>, for tips on how to solve this interesting, understanding-building, and fun-to-solve (if one is prepared and not under intense time pressure) problem. Only use the solution if you must. **Warning:** *The test problems will be chosen under the assumption that students really solved this problem.*