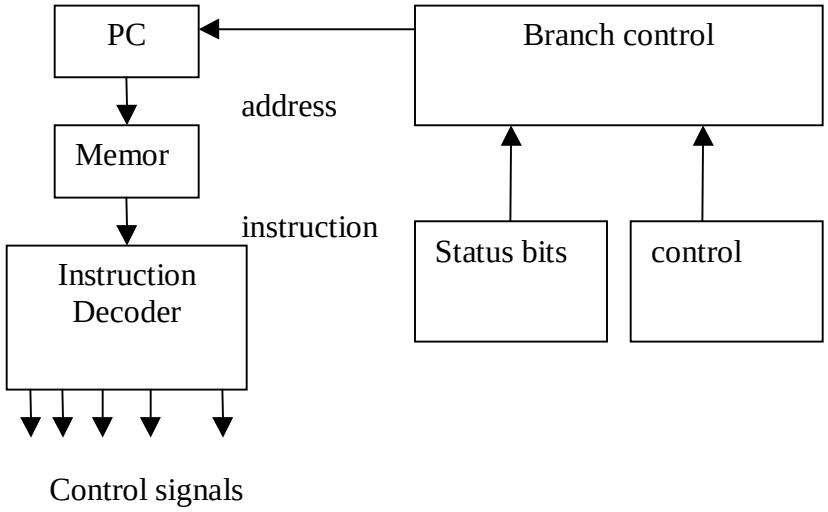
Back to Control

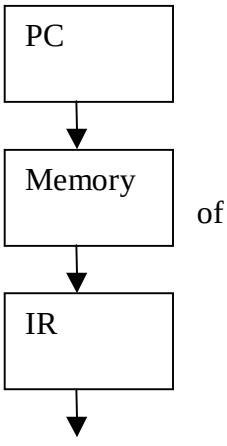


Control signals:

- Most connect to DP control inputs (FS, MD, AA…)
- Some branch control signals
  - Branch or not?
  - Conditional or unconditional
  - Which signals for conditional branches??
- Control for memory
- Constant-in for DP (for immediate mode instruction eg. Add 7 to R0
- For single- cycle control the instruction decoder is combinational
- So is the branch control

Multiple cycle control

- What if we want to spend several cycles on an instruction?
- We need to:
  - Store the instruction in a register
  - Decide what to do in each cycle
  - Store information about the current state (in cycle x of instruction y)
- First store the instruction:
  - IR: the instruction register
  - Load the IR to do a fetch



Microprogramming

- We will specify the series of steps to take to complete an instruction with a "micro-program"
    - A micro-program is part of the CPU design
    - The program (ie person writing machine code) cannot change it
- Each micro-program instruction (microinstruction)
    - Each microinstruction will execute in one cycle
    - It will activate whatever control signals are needed to do this job
- In our example architecture there will be a total of 256 microinstructions
    - These will have to implement every instruction the processor can do
    - The microinstruction will consist of a string of control bits.
        - The aren't decoded, just sent to the appropriate control signals
    - Microinstruction will be stored in a ROM

Micro-control

- We will use the same instruction format as the single-cycle CPU
    - 7 bit op-code
    - 3x3bit operands
- the first microinstruction to do when executing instruction X will be 0||X
    - ie instruction → put a 0 on the front = control address
- control address = location in control memory
- programmer wants op-code 1010101 executed
    - put a 0 on the front
        - 01010101
    - that's the control address
        - input to control memory
    - output of the control memory is the micro instruction
        - control signals sent to start the work