

Computation Structures — β -machine with bus - microcode (part 1)

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Microcode for β -machine with bus

1. Give symbolic microcode for instruction `BEQ(Ra, label, Rc)`.
2. Give symbolic microcode for a new instruction, `SWAPIFZ(Ra,Rb,Rc)`. When contents of register `Rc` is 0, this instruction swaps contents of `Ra` and `Rb` registers. Otherwise, it has no effect.
3. Combine `LD(Ra,Lit,Rd)` and `JMP(Rd,Rc)` in a single instruction. This new instruction `JMPI(Ra, Lit, Rc)` directs the program to an address found in memory at the address `Ra + Lit`. Register `Rc` shall receive the address of the instruction immediately following the `JMPI` we're executing. Provide the symbolic microcode for `JMPI(Ra, Lit, Rc)`
4. Give symbolic microcode for the following instruction:

```
BUZ(Ra,Lit,Rc): PC <- PC + 4
                EA <- PC + 4 * SEXT(Lit)
                TMP <- Reg[Ra]
                Reg[Rc] <- PC
                if TMP < 0 then PC <- EA
```

This instruction saves the program counter's value in register `Rc` and branches `Lit` instructions away iff the contents of register `Ra` is negative (**U**nder **Z**ero).