

CS150 - Computer Organization and Architecture

Homework #4 - Spring 2024

Please review the "RTL Primer" handout located on the course website before completing this homework.

1. Please produce the RTL for the OR instruction of the atmega328. Your RTL should only partition the instruction into the FETCH and EXECUTE phases.

FETCH:

```
PMAR <= PC
assert READ of PMEM
PMDR <= PMEM[PMAR]
IR <= PMDR
PC <= PC + 1
```

EXECUTE:

```
IF IR[15:10] = 001010
ALU1 <= R[IR[8:4]]
ALU2 <= R[{IR[9],IR[3:0]}]
assert OR of ALU
R[IR[8:4]] <= ALURESULT
```

2. Please produce the RTL for the NEG instruction of the atmega328. Your RTL should only partition the instruction into the FETCH and EXECUTE phases.

FETCH:

```
PMAR <= PC
assert READ of PMEM
PMDR <= PMEM[PMAR]
IR <= PMDR
PC <= PC + 1
```

EXECUTE:

```
IF {IR[15:9],IR[3:0]} = 10010100001
ALU1 <= R[IR[8:4]]
assert NEG of ALU
R[IR[8:4]] <= ALURESULT
```