

CSM151B - HW #6

| Op: | Inst | Cyc | ALU/Br | L/S |
|------|------------------|-----|--------|--------|
| LWA | \$t0, 0(\$s0) | | | |
| LWB | \$t1, 0(\$t0) | 1 | NOP | LWA |
| ADD | \$t1, \$t1, \$t1 | 2 | NOP | NOP |
| SW | \$t1, 0(\$t0) | 3 | NOP | LWB |
| ADDI | \$s0, \$s0, 4 | 4 | ADDI | NOP |
| BNE | \$s0, \$s2, Loop | 5 | ADD | NOP |
| | | 6 | BNE | SW, -4 |

• 1 iter = 6 cyc \Rightarrow 200 iters = 1200 cyc

With Unrolling

| 1. Unroll | 2. Condense | 3. Reg. Rename |
|-----------|-------------|----------------------|
| LWA | LWA | LWA \$t0, 0(\$s0) |
| LWB | LWB | LWB \$t1, 0(\$t0) |
| ADD | ADD | ADD \$t1, \$t1, \$t1 |
| SW | SW | SW \$t1, 0(\$t0) |
| ADDI | LWA, 4 | LWA \$t2, 4(\$s0) |
| LWA | LWB | LWB \$t3, 0(\$t2) |
| LWB | ADD | ADD \$t3, \$t1, \$t3 |
| ADD | SW | SW \$t3, 0(\$t2) |
| SW | ADDI, 8 | ADDI \$s0, \$s0, 8 |
| ADDI | BNE | BNE \$s0, \$s2, Loop |
| BNE | | |

4. Schedule

| Cyc | ALU/Br | L/S |
|-----|----------|------------|
| 1 | NOP | LWA \$t0 |
| 2 | NOP | LWB \$t1 |
| 3 | NOP | LWA \$t2 |
| 4 | ADD \$t1 | LWB \$t3 |
| 5 | ADDI | SW \$t1 |
| 6 | ADD \$t3 | NOP |
| 7 | BNE | SW \$t3, 0 |

\Rightarrow From 10 cyc to 7 cyc

• 1 iter = 7 cyc
• 200 iters = 1400 cyc