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CSE141 SP 2016

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CSE141 HW 3

4.14.1

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| LW R2,0(R1) | IF | ID | EX | MEM | WB |  |  |  |  |  |  |  |  |  |
| BEQ R2,R0,Label2 |  | IF | ID | ----- | EX | MEB | WB |  |  |  |  |  |  |  |
| LW R3,0(R2) |  |  |  |  |  | IF | ID | EX | MEB | WB |  |  |  |  |
| BEQ R3,R0,Label1 |  |  |  |  |  |  | IF | ID | --- | Ex | MEB | WB |  |  |
| BEQ R2,R0,Label2 |  |  |  |  |  |  |  | IF | --- | ID | EX | MEB | WB |  |
| SW R1,0(R2) |  |  |  |  |  |  |  |  |  | IF | ID | EX | MEB | WB |

4.14.2

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| LW R2,0(R1) | IF | ID | EX | MEM | WB |  |  |  |  |  |  |  |  |  |
| BEQ R2,R0,Label2 |  | IF | ID | ------- | EX | MEM | WB |  |  |  |  |  |  |  |
| LW R3,0(R2) |  |  | IF | ------- | ID | EX | MEB | WB |  |  |  |  |  |  |
| BEQ R3,R0,Label1 |  |  |  |  |  | IF | ID | EX | MEM | WB |  |  |  |  |
| ADD R1,R3,R1 |  |  |  |  |  |  | IF | ID | EX | MEM | WB |  |  |  |
| BEQ R2,R0,Label2 |  |  |  |  |  |  |  | IF | ID | EX | MEM | WB |  |  |
| LW R3,0(R2) |  |  |  |  |  |  |  |  | IF | ID | EX | MEM | WB |  |
| SW R1,0(R2) |  |  |  |  |  |  |  |  |  | IF | ID | EX | MEM | WB |

4.14.3

LW R2,0(R1)

Label1: BEZ R2,Label2 ; Not taken once, then taken

LW R3,0(R2)

BEZ R3,Label1 ; Taken

ADD R1,R3,R1

Label2: SW R1,0(R2)

4.14.4

If the current branch depends on the previous branch’s result, then there is a hazard. This happens when there are two R-type instructions happening back to back. The cycle must be stalled in order to allow for the information to be updated. The hazard is a data hazard.

4.14.5

See graph for 4.14.1; 14 pipeline cycles are used there. If the branches are executed in the ID stage, there will be 15 pipeline cycles. 14/14 = 1 and 14/15 = .93333.

4.14.6

If the current branch is using a register value from the branch directly before it, the current branch needs to be stalled because the first branch is in the EX stage. We need forwarding to make sure the branch works correctly. In order for this system to work, we would need another forwarding unit.

4.15.1

3 ´ (1 − 0.45) ´ 0.25 = 0.41

4.15.2

3 ´ (1 − 0.55) ´ 0.25 = 0.34

4.15.3

3 ´ (1 − 0.85) ´ 0.25 = 0.113

4.15.4

CPI w/out conversion

1 + 3 × (1 − 0.85) × 0.25 = 1.113

CPI w/ Conversion

1 + 3 × (1 − 0.85) × 0.25 × 0.5 = 1.056

Speedup from Conversion

1.113/1.056 = 1.054

4.15.5

CPI W/out Conversion

1.113

Cycles per Original inst

1 + (1 + 3 ´ (1 − 0.85)) ´ 0.25 ´ 0.5 = 1.181

Speedup from Conversion

1.113/1.181 = 0.94

4.15.6

Correctly Predicted

1.015

Correctly Predicted no loop back

1 + (1 + 3 ´ (1 − 0.98)) ´ 0.08 ´ 0.5 = 1.042

Accuracy

1.005/1.042 = 0.96