

TDTS08: Lab Report

Lab 2: Instruction Pipelining

Name	PIN	Email
Alexander Yngve	930320-6651	aleyn573@student.liu.se
Pål Kastman	851212-7575	palka285@student.liu.se

Contents

1	Introduction	3
2	Pipeline basics I	3
3	Pipeline basics II	3
4	Branch prediction	4
4.1	Description	4
4.2	Solution	4

1 Introduction

The purpose of this lab is to learn how instruction pipelining works and how branch prediction affects the performance of the pipeline.

2 Pipeline basics I

IF	DA	CO	FO	EX	WB
----	----	----	----	----	----

Figure 1 – Six stage pipeline.

LB instruction

IF – fetch instruction in memory.

DA – activate different parts in the cpu depending on the instruction.

CO – calculate the address in the memory where the operand is stored.

FO – fetch operand from memory.

EX – not used.

WB – write operand to register.

ADD instruction

IF – fetch instruction in memory.

DA – activate different parts in the cpu depending on the instruction.

CO – calculate the address in the memory where the operand is stored.

FO – fetch operand from memory.

EX – compute addition.

WB – write result to register.

The main difference for the two instruction is that LB doesn't need to use the instruction execute (EX) state, since its only loading data from the memory.

3 Pipeline basics II

When we have a short pipeline we get less time penalty due to that its only one step that needs redoing and therefore its detected earlier.

	1	2	3	4	5
1	IF	EX			
2		IF	EX		
3			IF	EX	
4				IF	EX

Figure 2 – Ideal pipeline operation.

	1	2	3	4	5	6
1	IF	EX				
2		IF	EX			
25			IF			
4				IF	EX	
5					IF	EX

Figure 3 – Pipeline operation during conditional jump.

4 Branch prediction

Here we analyze how the different branch prediction algorithms perform.

4.1 Description

For each predictor a benchmark was run according to the following command

```
sim-outorder -bpred predictor ~/TDTs08/bin/go.ss 3 8
```

4.2 Solution

The performance result can be seen in figure 4 below.



Figure 4 – Performance of the different branch prediction algorithms