

EECS 370 Notes

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Abstract

EECS 370 lecture notes.

Contents

1	Pipelining	2
1.1	Data Hazards	2
1.2	Figures	3
1.3	Commutative Diagram	3
1.4	Fancy Stuffs	4
2	Known Bugs	6
2.1	Introduction	6
A	Additional Proofs	9
A.1	Proof of Theorem 1.1.1	9

Chapter 1

Pipelining

Lecture 13: Data Hazards and Forwarding

1.1 Data Hazards

16 Feb. 1:30

Definition 1.1.1 (Data hazard). *Data hazards* occur if one instruction uses a register value that hasn't been updated by a prior instruction yet.

Note. Assume the register file yields the correct value of a register when read/written during the *same* cycle. This is consistent with most processors (eg. ARM/x86), but not Project 3.

Definition 1.1.2 (Natural number). We denote the set of *natural numbers* as \mathbb{N} .

Lemma 1.1.1 (Useful lemma). Given the axioms of [natural numbers](#) \mathbb{N} , we have

$$0 \neq 1.$$

An obvious proof. Obvious. ■

Proposition 1.1.1 (Useful proposition). From [Lemma 1.1.1](#), we have

$$0 < 1.$$

Exercise. Prove that $1 < 2$.

Answer. We note the following.

Note. We have [Proposition 1.1.1](#)! We can use it iteratively!

With the help of [Lemma 1.1.1](#), this holds trivially. ⊛

Example. We now can have $a < b$ for $a < b$!

Proof. Iteratively apply the exercise we did above. ⊛

Remark. We see that [Proposition 1.1.1](#) is really powerful. We now give an immediate application of it.

Theorem 1.1.1 (Mass-energy equivalence). Given [Proposition 1.1.1](#), we then have

$$E = mc^2.$$

Proof. The blank left for me is too small,^a hence we put the proof in [Appendix A.1](#). ■

^ahttps://en.wikipedia.org/wiki/Richard_Feynman

From [Theorem 1.1.1](#), we then have the following.

Corollary 1.1.1 (Riemann hypothesis). The real part of every nontrivial zero of the Riemann zeta function is $\frac{1}{2}$, where the Riemann zeta function is just

$$\zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s} = \frac{1}{1^s} + \frac{1}{2^s} + \frac{1}{3^s} + \cdots.$$

Proof. The proof should be trivial, we left it to you. ■

TODO

As previously seen. We see that [Lemma 1.1.1](#) is really helpful in the proof!

Internal Link

You should see all the common usages of internal links. Additionally, we can use citations as [\[New26\]](#), which just link to the reference page!

1.2 Figures

A simple demo for drawing:

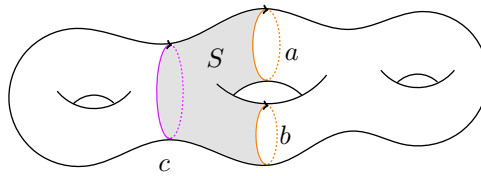


Figure 1.1: A 3-torus.¹

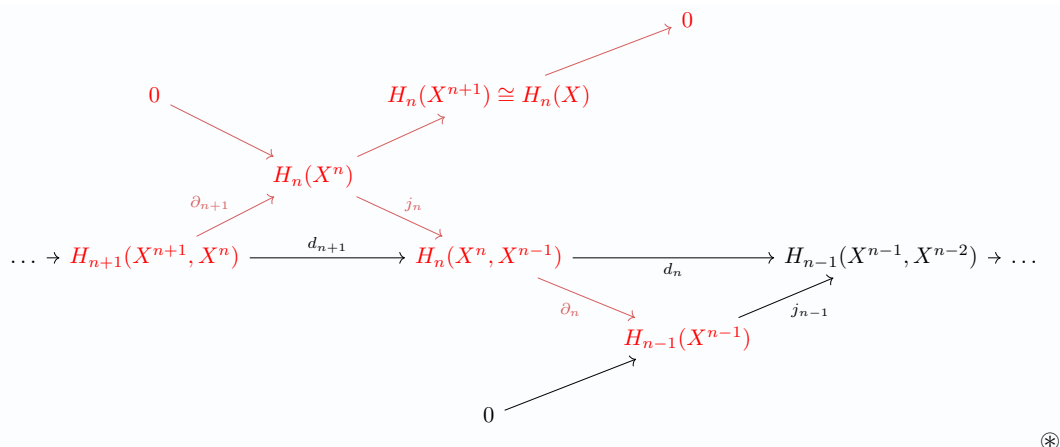
1.3 Commutative Diagram

We can use the package `tikz-cd` to draw some commutative diagram.

Example. The cellular homology agrees with singular homology.

Proof. The following commutative diagram shows everything.

¹For detailed information, please see <https://github.com/sleepymalc/VSCoDe-LaTeX-Inkscape>.



But this can be achieved by modify the header in an obvious way.²

²This time I mean it!

Chapter 2

Known Bugs

Lecture 2: Second Lecture

2.1 Introduction

9 Sep. 08:00

Nothing is bugs-free. There are some known bugs which I don't have incentive to solve, or it is hard to solve whatsoever. Let me list some of them.

2.1.1 Footnote Environment

It's easy to let you fall into a situation that you want to keep using `footnote` to add a bunch of unrelated stuffs. However, with our environment there is a known strange behavior, which is following.

Example. Footnote!^a

Remark. Oops! footnote somehow shows up earlier than expect!^a

^aThis is a footnote!

^aThis is another footnote!

Bugs caught!^b

^bThe final footnote which is ok!

As we saw, the footnote in the **Example** environment should show at the bottom of its own box, but it's caught by **Remark** which causes the unwanted behavior. Unfortunately, I haven't found a nice way to solve this. A potential way to solve this is by using `footnotemark` with `footnotetext` placing at the bottom of the environment, but this is tedious and needs lots of manual tweaking.

Furthermore, not sure whether you notice it or not, but the color box of **Remark** is not quite right! It extends to the right, another trick bug...

2.1.2 Mdframe Environment

Though `mdframe` package is nice and is the key theme throughout this template, but it has some kind of weird behavior. Let's see the demo.

Proof of Theorem 1.1.1. We need to prove the followings.

Claim. $E = mc^2$.

Proof. Nonsense.

Nonsense,
Nonsense,
Nonsense,
Nonsense,
Nonsense.

⊗



I expect it should break much earlier, and this seems to be an **algorithmic issue** of **mdframe**. One potential solution is to use **tcolorbox** instead, but I haven't completely figure it out, hence I can't really say anything right now.

Appendix

Appendix A

Additional Proofs

A.1 Proof of [Theorem 1.1.1](#)

We can now prove [Theorem 1.1.1](#).

Proof of [Theorem 1.1.1](#). See [here](#).



Bibliography

- [New26] I. Newton. *Philosophiae naturalis principia mathematica*. Innys, 1726. URL: <https://books.google.com/books?id=WeZ09rjv-1kC>.