How to read a paper

for a Part III Essay

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Overview

> "Begin at the beginning," the King said, very gravely, "and go on till you come to the end: then stop."
>
> – *Lewis Carroll, Alice in Wonderland*.

This does not work for academic papers!

Overview

Five Steps

- Step 1: Quick read through — What is the paper about?
- Step 2: Consider — Digest what it's about.
- Step 3: "Read around" — Gather other viewpoints.
- Step 4: 2nd read through — Solidify your understanding.
- Step 5: Nitty gritty read through — Drill deeper.

It's much easier to read the details in a paper when you already have a rough idea about the main message.

Choosing Essay Topic

Before reading papers

- Read essay topic descriptions.
- Perhaps read abstracts of some indicated papers.
- Talk to Essay Setter. (Sometimes this is “group meeting”.)

Interested in several topics?

- It’s ok to attend several such “first meetings”.
- Attending first meeting doesn’t commit you to the essay.
- Get a feel for the “style of maths” (and perhaps “style of papers”) involved in the topics.
- Which of those are you willing/interested to “wrestle” with?

Step 1: Quick read through

Take 1/2 - 1h.

Aim: What is this paper about? Main result(s)?
Get a feel for the style of maths needed.
(Within main area? Using links to other areas? ...)

Pure Maths

- Abstract
- Introduction: in detail
- Main results
- Definitions
- Constructions

Applied Maths

- Abstract
- Introduction
- Look at pictures/graphs
- Conclusions
- Think about how they might have got there

Ok to do (minor version of) this for main paper of 2-3 essays.

Step 2: Consider

- What is the paper about?
- Outline of the paper?
- Main results / theme?
- Where is the “meat” of the paper?
- Why is it interesting/important?
- Which are the bits you’ll have to “unpack”?

Can you already see what the main message of the paper is?
(Not nec. possible at this point: but keep thinking about it.)

Step 2: Consider

Pure Maths: 5 minute explanation of proof of main result

- Can you break it down into some “sub-theorems”?
- Does the proof “translate” the problem into another area?
- Is it a “here is the construction of the thing we say exists”?
- Or is it “if that existed, then this other thing would exist, but we know it doesn’t”?

Stats: main algorithm

- What is/are the main idea(s) for the algorithm?
- Can you describe the key steps of the algorithm?
- What is the intuition for different steps?
- Intuitively, what might the conditions be needed for?
- What simple settings/examples could this be applied to? What results would it give?

Step 2: Consider

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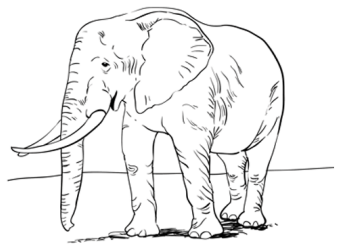
Step 3: “Read around”

Aim: Get variety of view-points.
Get background, earlier (easier) versions of results,
context the work sits in.
How is this paper used in other work?

Read (as above)

- Papers referred to in the paper.
- Other papers by same author(s) in same area.
- Papers which use/refer to this paper.
  ($\longrightarrow$ MathSciNet)



Contributions to building up a picture.

Step 4: 2nd read through

Pure Maths

- Read results, definitions, constructions in more detail.
- Take example/simple case along.
- Skip technical details.

Applied Maths

Work through middle of paper

- Understand methods used
- see which equations were used
- what approximations were made

Iterate 2-4 as needed.

Decisions

At some point in this iteration:

- Will I stick with the essay?
- Which bits will I “unpack” further?
- What direction will I take my essay?
- Make outline.

Take outline to Essay Setter: discuss.

Step 5: Nitty gritty read through

Pure Maths

- Look in detail at hypotheses: where used?
- Technical or “fundamental” reasons?
- Any “implicit” hypotheses?
- Consider with relaxed conditions
  “What happens if ....”

Applied Maths

- Look in detail at methods and approximations
- For which parameters does this method apply?
- When does it not apply?

Next term: From Outline to Essay.

Go and enjoy reading research papers!