An Introduction to Research Practices in Computer Science

- Tiny details for doing research

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ssn

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Outline

- Preamble
  - Motivation
  - Abstraction
  - Terminologies
- Doing research
  - CS Research areas
  - Workflow
  - Discussion and Idea
- Writing up research
  - Methods
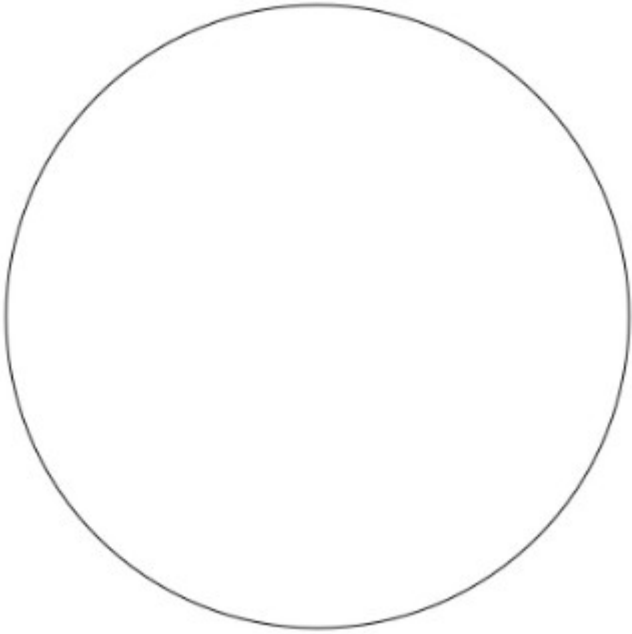 - Standard Template
  - General Tips
- Demo

Prerequisites
DSA

Motivation

Seeking to find answers to the unknown (why?)
Questions are a natural thing of
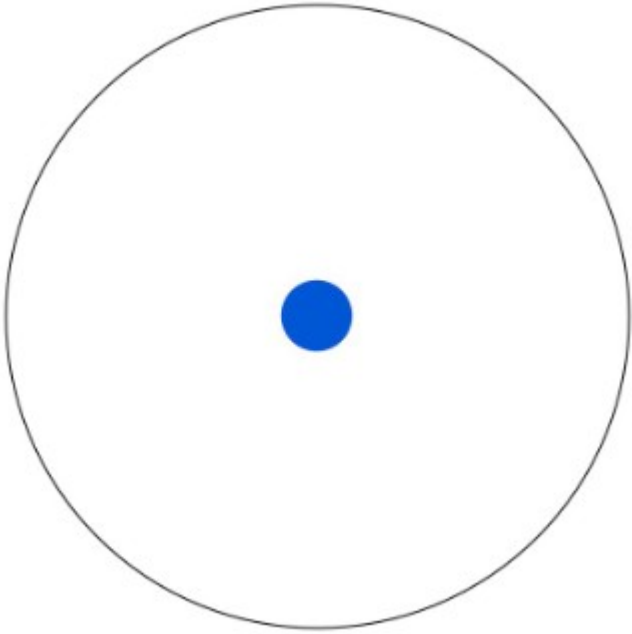a <u>curious</u> mind.

E.g. A child with a new toy
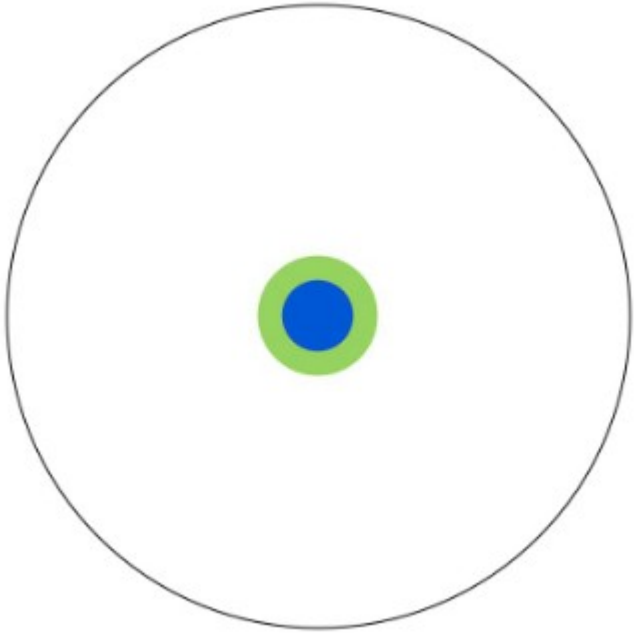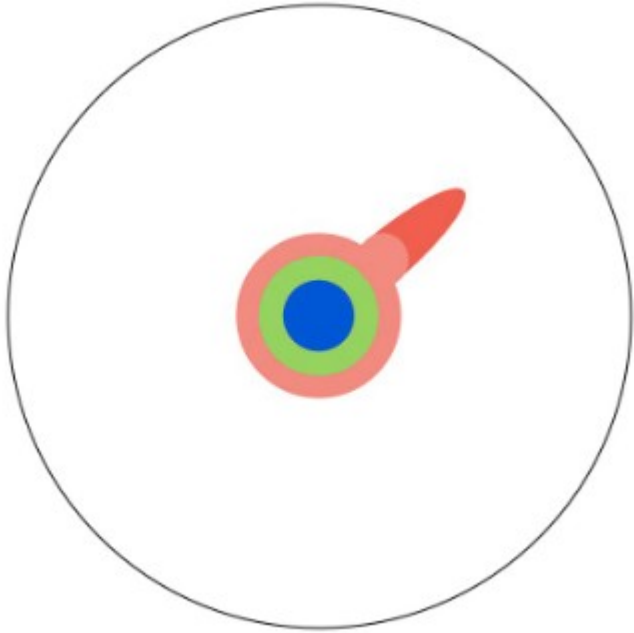
Research: 10000-feet view

Research: 10000-feet view

Research Practices Talk @ SSN

Research: 10000-feet view

Prof. Matt Might's blog https://matt.might.net/articles/phd-school-in-pictures/

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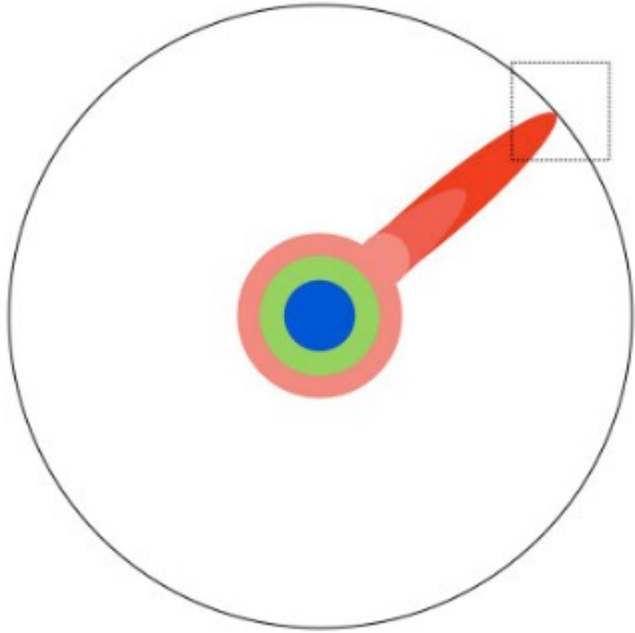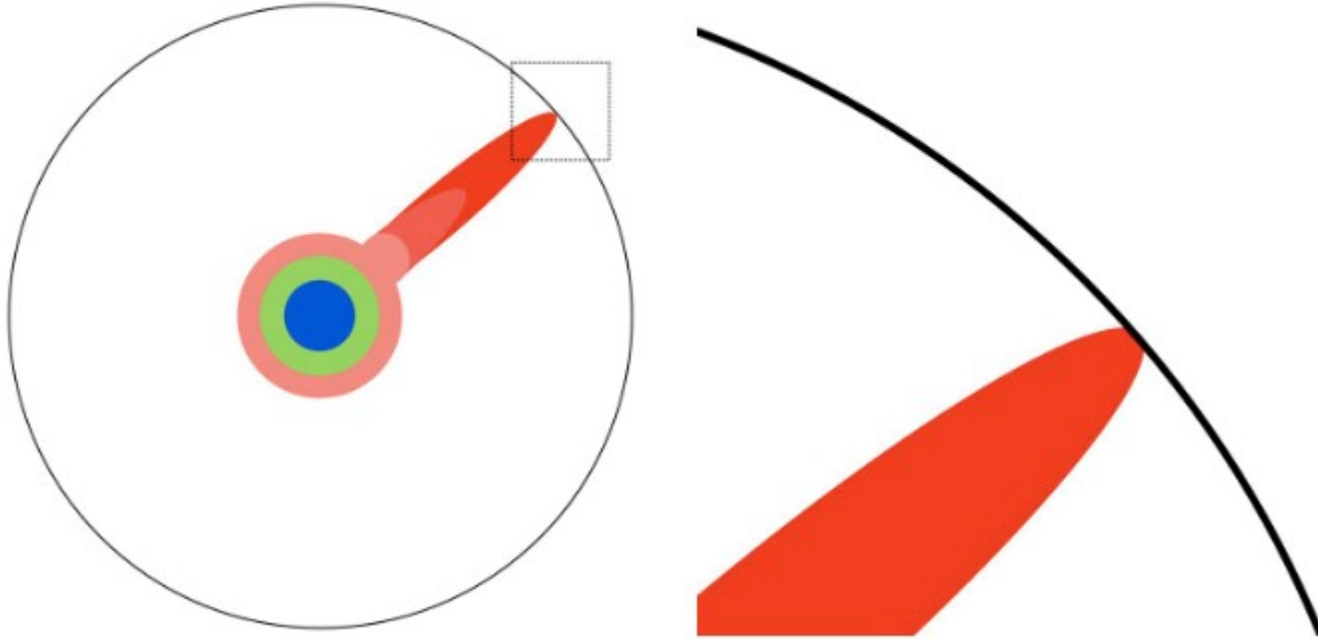
Research: 10000-feet view

Research: 10000-feet view

Research: 10000-feet view

Abstraction

- Google Map: Route from home to College
- Internet: Routing protocol
- Google Map: Show me the restaurants nearby
- Friends suggestion in facebook

- Shortest Path Problem
- Single Source Shortest Problem
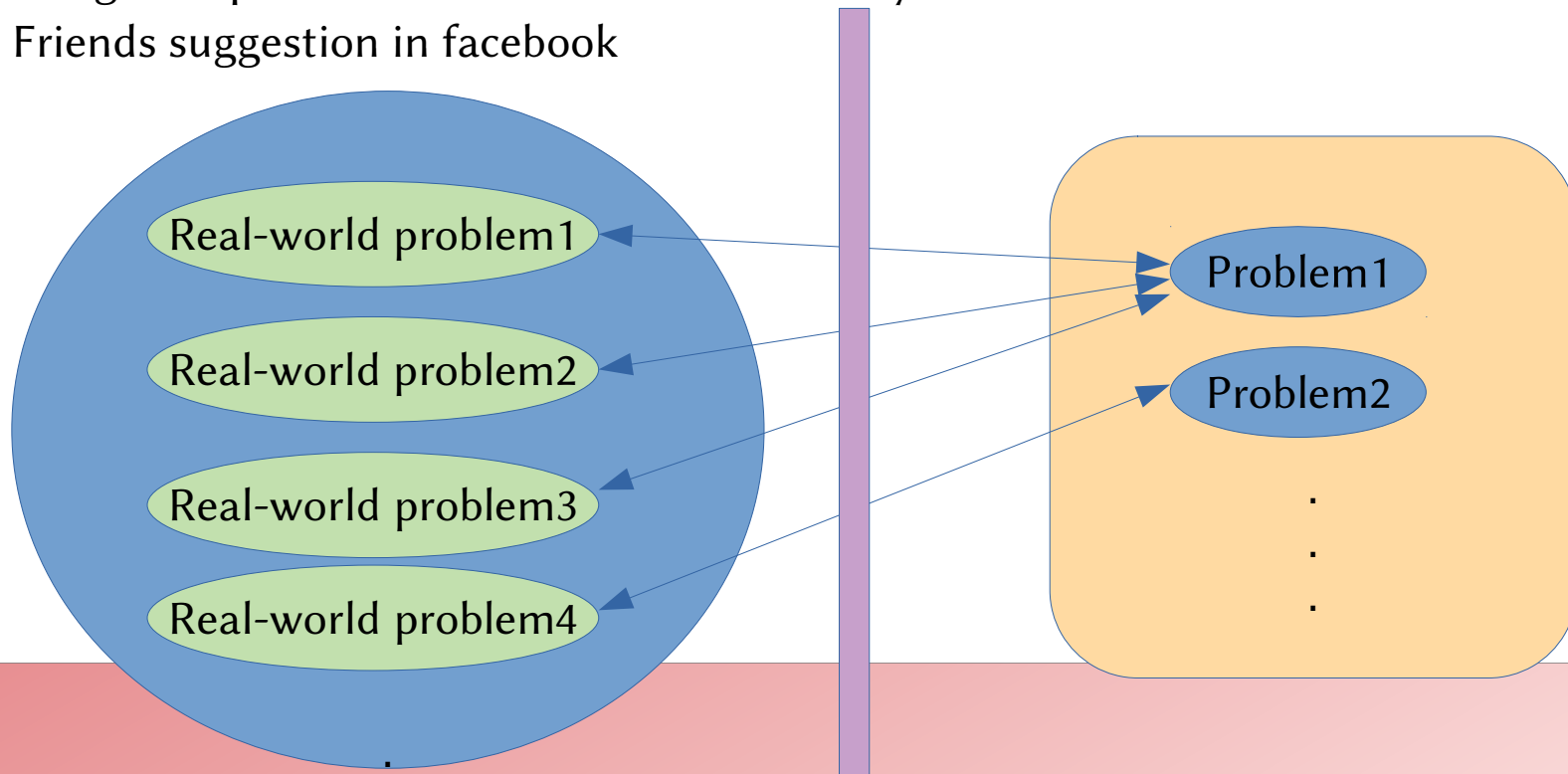
Terminologies

- Research Work
- Research Problem
- Literature

- Write-up = Text version of idea
- Venue = Conference/Journal
- Paper = Published work
- Manuscript = Unpublished work

CS Reseach

- Theory CS

- Systems

- Intelligent Systems

CS Reseach

- **Theory CS**
  - Algorithms, Graph theory,
  - Logic, Complexity,
  - Cryptography, ..
- Systems

- Intelligent Systems

Thanks to https://www.csa.iisc.ac.in/category/research/

CS Reseach

- Theory CS

- **Systems**
  - Compilers, Networks
  - DBMS, Architecture,
  - OS, Wireless,
  - Embedded, Parallel
- Intelligent Systems

Thanks to https://www.csa.iisc.ac.in/category/research/

CS Research

- Theory CS

- Systems

- <mark>**Intelligent Systems**</mark>
  - AI, ML, DL,
  - NLP, PR
  - Game theory, DS

Thanks to https://www.csa.iisc.ac.in/category/research/

How to choose research area/problem

- Most frequently asked question!

Courtesy: Tinkerbell [2008] Disney Animation Movie
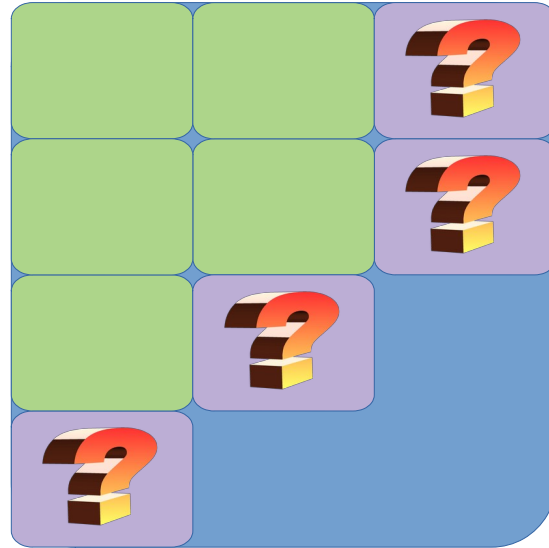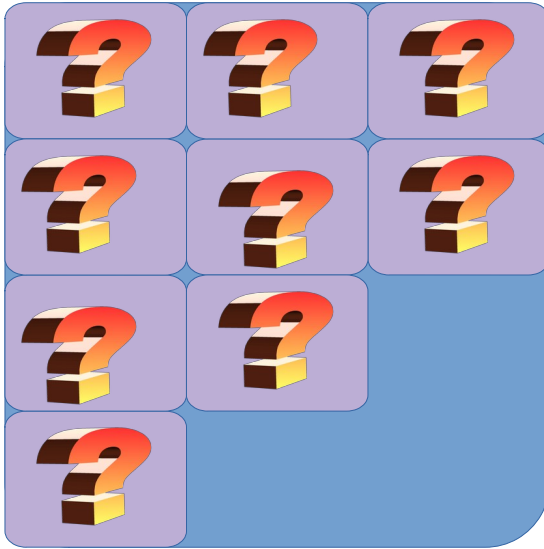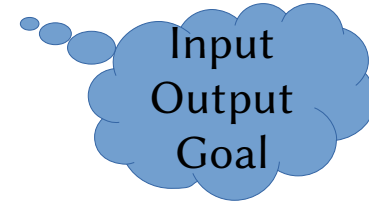
How to choose research area/problem

- Through Courses
- Attend research seminars/talks
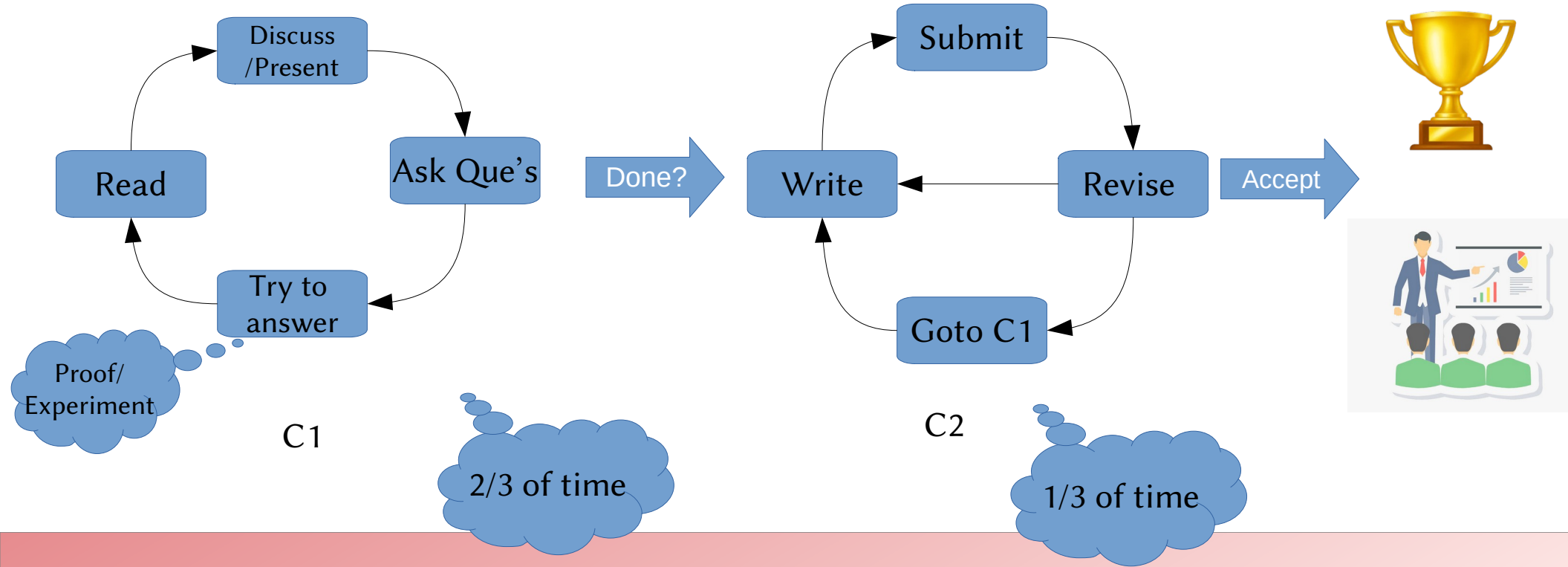- Attend conferences talks
- Read Survey papers

Useful Websites

- Google Scholar
- DBLP

Doing research – Ask and answer question

- Play with small examples --> properties
- Ask a lot of small questions
- Answer some of those
- There is a bigger question //which no one knows the answer yet!

Workflow of any research work

Read → Discuss /Present → Ask Que's → Try to answer → Read (C1)

Proof/ Experiment

Done? →

Write → Submit → Revise → Write
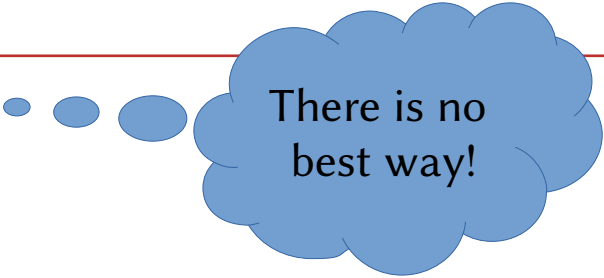
Revise → Goto C1 → Write

Accept →

C1

C2

2/3 of time

1/3 of time

Reading papers

- What is best way to read a paper?
- Read
  - Abstract and Conclusion
  - Section heading
  - Figures, Plots
  - Remaining Sections
  - Read mutiple times

There is no best way!

Reading papers

- Video-presentation in conference or,
- Seminar Talk of a Paper
- Presentation slides of a Paper

- To understand a paper better
  - While reading, in-between
  - Pause and think how would you answer the question posed?
  - Your answer might be wrong
  - But, the process helps to understand techniques in paper better :-)
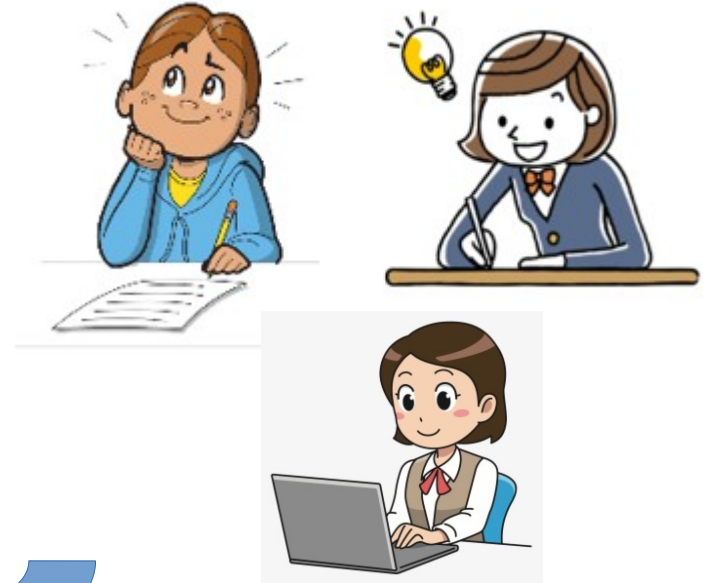
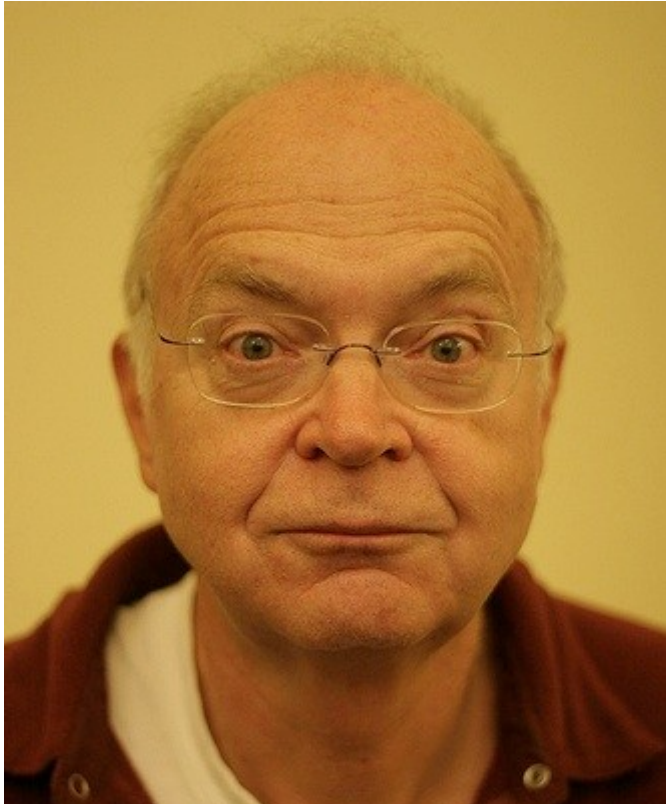# Reading papers

Have a different perspective!

Courtesy: Big hero 6, [2014] Disney Animation Movie

Discussion and Ideas

Research Practices Talk @ SSN

Writing up Research

"Of equal importance to solving a problem is the communication of that solution to others."
- Donald Knuth

Research Practices Talk @ SSN
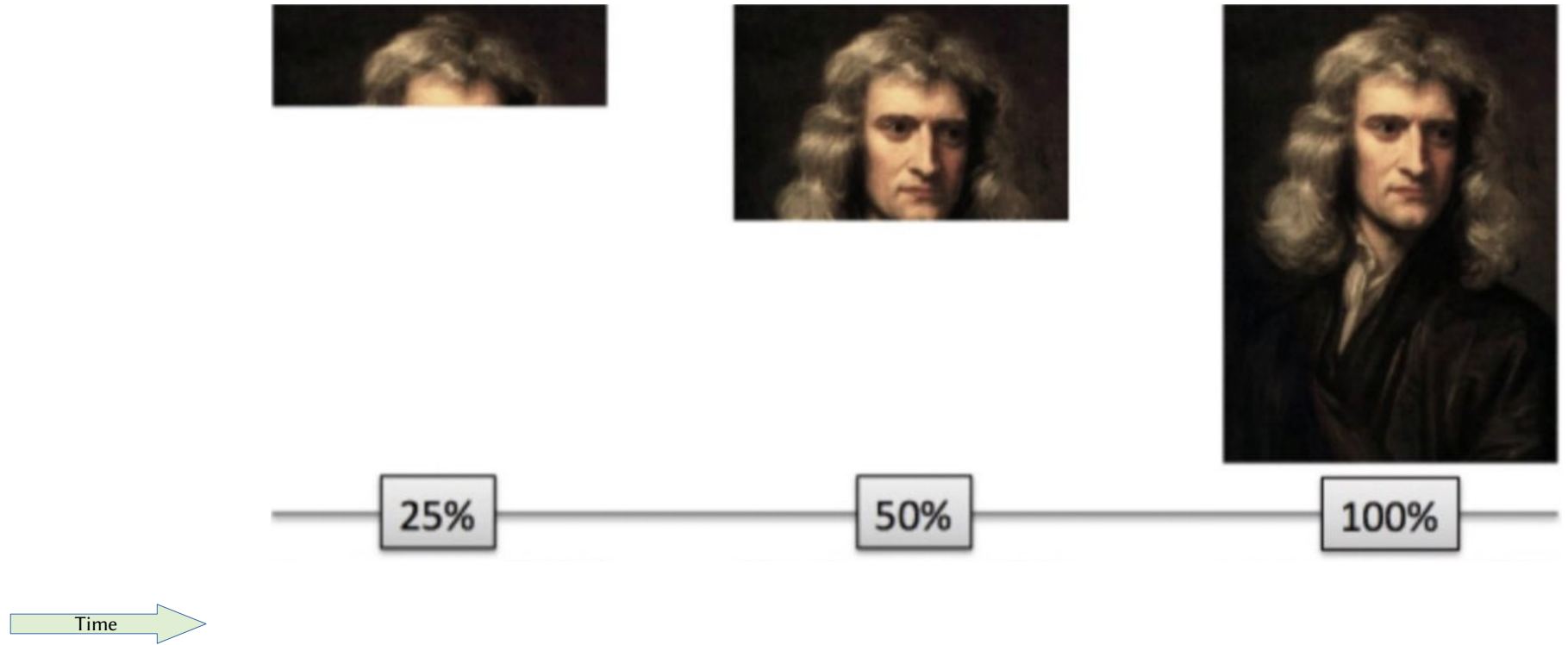
Writing – Standard Template

- Title = Concise
- Abstract = Trailer
- Section
  - Introduction
  - Related works
  - <ABC> Algorithm/Idea
  - Results/Experiments   //Tables, Figs., Plots
  - Conclusion
  - References   // BibTex

- Remember the flow of the story
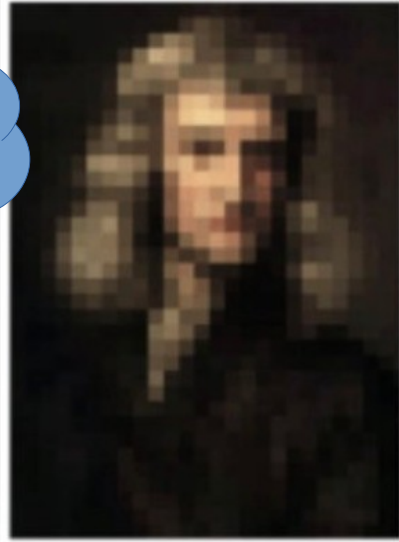- Grammar and spell-check

Writing – Ways to write

Writing – Method 1

Writing – Method 2
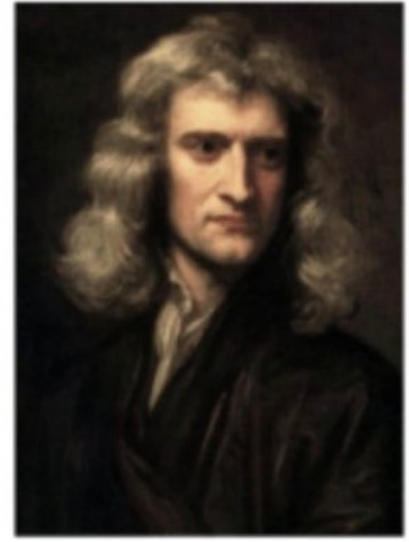
Writing – Submitting

- Conferance or Journal format (.docx or TeX)
- Page-limit (12-15pages)
- Use overleaf and LaTeX   //Must know for a CS researcher
- No Plagiarism!
- Stay away from predatory Journals!

- 45 to n days for decision
- Review type
  - Single-blind
  - Double-blind
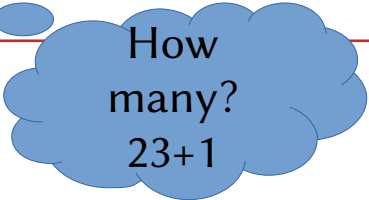
Demo

- LaTeX
  - Overleaf - How write?
  - Why it is useful?
  - Documentation

- Seaching Paper in
  - Google Scholar
  - DBLP

- Subscribing for email alerts //Google Scholar
  - Experts in field

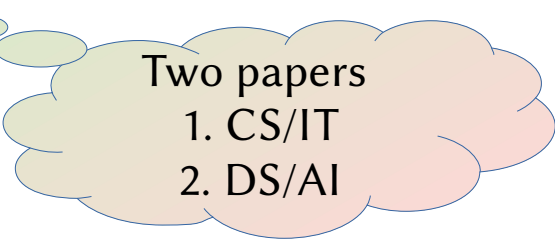- Searching Conference
  - WikiCFP

Admission to IITx/IISc

- M.Tech
  - GATE Exam https://gate.iitm.ac.in
  - AIR ~150-1100 http://mtechadm.iitm.ac.in
  - Common Offer Acceptance Portal https://iitk.ac.in/coap2024/
  - Based only GATE scores
  - GATE Rank + Interviews   //Some IIT M.Techs

- Direct PhD and M.S (Research)
  - AIR ~200-2000
  - Written test + Interview
  - https://research.iitm.ac.in

- PhD
  - Masters + Bachelors CGPA
  - Written test (GATE Level)
  - Interview to two areas.

How many? 23+1

Two papers
1. CS/IT
2. DS/AI

Projects, Interships

References

- Donald Knuth, ACM Turing awardee Post1 Post2 Post3
- Manas Thakur, Assistant Professor, IIT Bombay. Post1
- Biswabandan Panda, Assistant Professor, IIT Bombay. Post1 Post2 Post3
- Thanks to my advisors, professors, students and friends at IIT Madras for the wisdom.
- Thanks to Google Images for pictures. :-)

Questions?

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