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SE252:Lecture 10, Feb 5

# **IL01**:Parallel and Distributed Systems Context

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# ILO 1

- Parallel and Distributed Systems Context
  - *Classify* and *describe* the architecture and taxonomy of
    - » parallel and distributed computing,
    - » Shared and distributed memory, and
    - » data and task parallel computing.
  - *Explain* and *contrast* the role of Cloud computing within this space.

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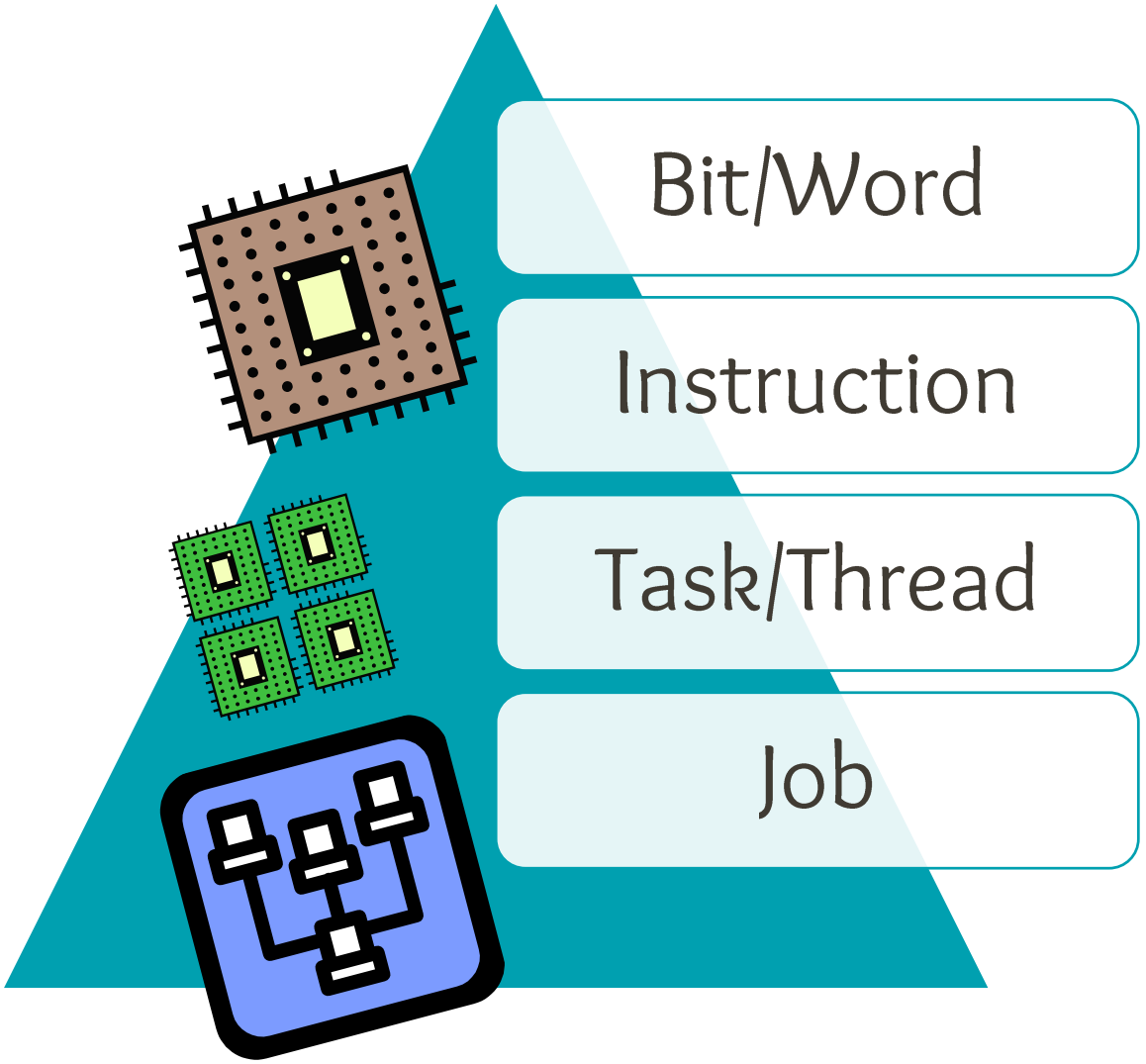
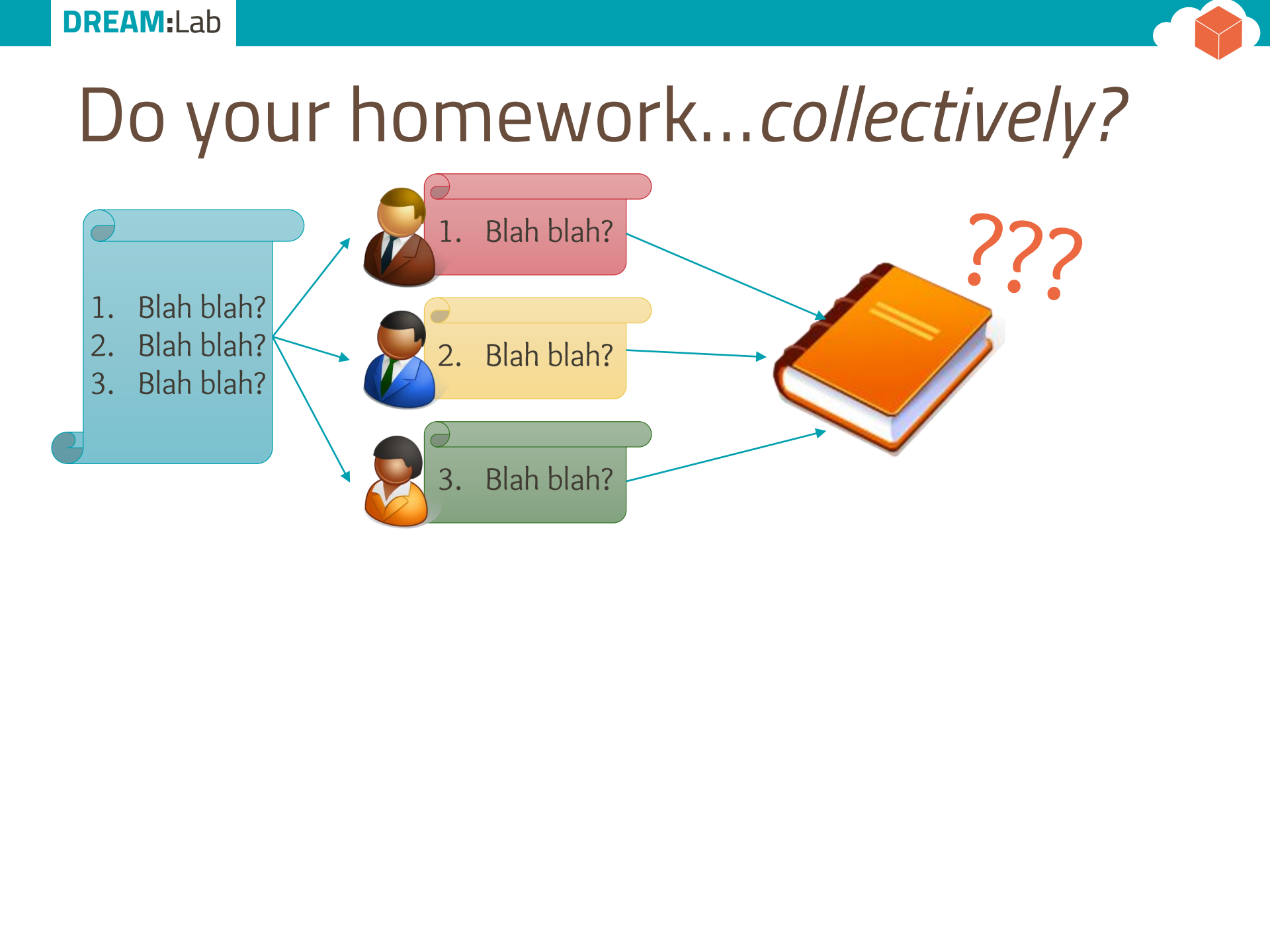
# Lecture 10

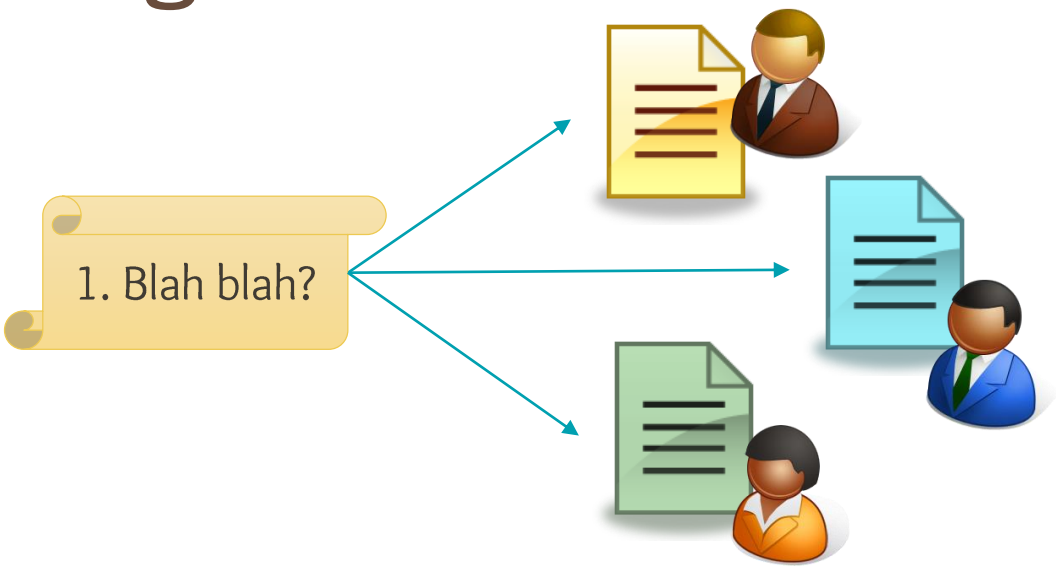
# Degrees of parallelism





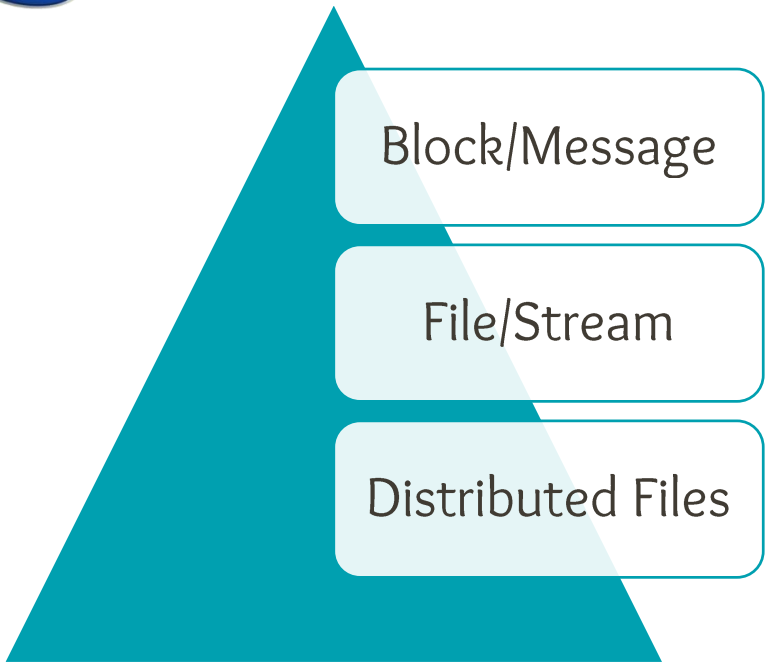
# Do your homework...*collectively?*

# Degrees of Parallelism




Do your review…*collectively?*

- Data parallel vs. Task Parallel
  - Independent processes
  - Independent data dependency



# Scalability

- **System Size**: Higher performance when adding more machines
- **Software**: Can framework and middleware work with larger systems?
- **Technology:** Impact of scaling on time, space and diversity
- **Application**: As problem size grows (compute, data), can the system keep up?
- **Vertical vs Horizontal:** ?
- …

# Scalability

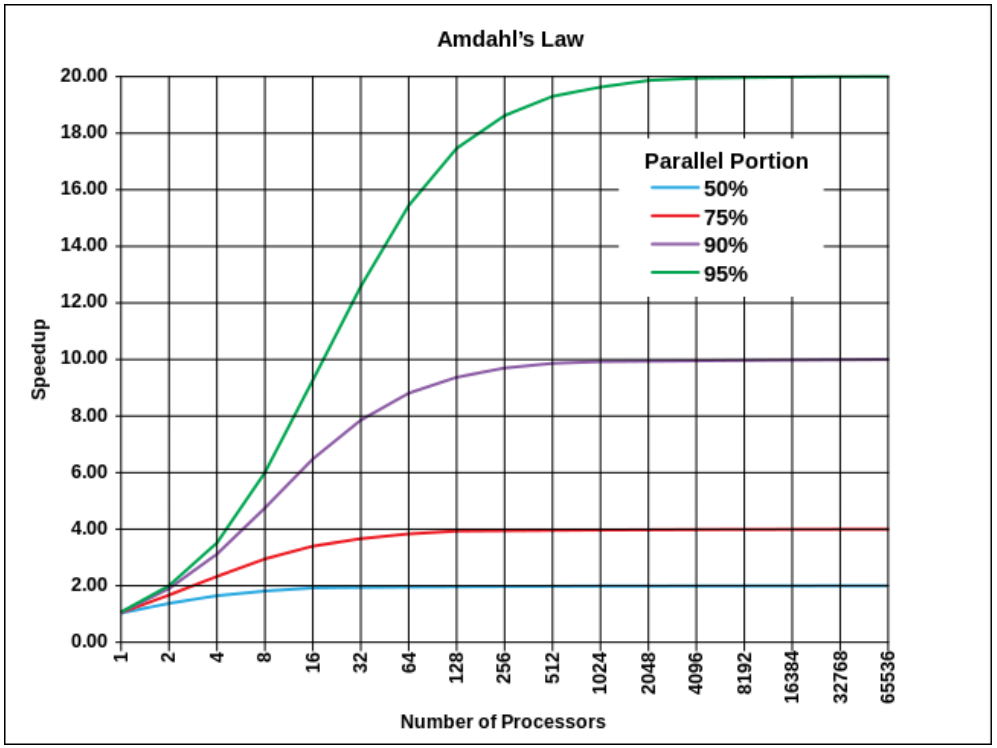
- Amdahl's Law for Application Scalability
  - *Speedup limited by sequential bottleneck*
- **T**: total time on uni-processor
- **a**: fraction of code that is sequential
- Total exec time on **p** processors is:

$$T_p = a.T + (1-a).T/p$$

- Speedup $S_p = T/[a.T + (1-a).T/p]$

$$= 1/[a + (1-a)/p]$$

# Amdahl's Law

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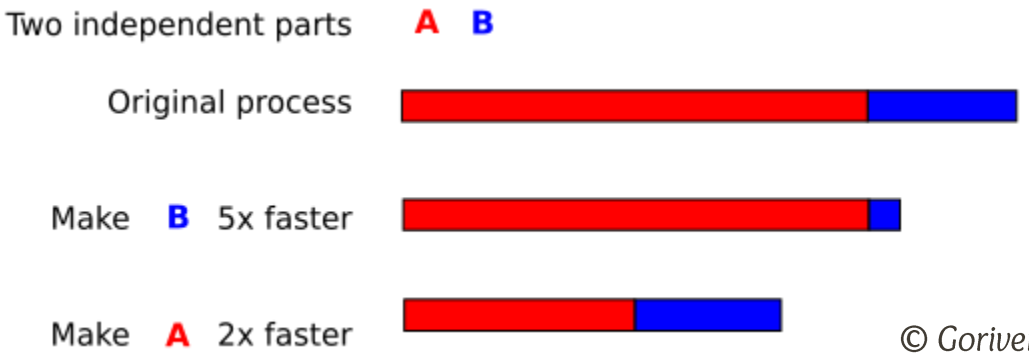


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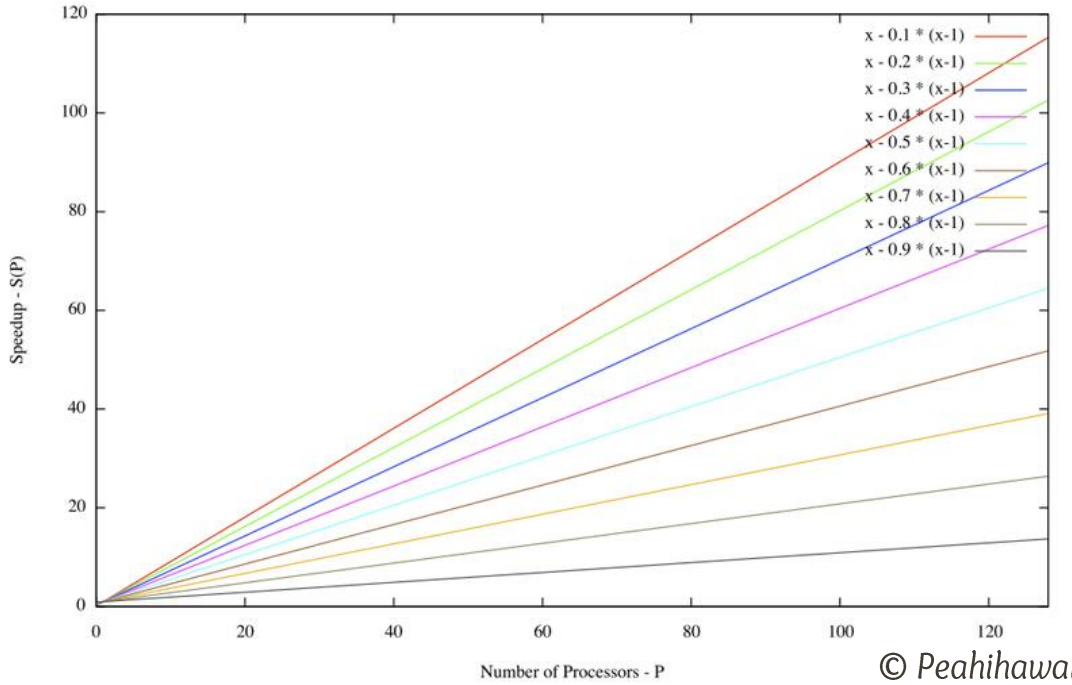
# Scalability

- Gustafson's Law
  - $S_p = p - a.(p-1)$
  - "Scaled speedup"
  - Problem size increases with # of processors



# Scalability

- Strong vs. Weak Scaling
- **Strong Scaling**: How the performance varies with the # of processors for a *fixed total problem size*
- **Weak Scaling**: How the performance varies with the # of processors for a *fixed problem size per processor*

# Availability

- Up time of the system
- Limit single points of failures
- Mean time to failure *(MTTF)*
- Mean time to recovery *(MTTR)*
- Availability = `MTTF / [MTTF + MTTR]`

- *What happens as system size increases?*

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# How to Review a Paper

# Three Pass Reading*

## Pass 1 *(~15 mins)*

- Title, Abstract, Introduction
- Section, Sub-section headings
- Glance at math, formulae
- Read conclusions
- Glance at references

- *Category, Context, Correctness, Contributions, Clarity*

*How to Read a Paper, S. Keshav, 2013

# Three Pass Reading

## Pass 2 *(~2 hours)*

- Read carefully, skip fine details, proofs
- Note down confusing terms, definitions
- Review figures carefully
- Note down references to follow up

- *Grasp the paper contents*
- *Summarize key ideas convincingly*

*How to Read a Paper, S. Keshav, 2013

# Three Pass Reading

## Pass 3 *(~4-6 hours)*

- "Re-implement" the paper
- Identify hidden assumptions, failings
- Challenge every assumption
- Mark ideas for future work
- Identify missing citations

- *Rewrite paper*

*How to Read a Paper, S. Keshav, 2013

# Adversarial Reviewer

- "gut feeling, or a lack of enthusiasm for the problem"
- "seek out every last negative point"
- **Goldilocks:** Damned if you do, damned if you don't
- "If you can't say something nasty, don't say anything at all"
- "revision by a native English speaker"
- "authors consider problem X; however, a more fundamental aspect is Y"

How NOT to review a paper: The tools and techniques of the adversarial reviewer, Graham Cormode, SIGMOD Record, December 2008 (Vol. 37, No. 4)

# Adversarial Reviewer

- "This paper leaves many questions unanswered."
- "The results are open to other interpretations."
- "This is far from the last word on the subject."
- "Some claims are questionable."
- "The paper is of limited interest."

How NOT to review a paper: The tools and techniques of the adversarial reviewer, Graham Cormode, SIGMOD Record, December 2008 (Vol. 37, No. 4)

# Questions to Consider

- What are *motivations* for this work?
- What is the proposed *solution*?
- What is your analysis of the identified problem, idea and evaluation?
- What are the *contributions*?
- What are *future directions* for this research?
- What questions are you left with?
- What is your take-away message from this paper?

How to Read an Engineering Research Paper, William G. Griswold

# Review Report *(2 pages)*

- ***Rewrite the abstract*** with an outline of the main points of the paper and conclusions
- ***Critical Review***: Reading a research paper must be a critical process. You should not assume that the authors are always correct. Instead, be suspicious.
- ***Creative Review***: Reading creatively involves harder, more positive thinking. What are the good ideas in this paper? Do these have other applications? Are there possible improvements?
- ***Compare related work***: Are the ideas really novel, or have they appeared before? What are the similarities?
- ***Conclude*** with your opinion of the paper

How to read a research paper, Michael Mitzenmacher