学术研究方法浅论

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马 帅

提纲

- 科研是什么？
- 数学对计算机意味着什么？
- 如何读/写论文
- 如何制定目标
- 基础计算机书籍推荐

是甄士隐言？

还是贾雨村？

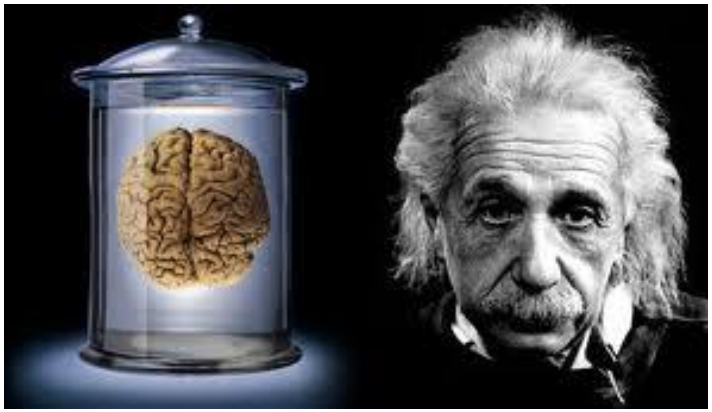
☺一家之言☺

科研是什么？

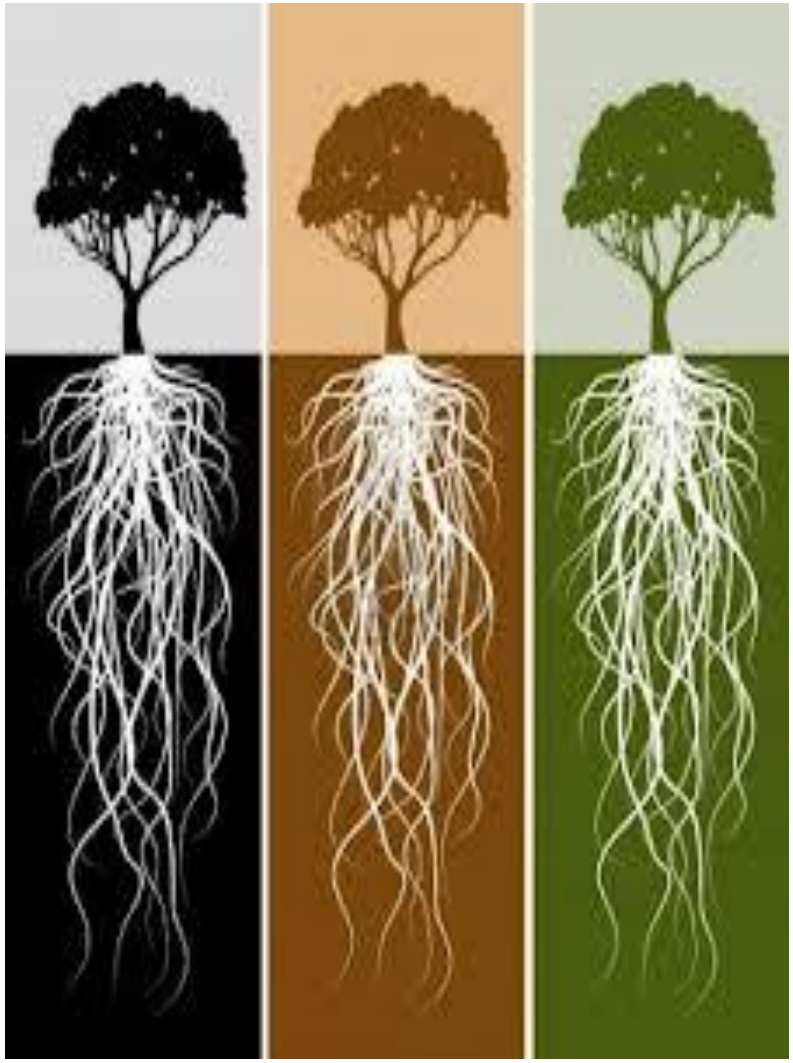
科研是什么之创新性

- 工程强调的是work
- 科研强调的是innovation

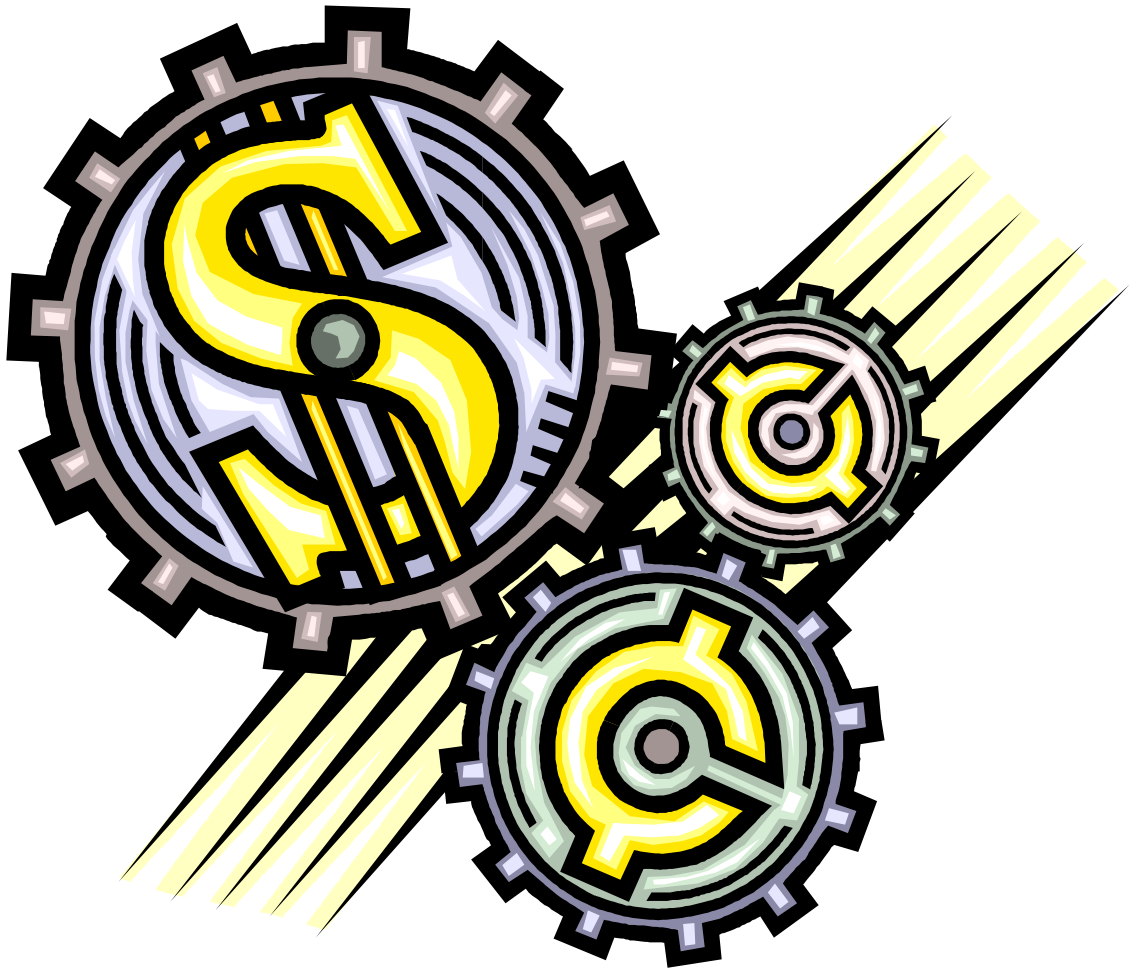
科研是什么之疯狂的脑袋



科研是什么之根深叶茂



科研是什么之节点控制



科研是什么之合作与独立

科研是什么之根与主干

- 坚持主流研究方向
  - 要有“根”，要有“主干”
  - 可以有“细枝”，可以有“末梢”
- 根
  - 系统
- 主干
  - 分布式计算、
  - 软件与服务、
  - 数据库/数据挖掘

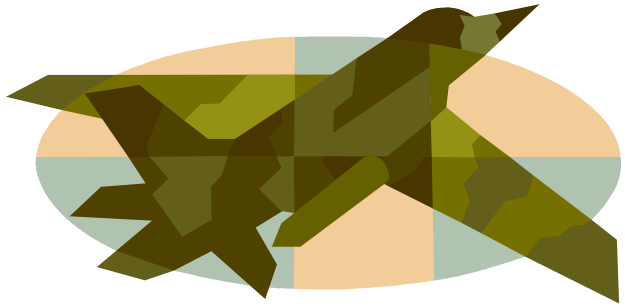
科研是什么之集中优势兵力

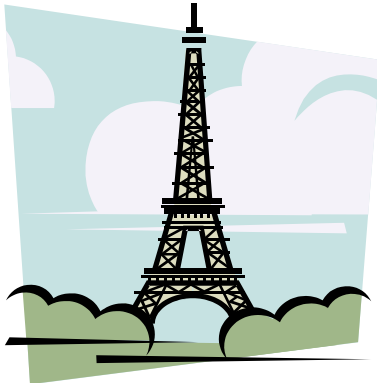
- 瞄准一个方向的列表（会议和期刊）
- 两点要求：
  - 博士生和硕士生文章只能发表列表中的会议和期刊（专利不算数）
  - 杜绝剽窃-可耻

科研是什么之学术道德

违法必究，执法必严！

科研是什么之。。。





数学对计算机意味着什么？

数学奇才是计算机之父

- 众所周知，1946年发明的电子计算机，大大促进了科学技术的进步，大大促进了社会生活的进步。
- 鉴于冯·诺依曼在发明电子计算机中所起到关键性作用，他被西方人誉为"计算机之父".

数学对计算机的重要性

- 数学修养的潜移默化
- 提高空间思维能力和逻辑判断能力
- 数学的训练对科研有着积极重要的作用

How to read/write papers

How to Evaluate a Paper?

- Novelty of the problem (25%)
- Technical depth (25%)
- Writing (25%)
- Experiments (25%)

How to Get the Idea?

- Positive
  - For any idea, you can always do something
- Negative
  - Extremely challenging to get good ideas.
    - Repeated work is NOT called research!
  - Observation – using your brain
  - Refine, refine and refine, but with an expectation in your mind!
  - Explain by examples

How to Get the Solution?

- Complexity analysis
  - PTIME, NP, EXPTIME, …
- Approximation analysis for NPC problems
  - With performance guarantees
- Heuristic solutions
  - With certain properties
- No fixed rules to follow for algorithm design
  - Fully understand the problem
  - Designed algorithms based on the special characteristics for the problem itself

How to Write the Paper?

- It is art - very difficult!
  - Practice, practice and practice!
  - Writing, writing and writing!
  - Proofreading, proofreading, and proofreading!
- If people could not understand your writing, they could not evaluate your work.
  - Sir Isaac Newton
- Two good habits
  - Writing down and remember good sentences when you are reading papers
  - Ask your “friends”, who could speak truth to you, to check what you have written

How to do Experiments?

- Design experimental plans
- Show people the idea is good, and the solution is good
- Datasets
  - Real life data
  - Synthesized data
- Always remember what you need to show to people!

Stages of Paper Submission

- Submission
- Feedback (optional)
- Shepherd (optional)
- Acceptance/Rejection notification
- Preparing camera ready
- Experimental repeatability (optional)
- Attend conference/present your work
  - Make big noises
  - Show people your good work

Two Rules

- WWH rule
  - What, why, how
- Think about everything from the view point of reviewers

One Warning

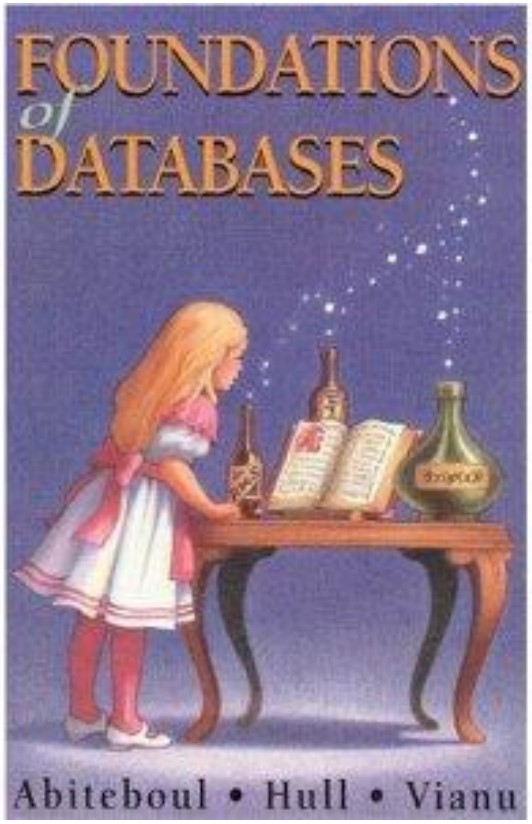
- NO plagiarism…

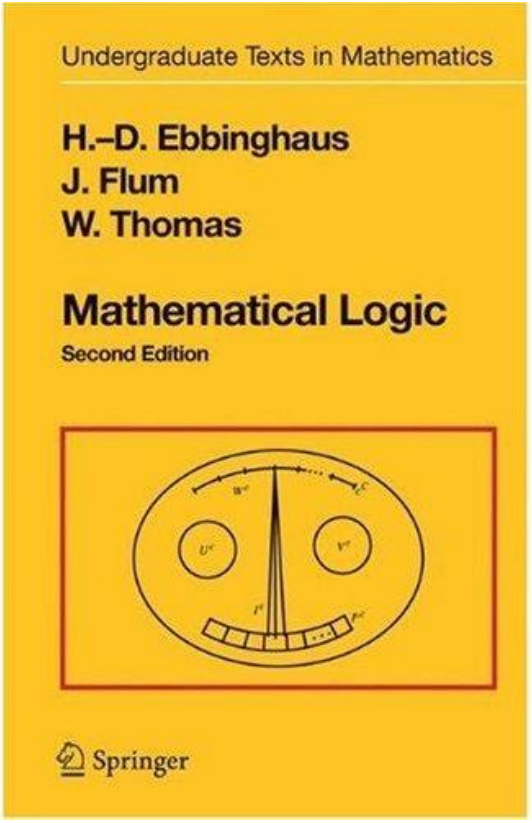
如何制定目标？

- 管理学大师杜拉克提出制定目标的“SMART”法则：
  - S (specific)：明确，不能只是形容概括
  - M (measurable)：可衡量，需要量化
  - A (attainable)：可达到的，不能是遥不可及的
  - R (relevant)：结果导向：与长远目标具有相关性
  - T (time-based)：有时限的

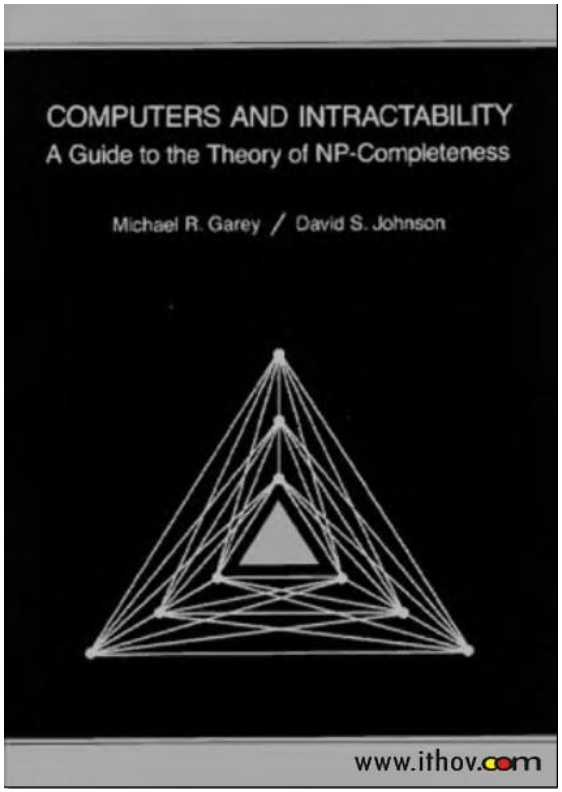
Book Recommendation

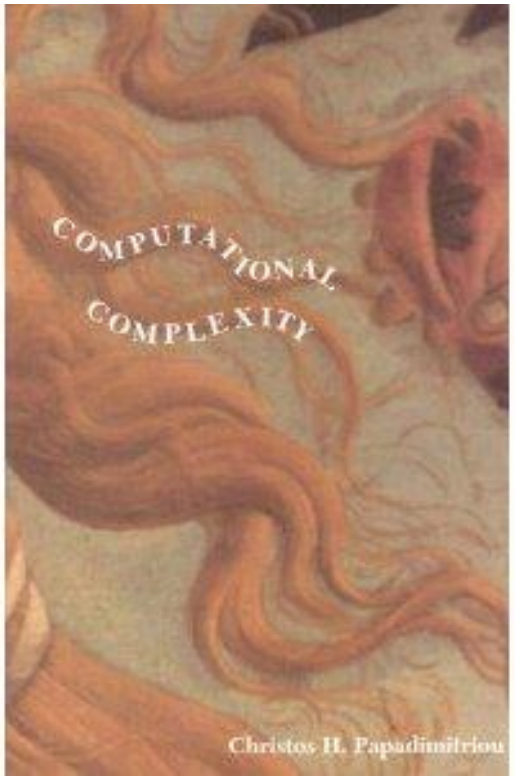
Databases and Logic



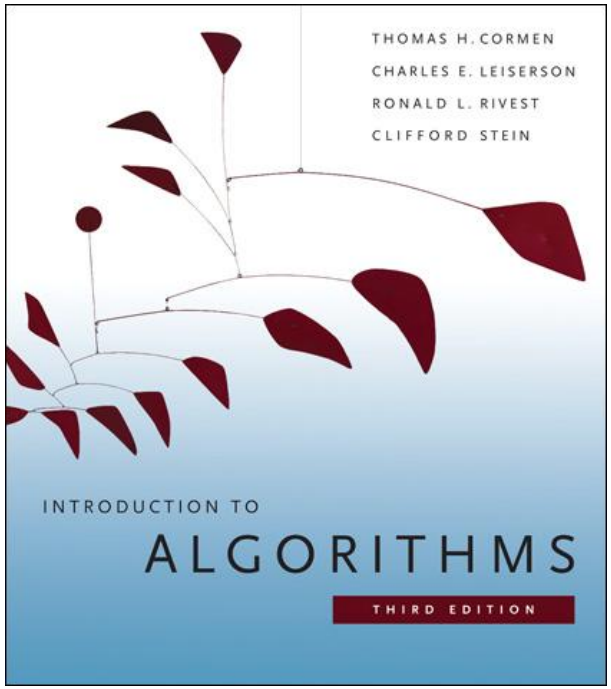


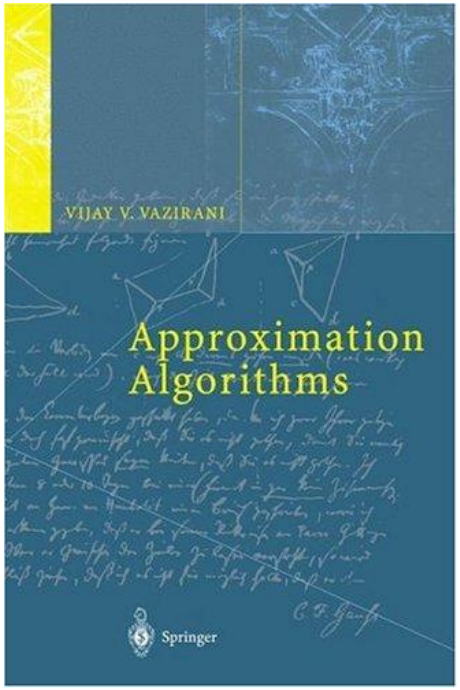
Computational Complexity

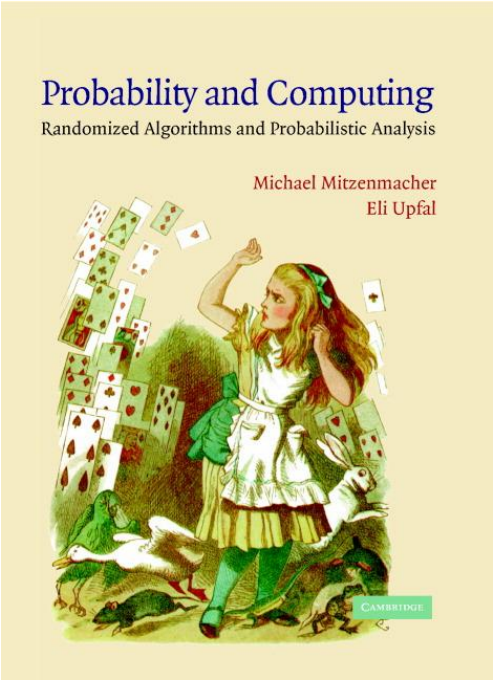




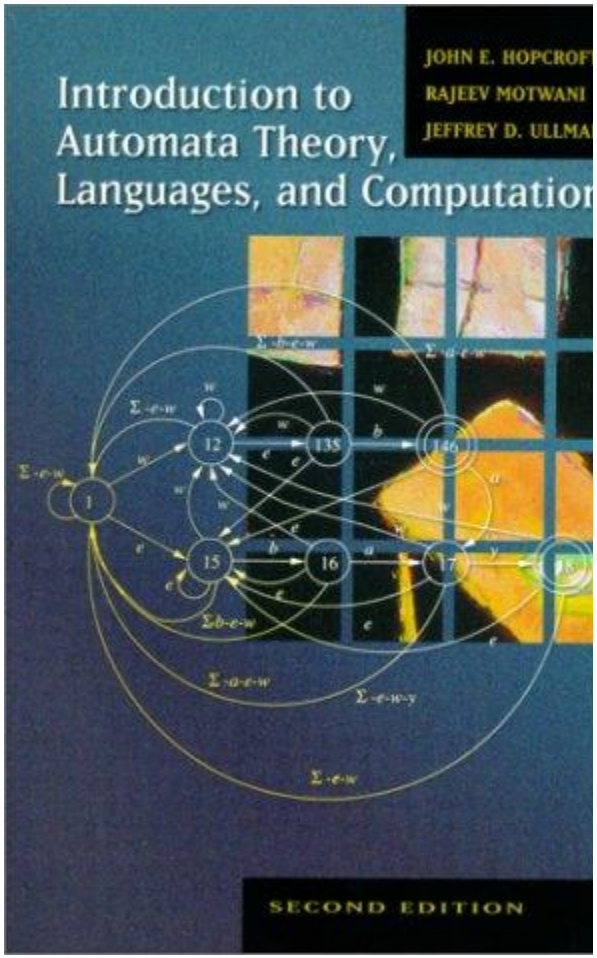
Algorithms

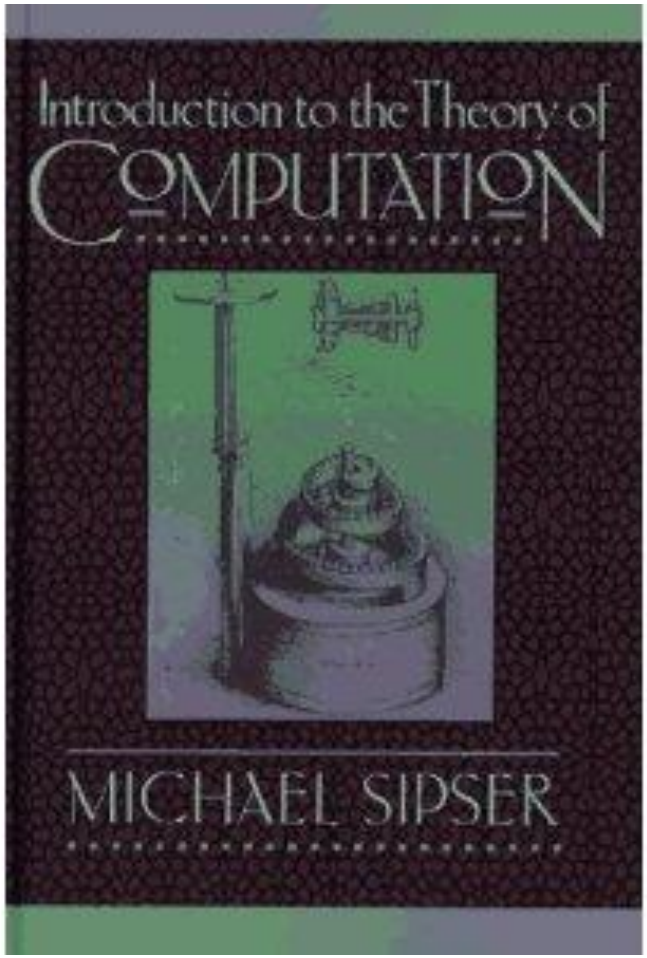

THOMAS H. CORMEN
CHARLES E. LEISERSON
RONALD L. RIVEST
CLIFFORD STEIN
INTRODUCTION TO
ALGORITHMS
THIRD EDITION


VIJAY V. VAZIRANI
Approximation Algorithms
Springer

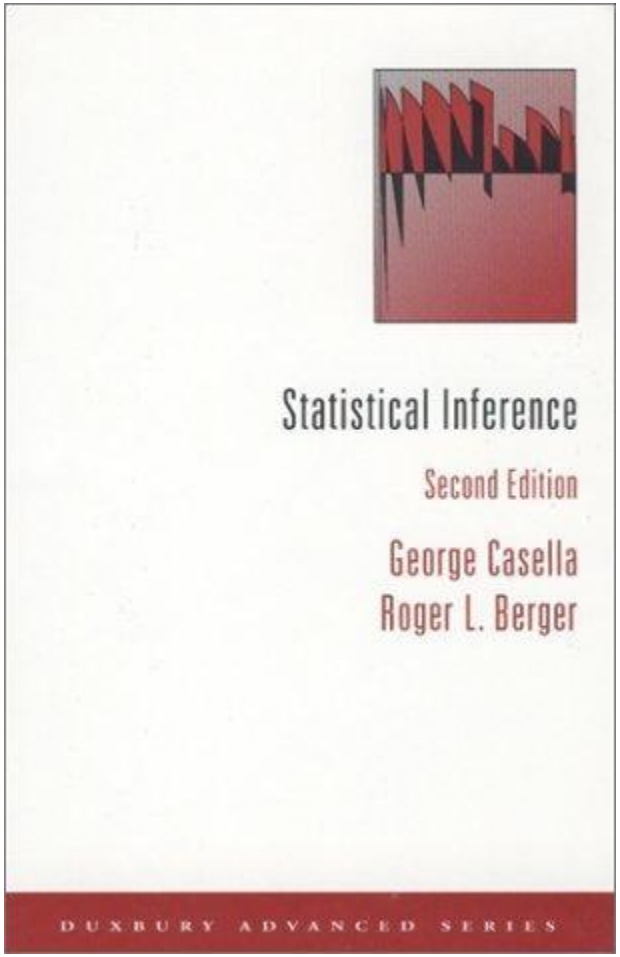

Probability and Computing
Randomized Algorithms and Probabilistic Analysis
Michael Mitzenmacher
Eli Upfal
CAMBRIDGE

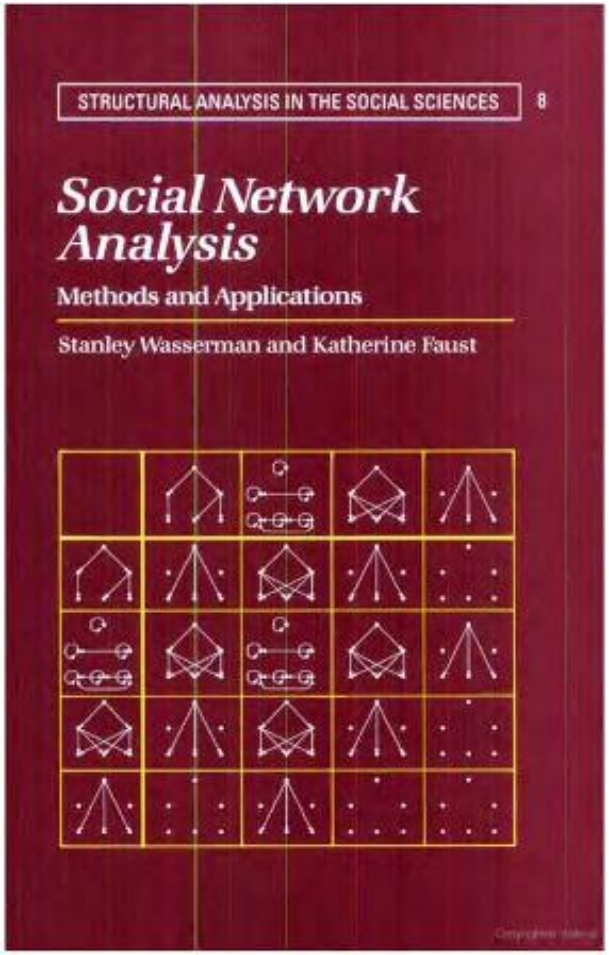
Formal Languages



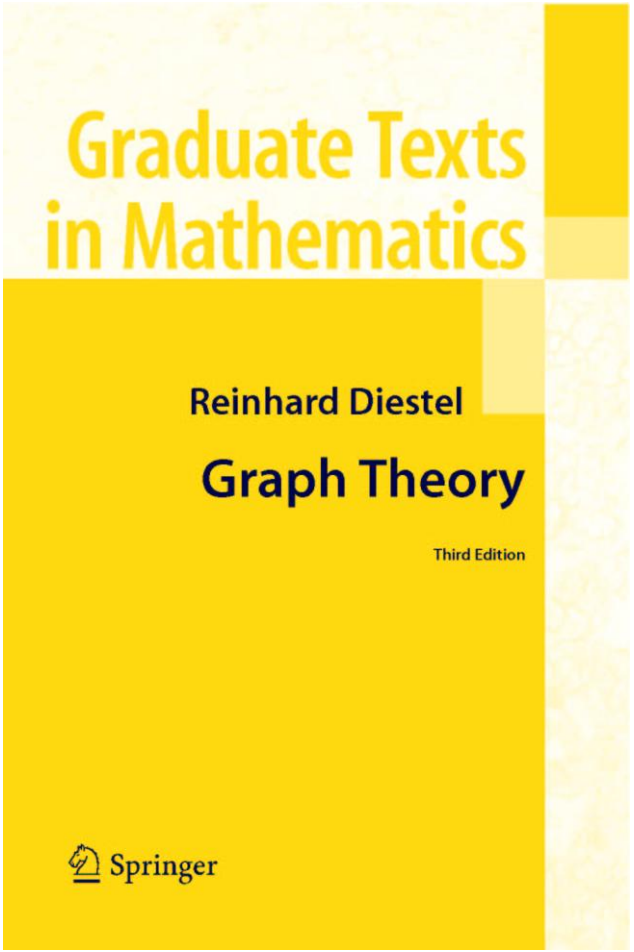


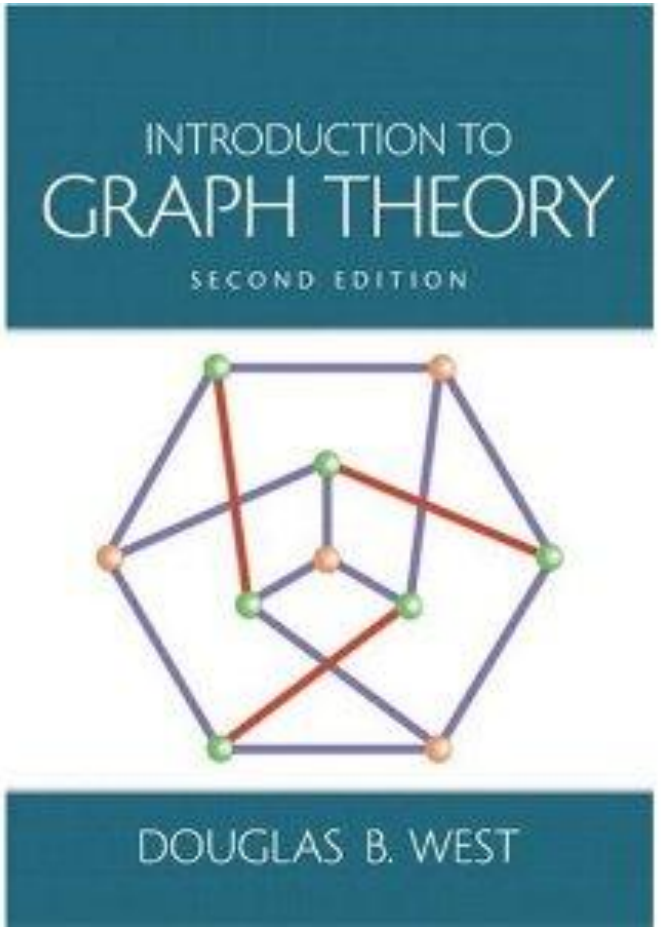
Statistics and Social Networks





Graph Theory





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