

Research Methods (TP)

Practice: Research Methodology and Research Literature

Nuno Pereira, DEI/ISEP, 2025

Activity I: Draft of your Research Question

Write your research question(s)

- What do you want to research in the form of 1-2 questions that capture the work's essence

Briefly think about

- How will you answer your research questions (selecting case/artifact, data collection) ?
- How will you analyze the data ?
- What results do you expect to obtain?
- **Optional:** Sketch an Illustration of your research process
- Discuss with the instructor

Research Literature

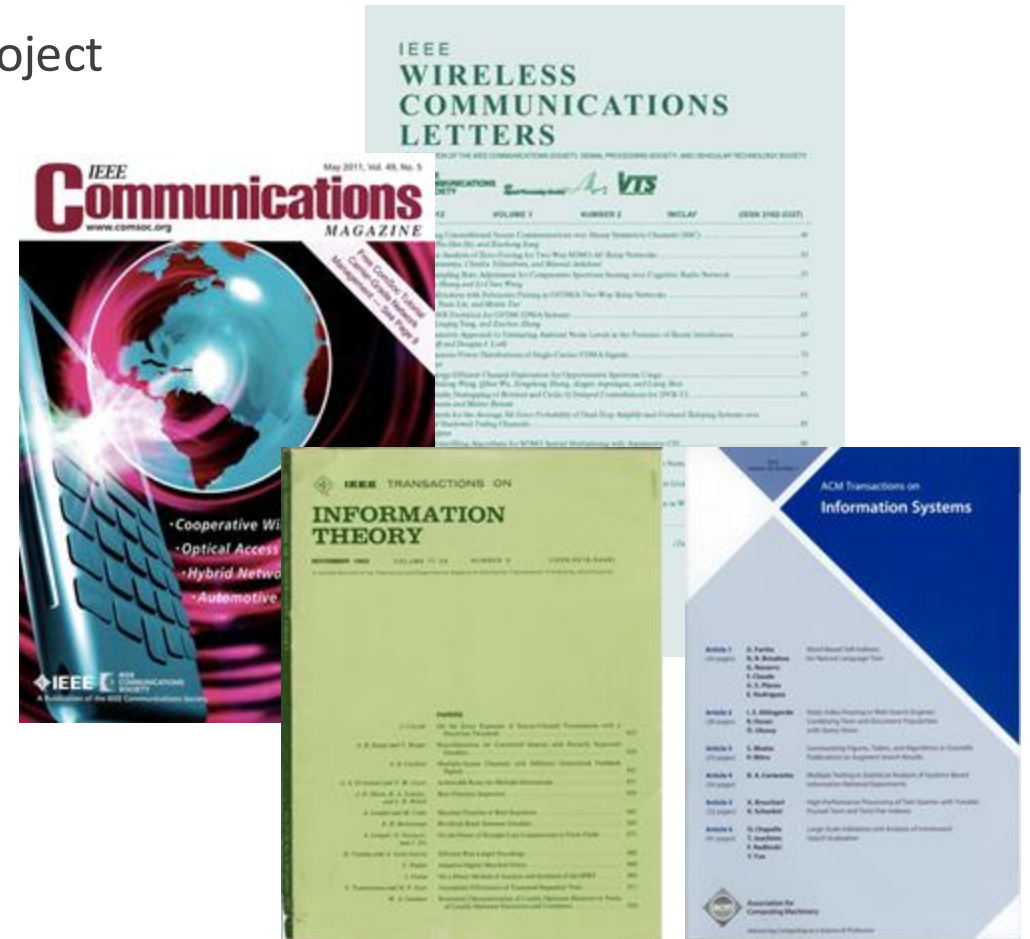
Research Papers 1/3

These are an important source of information for your project

Peer-reviewed articles, written by experts in academic or professional fields

They are excellent sources for your work

Most of the databases/libraries on B-On





Research Papers 2/3

Let us see an example (ACM Digital library)


Who ?

ARTICLE



Scheduling Algorithms for Multiprogramming in a Hard-Real-Time Environment

Authors:  C. L. Liu,  James W. Layland [Authors Info & Claims](#)

Journal of the ACM, Volume 20, Issue 1 • pp 46–61 • <https://doi.org/10.1145/321738.321743>

Published: 01 January 1973 [Publication History](#) 

7,020 25,457

When ?

The contents of the paper should clearly answer What?, Where? and Why?

Research Papers 3/3

Can we use this information (venue, citations) further ?

ARTICLE

Scheduling Algorithms for Multiprogramming in a Hard-Real-Time Environment

Authors:  [C. L. Liu](#),  [James W. Layland](#) [Authors Info & Claims](#)

Journal of the ACM, Volume 20, Issue 1 • pp 46–61 • <https://doi.org/10.1145/321738.321743>

Published: 01 January 1973 [Publication History](#) 

 7,020  25,457

    eReader  PDF

Publication venue ?

How many times cited ?

Evaluating Citations

Citations do give us some measure of how many times other researchers have found the work “useful”

Beware, though:

- Citations are counted automatically, and this process has errors
- “Matthew effect”
 - as highly cited papers tend to have higher visibility, they gain more citations
- Not all citations are “good” citations:
 - “... we have found previous work [1] that has an error...”
 - “... we have found many previous works [1-10] using an inadequate approach”
 - Self citations, tangent citations, biased citations (e.g. acknowledge a famous work/professor in a field), ...
- Some work might be very useful in industry, but the people that use it do not write papers...
- Scientific communities have different dimensions
 - a high citation count in one community might be a very low count in another
- Age plays a role in citation count
- ...

Evaluating Citations

Places to find citation counts

Google Scholar

- <https://scholar.google.pt/>

ACM Digital Library

- <http://dl.acm.org/>

Google Scholar

scheduling algorithms for multiprogramming in a hard-real-time environment

Articles

Any time
Since 2023
Since 2022
Since 2019
Custom range...

Sort by relevance
Sort by date

Any type
Review articles

☐ include patents
☒ include citations

Scheduling algorithms for multiprogramming in a hard-real-time environment
CL Liu, JW Layland
Journal of the ACM (JACM), 1973 • dl.acm.org

[PDF] acm.org
Texto Integral@b-on

The problem of multiprogram scheduling on a single processor is studied from the viewpoint of the characteristics peculiar to the program functions that need guaranteed service. It is shown that an optimum fixed priority scheduler possesses an upper bound to processor utilization which may be as low as 70 percent for large task sets. It is also shown that full processor utilization can be achieved by dynamically assigning priorities on the basis of their current deadlines. A combination of these two scheduling techniques is

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ARTICLE

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Scheduling Algorithms for Multiprogramming in a Hard-Real-Time Environment

Authors: C. L. Liu, James W. Layland [Authors Info & Claims](#)

Journal of the ACM, Volume 20, Issue 1 • pp 46–61 • <https://doi.org/10.1145/321738.321743>

Published: 01 January 1973 [Publication History](#)

7,020 **25,457**

Evaluating Citations

Places to find citation counts

Semantic Scholar

- <https://www.semanticscholar.org/>

The screenshot shows the Semantic Scholar interface for a paper titled "Scheduling Algorithms for Multiprogramming in a Hard-Real-Time Environment" by J. C. L. L. J. Layland. The paper's citation count of 2,563 is highlighted with an orange circle. A sidebar on the right provides a breakdown of citation types: Highly Influential Citations (366), Background Citations (332), Methods Citations (612), and Results Citations (32). The bottom of the page features tabs for "2,563 Citations", "16 References", and "Related Papers".

SEMANTIC SCHOLAR

Scheduling Algorithms for Multiprogramming in a Hard-Real-Time Environment

Search Sign In

DOI: 10.1145/321738.321743 • Corpus ID: 262638897

Scheduling Algorithms for Multiprogramming in a Hard-Real-Time Environment

J. C. L. L. J. Layland • Published 3 January 1989 • Computer Science • J. ACM

The problem of multiprogram scheduling on a single processor is studied from the viewpoint of the characteristics peculiar to the program functions that need guaranteed service. It is shown that an optimum fixed priority scheduler possesses an upper bound to processor utilization which may be as low as 70 percent for large task sets. It is also shown that full processor utilization can be achieved by dynamically assigning priorities on the basis of their current deadlines. A combination of...

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2,563 Citations

16 References

Related Papers

2,563 Citations

Highly Influential Citations 366

Background Citations 332

Methods Citations 612

Results Citations 32

[View All](#)

Evaluating Citations

Places to find citation counts

Web of Science

- <https://www.webofknowledge.com/>

SCHEDULING ALGORITHMS FOR MULTIPROGRAMMING IN A HARD-REAL-TIME ENVIRONMENT

By: LIU, CL (LIU, CL); LAYLAND, JW (LAYLAND, JW)

JOURNAL OF THE ACM
Volume: 20 Issue: 1 Pages: 46-61
DOI: [10.1145/321736.321743](https://doi.org/10.1145/321736.321743)
Published: 1973
[View Journal Information](#)

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Publisher
ASSOC COMPUTING MACHINERY, 1515 BROADWAY, NEW YORK, NY 10036

Categories / Classification
Research Areas: Computer Science
Web of Science Categories: Computer Science, Hardware & Architecture; Computer Science, Information Systems; Computer Science, Software Engineering; Computer Science, Theory & Methods

Document Information
Document Type: Article
Language: English
Accession Number: WOS:A1973O597400005
ISSN: 0004-5411

Journal Information
Impact Factor: Journal Citation Reports®

Citation Network

2,715 Times Cited
14 Times Cited
[View Related Records](#)
[View Citation Map](#)
[Create Citation Alert](#)
(data from Web of Science™ Core Collection)

All Times Cited Counts
2,997 in All Databases
2,715 in Web of Science Core Collection
1 in BIOSIS Citation Index
288 in Chinese Science Citation Database
0 in Data Citation Index
5 in Russian Science Citation Index
5 in ScELO Citation Index

Usage Count
Last 180 Days: 9
Since 2013: 25
[Learn more](#)

Most Recent Citation
von der Brueggen, Georg. Exact speedup factors for linear-time schedulability tests for fixed-priority preemptive and non-preemptive scheduling . INFORMATION PROCESSING LETTERS, JAN 2017.

Evaluating Publication Venues

Papers are published in essentially two types of venues

- Conference proceedings
- Journals

Publication venues do not say everything about a paper, but

- Tend to indicate that the paper went through additional scrutiny
- Provide some pillars for the non-expert (prominent journals, conferences, ...)



Evaluating Journals

A common way to assess journals is using a measure of their impact

- Impact is measured based on citation counts
- Has the same flaws as paper citation counts
 - bias towards authors, journals, disciplines, institutions, countries...

A high impact journal does not guarantee papers are flawless or relevant, but:

- Papers go through a rigorous peer review
- Editors try to maintain good quality and relevance of selected articles



Journal Impact – JCR and Scopus

Journal Citation Reports (JCR) – ISI Thomson

- Impact Factor (IF) of journals based on citation information of journals indexed in Web of Science (WoS)
- “Rigorous” process to determine included journals
- Widely used, but somewhat weak coverage of Computer Science
- <http://webofknowledge.com/>

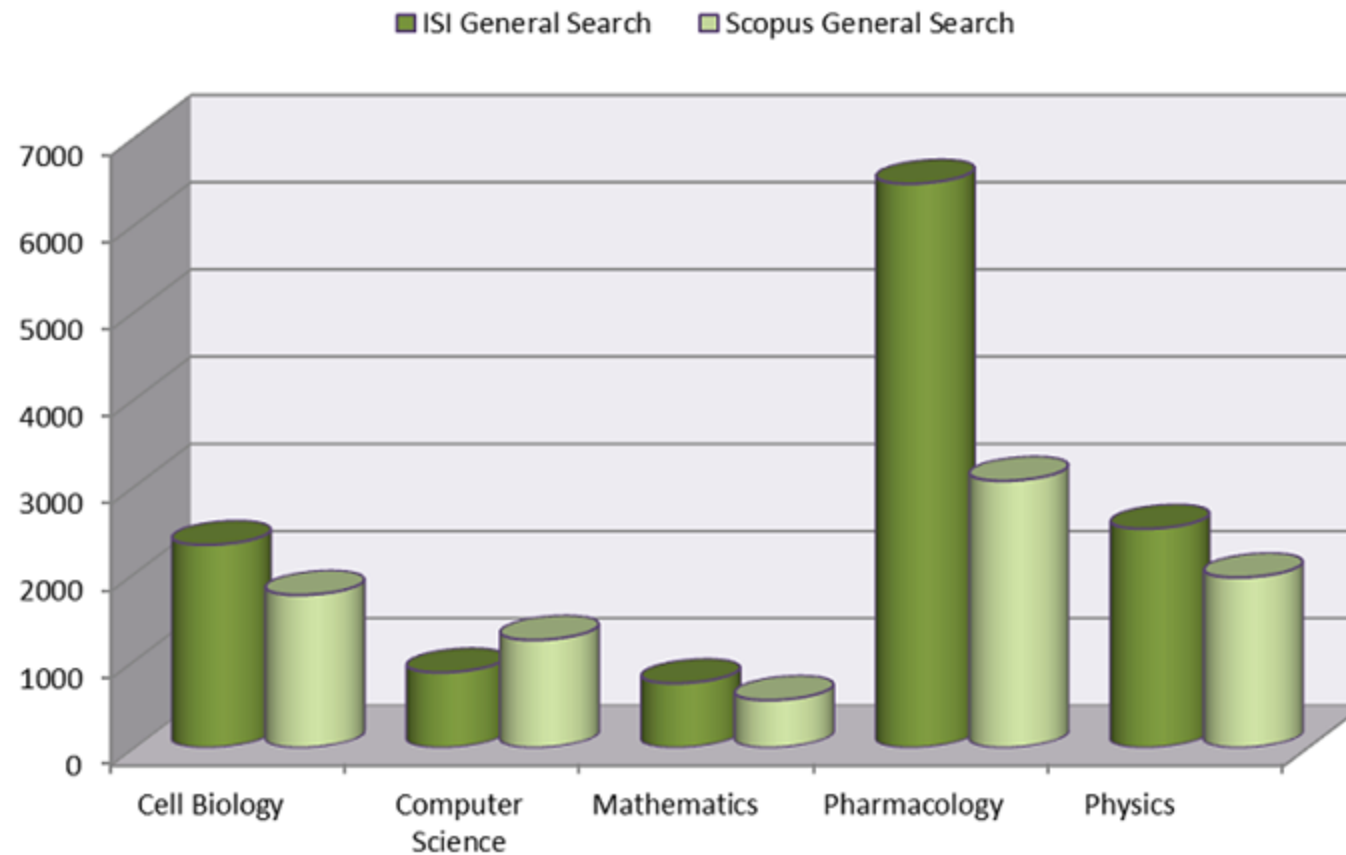


SciMago Journal & Country Rank (SJR) - Elsevier

- Journal & Country Rank (JCR) of journals based on citation information of journals indexed in Scopus
- “More inclusive” process to determine included journals
- <http://www.scimagojr.com/>



Journal Impact – JCR and Scopus Coverage



Number of citations for ISI and Scopus General Search: Science disciplines

http://www.harzing.com/popbook/ch16_2_1.htm

Journal Impact - JCR

Browse journals in JCR

Select Journals

Select Categories

Select JCR Year
2014

Select Edition
☒ SCIE ☒ SSCI

Open Access
☐ Open Access

Category Schema
Web of Science

Select Category

☐ COMMUNICATION

☒ COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE

☒ COMPUTER SCIENCE, CYBERNETICS

☒ COMPUTER SCIENCE, HARDWARE & ARCHITECTURE

☒ COMPUTER SCIENCE, INFORMATION SYSTEMS

☒ COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS

☒ COMPUTER SCIENCE, SOFTWARE ENGINEERING

☒ COMPUTER SCIENCE, SYSTEMS

☐ CONSTRUCTION

Select Journals

Select Categories

Select JCR Year
2014

Select Edition
☒ SCIE ☒ SSCI

Open Access
☐ Open Access

Category Schema
Web of Science

Select Category

☐ ENGINEERING, AEROSPACE

☐ ENGINEERING, BIOMEDICAL

☐ ENGINEERING, CHEMICAL

☐ ENGINEERING, CIVIL

☒ ENGINEERING, ELECTRICAL & ELECTRONIC

☐ ENGINEERING, ENVIRONMENTAL

☐ ENGINEERING, GEOLOGICAL

☐ ENGINEERING, INDUSTRIAL

☐ ENGINEERING, MANUFACTURING

Journals By Rank		Categories By Rank			
Journal Titles Ranked by Impact Factor					Show Visualization +
Compare Selected Journals		Add Journals to New or Existing List		Customize Indicators	
		Full Journal Title	Total Cites	Journal Impact Factor	Eigenfactor Score
<input type="checkbox"/>	1	IEEE TRANSACTIONS ON FUZZY SYSTEMS	8,581	8.746	0.01281
<input type="checkbox"/>	2	IEEE Communications Surveys and Tutorials	2,788	6.806	0.01567
<input type="checkbox"/>	3	International Journal of Neural Systems	1,154	6.507	0.00203
<input type="checkbox"/>	4	IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS	27,141	6.498	0.06333
<input type="checkbox"/>	5	IEEE TRANSACTIONS ON SYSTEMS MAN AND CYBERNETICS PART B- CYBERNETICS	7,317	6.220	0.01829
<input type="checkbox"/>	6	IEEE TRANSACTIONS ON POWER ELECTRONICS	21,131	6.008	0.04013
<input type="checkbox"/>	7	IEEE SIGNAL PROCESSING MAGAZINE	5,989	5.852	0.01478
<input type="checkbox"/>	8	IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE	29,822	5.781	0.05103
<input type="checkbox"/>	9	IEEE WIRELESS COMMUNICATIONS	3,015	5.417	0.01696

Journal Impact – Google Scholar

Google Scholar (GS) Top Publications

- https://scholar.google.com/citations?view_op=top_venues&hl=en&vq=eng
- Top 20 publications in several fields, based on GS citation count

Google Scholar	Architecture	Engineering & Computer Science (general)	Oil, Petroleum & Natural Gas
	Artificial Intelligence	Environmental & Geological Engineering	Operations Research
▼ English	Automation & Control Theory	Evolutionary Computation	Plasma & Fusion
Business, Economics	Aviation & Aerospace Engineering	Food Science & Technology	Power Engineering
Chemical & Materials	Bioinformatics & Computational Biology	Fuzzy Systems	Quality & Reliability
▼ Engineering & Computer Science	Biomedical Technology	Game Theory and Decision Science	Radar, Positioning & Navigation
Subcategories...	Biotechnology	Human Computer Interaction	Remote Sensing
Health & Medical Sciences	Ceramic Engineering	Information Theory	Robotics
Humanities, Literature	Civil Engineering	Library & Information Science	Signal Processing
Life Sciences & Earth	Combustion & Propulsion	Manufacturing & Machinery	Software Systems
Physics & Mathematics	Computational Linguistics	Materials Engineering	Structural Engineering
Social Sciences	Computer Graphics	Mechanical Engineering	Sustainable Energy
Chinese	Computer Hardware Design	Medical Informatics	Technology Law
Portuguese	Computer Networks & Wireless Communication	Metallurgy	Textile Engineering
German	Computer Security & Cryptography	Microelectronics & Electronic Packaging	Theoretical Computer Science
Spanish	Computer Vision & Pattern Recognition	Mining & Mineral Resources	Transportation
French	Computing Systems	Molecular Modeling	Water Supply & Treatment
Italian	Data Mining & Analysis	Multimedia	Wood Science & Technology
Japanese	Databases & Information Systems	Nanotechnology	
Dutch	Educational Technology	Ocean & Marine Engineering	

Evaluating Conferences

Data about conferences can be even less conclusive

- ISI Web of Science includes the “Conference Proceedings Citation index”
- Google Scholar and Microsoft Academic provide some information regarding conferences
- The CORE Conference Ranking is a reference often used
 - Conferences are assigned to one of the following categories:
 - A* - flagship conference, a leading venue in a discipline area
 - A - excellent conference, and highly respected in a discipline area
 - B - good conference, and well regarded in a discipline area
 - C - other ranked conference venues that meet minimum standards
 - Australasian - A conference for which the audience is primarily Australians and New Zealanders
 - Unranked - A conference for which no ranking decision has been made
- <http://portal.core.edu.au/conf-ranks/>

The CORE Conference Ranking

Title ◇	Acronym ◇	Source ◇	Rank ◇	Changed? ◇	FoR ◇	Comments	Average Rating
National Conference of the American Association for Artificial Intelligence	AAAI	CORE2014	A*	Yes	0801	0	N/A
International Conference on Autonomous Agents and Multiagent Systems	AAMAS	CORE2014	A*	Yes	0801	1	5.0
Association of Computational Linguistics	ACL	CORE2014	A*	Yes	0801	0	N/A
ACM Multimedia	ACMMM	CORE2014	A*	Yes	0803	2	N/A
Architectural Support for Programming Languages and Operating Systems	ASPLOS	CORE2014	A*	Yes	0803	0	N/A
Computer Aided Verification	CAV	CORE2014	A*	Yes	0802	0	N/A
ACM Conference on Computer and Communications Security	CCS	CORE2014	A*	Yes	0803	0	N/A
International Conference on Human Factors in Computing Systems	CHI	CORE2014	A*	Yes	0806	0	N/A
Annual Conference on Computational Learning Theory	COLT	CORE2014	A*	Yes	0801	0	N/A
Advances in Cryptology	CRYPTO	CORE2014	A*	Yes	0804	0	N/A
Data Compression Conference	DCC	CORE2014	A*	Yes	0804	0	N/A
International Conference on the Theory and Application of Cryptographic Techniques	EuroCrypt	CORE2014	A*	Yes	0804	0	N/A
IEEE Symposium on Foundations of Computer Science	FOCS	CORE2014	A*	Yes	0802	0	N/A
Foundations of Genetic Algorithms	FOGA	CORE2014	A*	Yes	0801	0	N/A
International Symposium on High Performance Computer Architecture	HPCA	CORE2014	A*	Yes	0803	0	N/A
International Conference on Automated Planning and Scheduling	ICAPS	CORE2014	A*	Yes	0801	0	N/A
IEEE International Conference on Computer Vision	ICCV	CORE2014	A*	Yes	0801	0	N/A
International Conference on Data Engineering	ICDE	CORE2014	A*	Yes	0804	0	N/A
IEEE International Conference on Data Mining	ICDM	CORE2014	A*	Yes	0804	1	5.0
International Conference on Functional Programming	ICFP	CORE2014	A*	Yes	0803	0	N/A
International Conference on Information Systems	ICIS	CORE2014	A*	Yes	0806	0	N/A
International Conference on Machine Learning	ICML	CORE2014	A*	Yes	0801	0	N/A

Use With Caution

Citations and rankings have very important flaws

- Do not cover all scholarly publications
- Include non-scholarly publications
- Can be “gamed”¹
- Perform worst for older publications
- (other flaws previously)
- ...



Nevertheless, they provide a **good initial indication for the non-expert**

¹<https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.2004089>

Libraries and Online Literature Databases

Academic libraries focus on organizing information to meet the needs of academics

Organized by, e.g.:

- established fields of research, types of publication (books, thesis, journals,...)

Online Libraries

- Scientific Repository of the Polytechnic Institute of Porto
 - <https://recipp.ipp.pt/>
 - DEI MSc Dissertations: <https://recipp.ipp.pt/handle/10400.22/364>
- B-On
 - <http://www.b-on.pt/>



ACM Digital Library (Pay walled; B-On)

- <http://dl.acm.org/>

Examples of Relevant Online Libraries/Databases

ACM Digital Library (Pay walled; B-On)

- <http://dl.acm.org/>

IEEE Explore (Pay walled; B-On)

- <http://ieeexplore.ieee.org/>

DBLP

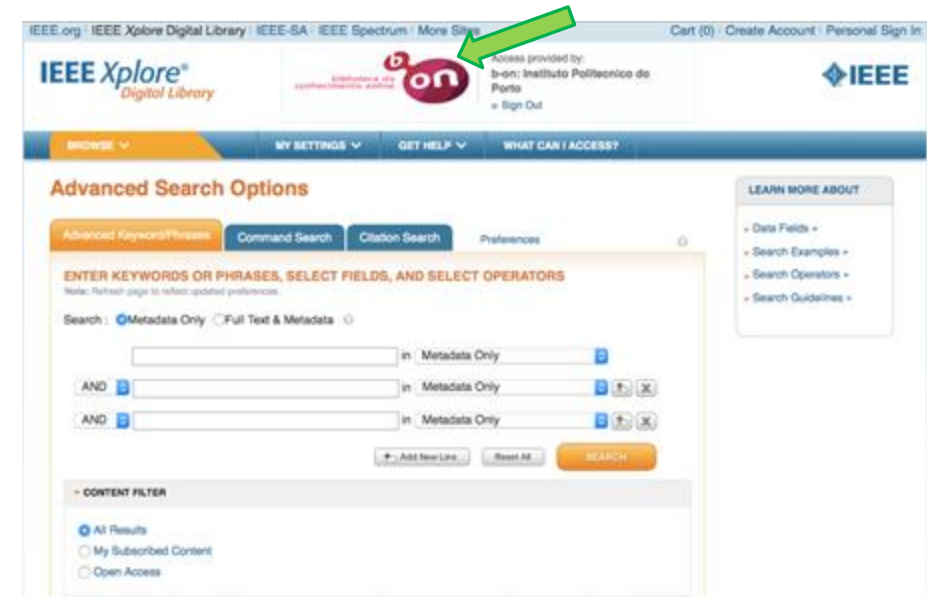
- <http://dblp.uni-trier.de/> (Free)

The Collection of Computer Science Bibliographies (Free)

- <http://iinwww.ira.uka.de/bibliography/>

Arxiv.org (Free)

- <http://arxiv.org/>



Recording and Organizing Information

Always record your findings adequately

- Record:
 - author(s),
 - title,
 - year of publication,
 - publisher,
 - edition/version/issue/volume,
 - access information (URL, DOI, Reference ID...),
 - location,
 - abstract, keywords (preferably)...

Don't trust your memory!...

Many different ways:

- Cards with notes (physically or on the computer)
- Articles (physically or on the computer) with text highlighted and notes
- **Reference management software**



Reference Management Software

There are many tools to help you collect, organize, cite, and share your research sources

Zotero

- free reference manager
- <https://www.zotero.org/>

Mendeley

- free reference manager and academic social network
- <https://www.mendeley.com/>

EndNote

- commercial reference manager
- <http://endnote.com/>

Use one!

zotero



EndNote®

Activity II: Search Digital Libraries

Develop the suggested activity (see "Activity II: Search Digital Libraries" in Moodle):

1. Search the Acm Digital Library
2. Search the SciMago Journal & Country Rank (JSR)
3. Search the Web of Science (WoS)

Resources

- S. Keshav, “How to Read a Paper”. Online:
<http://ccr.sigcomm.org/online/files/p83-keshavA.pdf>
- William G. Griswold, “How to Read an Engineering Research Paper”. Online:
<http://cseweb.ucsd.edu/~wgg/CSE210/howtoread.html>

Also in Moodle, folder “Resources”

Summary

Drafting your Research Question

Guidelines to start looking into research literature and their caveats

Tools for managing your references and reference styles