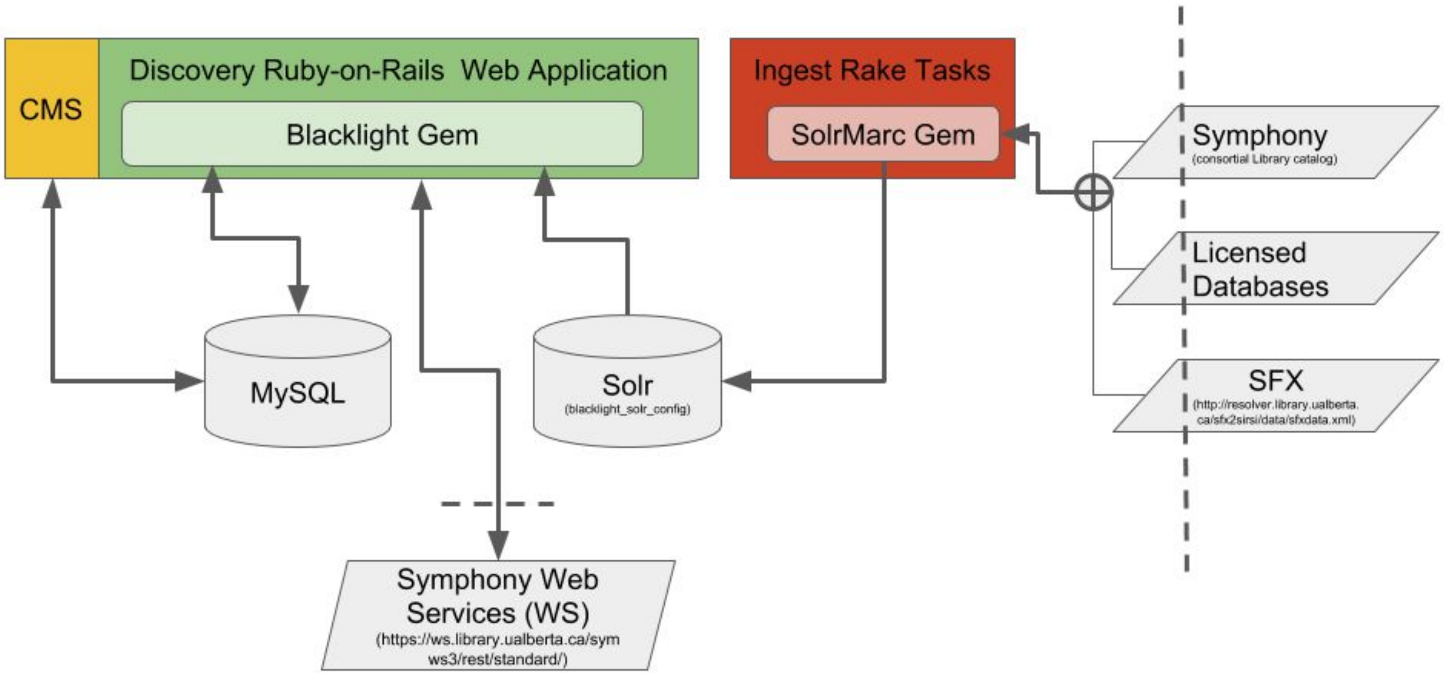
Search/Discovery "Under the Hood"

Tricia Jenkins and Sean Luyk | Spring Training 2019

Outline

- Search in libraries
- Search trends
- Search “under the hood”

Discovery


CMS
Discovery Ruby-on-Rails Web Application
Blacklight Gem
Ingest Rake Tasks
SolrMarc Gem
MySQL
Solr
(blacklight_solr_config)
Symphony
(consortial Library catalog)
Licensed Databases
SFX
(http://resolver.library.ualberta.ca/sfx2sirsi/data/sfxdata.xml)
Symphony Web Services (WS)
(https://ws.library.ualberta.ca/symws3/rest/standard/)

The Discovery Technology Stack

Solr

- Open Source Apache Project since 2007
- Webserver providing search capabilities
- Based on Apache Lucene
- Main competitor: Elastic Search
- Powers:

ebay

INTERNET ARCHIVE

NETFLIX

travelocity

LexisNexis™

> “Compared with the research tradition developed in information science and subsequently diffused to computer science, **the historical antecedents for understanding information retrieval in librarianship and indexing are far longer but less widely influential today**”

Warner, Julian. *Human Information Retrieval*. MIT Press: 2010

Search in Libraries

Search Goal #1

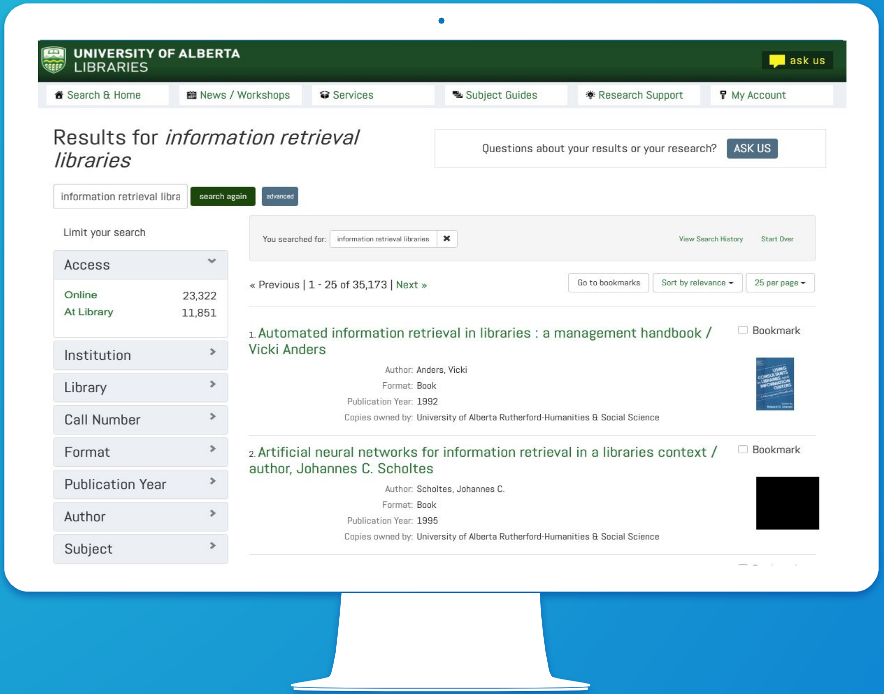
Retrieve all relevant documents for a user query, while retrieving as few non-relevant documents as possible

What makes search results “relevant”?

It's all about expectations...

Search Relevance is Hard

Users: relevant to me



UNIVERSITY OF ALBERTA
LIBRARIES

ask us

Search & Home | News / Workshops | Services | Subject Guides | Research Support | My Account

Results for *information retrieval libraries*

Questions about your results or your research? ASK US

information retrieval libra | search again | advanced

Limit your search

Access	
Online	23,322
At Library	11,851

Institution

Library

Call Number

Format

Publication Year

Author

Subject

You searched for: information retrieval libraries ✖ View Search History Start Over

« Previous | 1 - 25 of 35,173 | Next »

Go to bookmarks | Sort by relevance ▾ | 25 per page ▾

1. Automated information retrieval in libraries : a management handbook / Vicki Anders

□ Bookmark

Author: Anders, Vicki
Format: Book
Publication Year: 1992
Copies owned by: University of Alberta Rutherford-Humanities & Social Science

2. Artificial neural networks for information retrieval in a libraries context / author, Johannes C. Scholtes

□ Bookmark

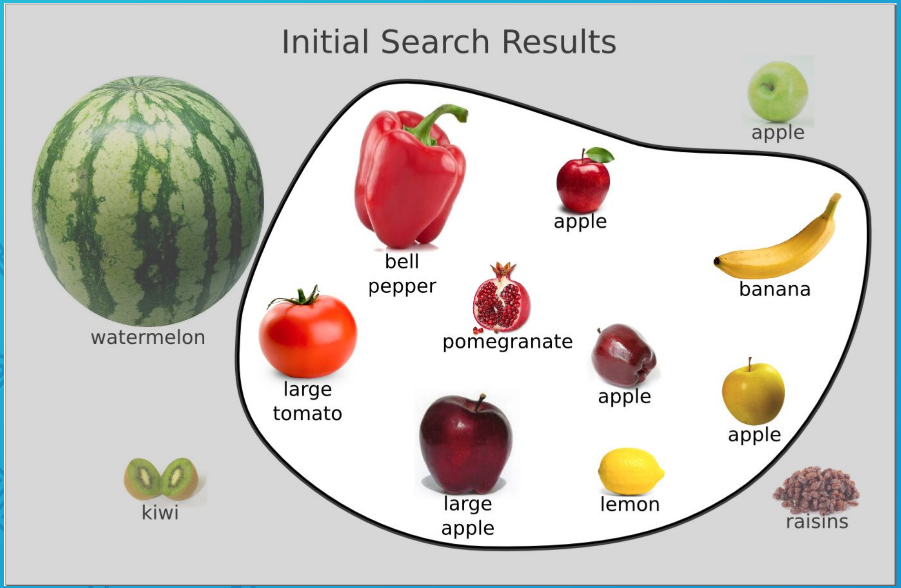
Author: Scholtes, Johannes C.
Format: Book
Publication Year: 1995
Copies owned by: University of Alberta Rutherford-Humanities & Social Science

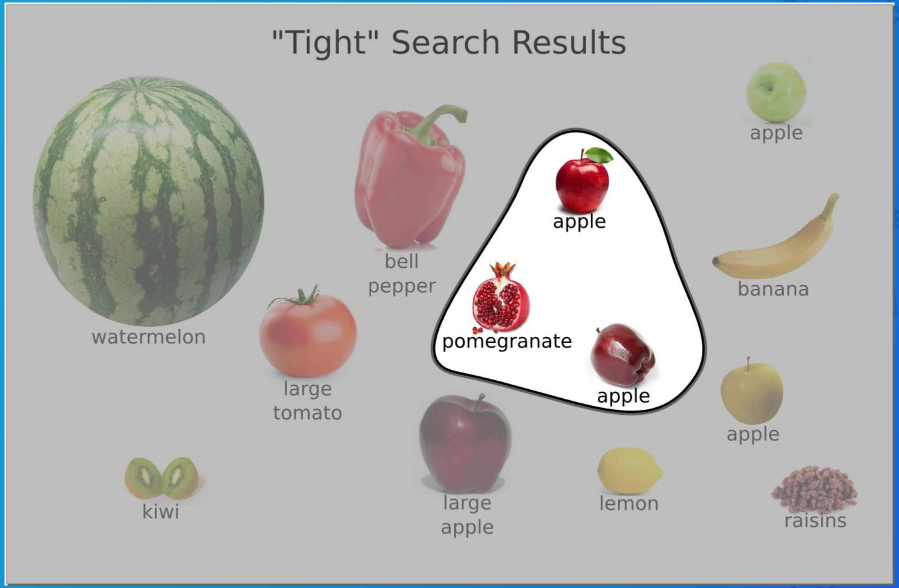
Technologists: relevant as defined by the model

Expectations for Precision Vary

Relevance and Precision are Always at Odds

Search query: “apples”





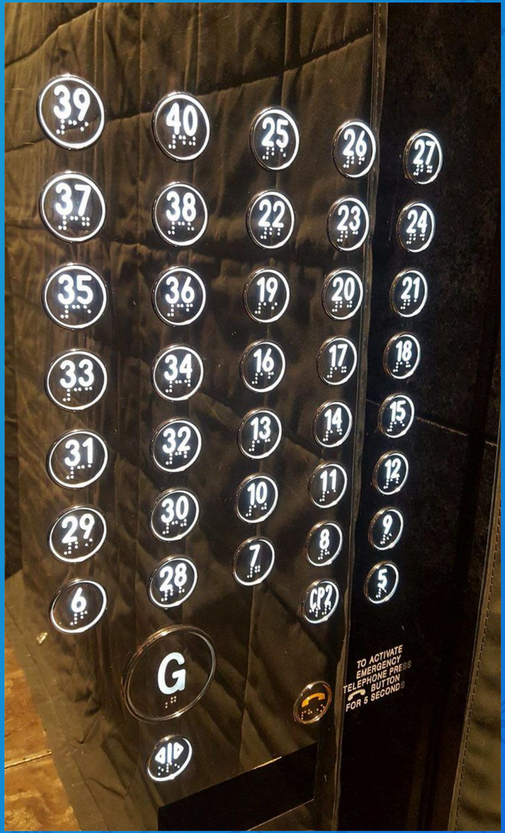
Berryman, John. “Search Precision and Recall by Example” <https://opensourceconnections.com/blog/2016/03/30/search-precision-and-recall-by-example/>.

Search Goal #2

Provide users with a good search experience

What makes for a "good" user experience?

How do we know if we're providing users with a good search experience?



“

“To design the best UX, pay attention to what users **do**, not what they **say**. Self-reported claims are unreliable, as are user speculations about future behavior. Users do not know what they want.”

Nielsen, Jakob. “First Rule of Usability? Don’t Listen to Users”

<https://www.nngroup.com/articles/first-rule-of-usability-dont-listen-to-users/>

How do our users search?

What are their priorities?

How do different user groups search?

Search Trends in Libraries

Focus on Delivery, Ditch Discovery (Utrecht)

- Improve delivery at point of need (e.g. Google Scholar)
- Don't invest in discovery. Let users use the systems they already do
- Provide good information on the best search engines for different kinds of materials

Coordinated Discovery (UW-Madison)

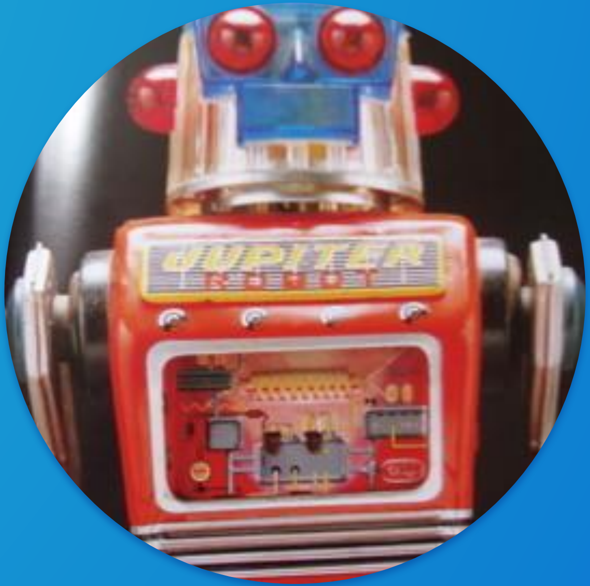
- Show users information categories
- Connect searches across the categories, and recommend relevant resources from other categories
- Promote serendipitous discovery
- Present different metadata for different categories
- UI = not bento, but also not jambalaya

https://www.library.wisc.edu/experiments/coordinated-discovery/

New Developments

Machine Learning/AI Assisted Search

- Use supervised/unsupervised machine learning to improve search relevance
- Use real user feedback (result clicks) and/or document features (e.g. quality) to train a learning to rank (LTR) model



Machine Learning (in a nutshell)

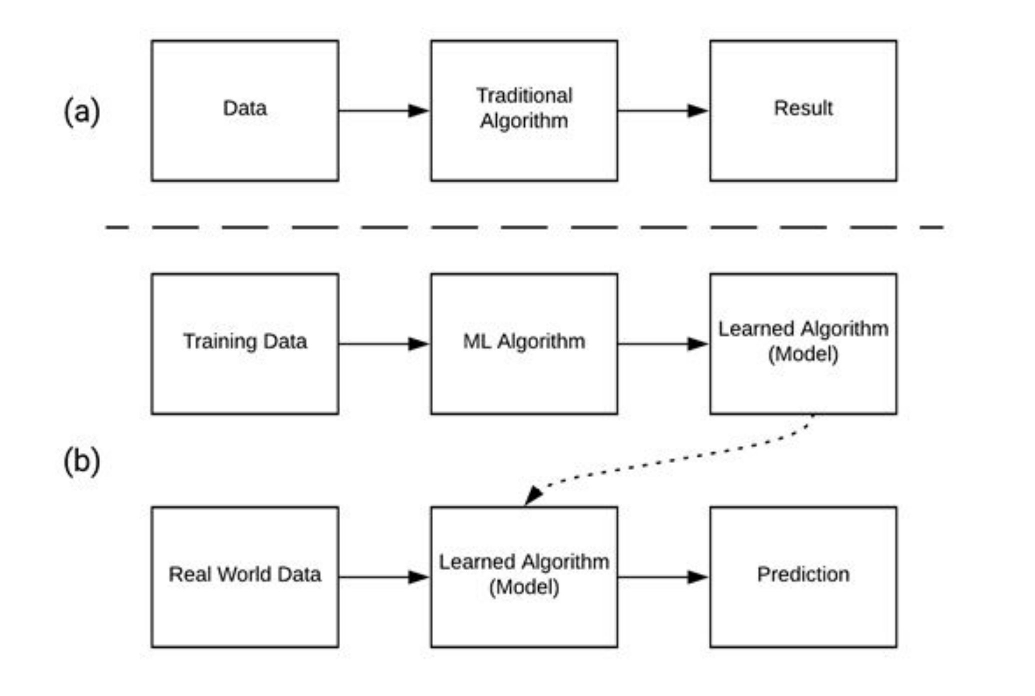


Figure 1. A traditional algorithm (a) versus a machine learning algorithm (b).

Harper, Charlie. “Machine Learning and the Library or: How I Learned to Stop Worrying and Love My Robot Overlords.” *Code4Lib Journal* 41 <https://journal.code4lib.org/articles/13671>

Machine Learning-Powered Discovery

Some examples...

- Carnegie Museum of Art Teenie Harris Archives
  - Automated metadata improvement, facial recognition: https://github.com/cmoa/teenie-week-of-play

- Capacity building: Fantastic Futures, Stanford Library AI Initiative/Studio

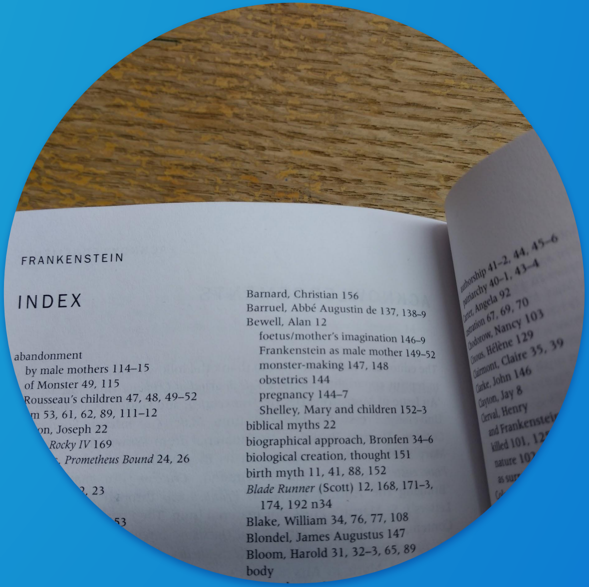
Clustering/Visualization

- Use cluster analysis methods to group similar objects
- Example: Carrot2 (open source clustering engine)
- Example: Stanford's use of Yewno

Search Under the Hood

Index

If you are trying to find a subject in a book, where do you look first?



FRANKENSTEIN

INDEX

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Indexing Concepts

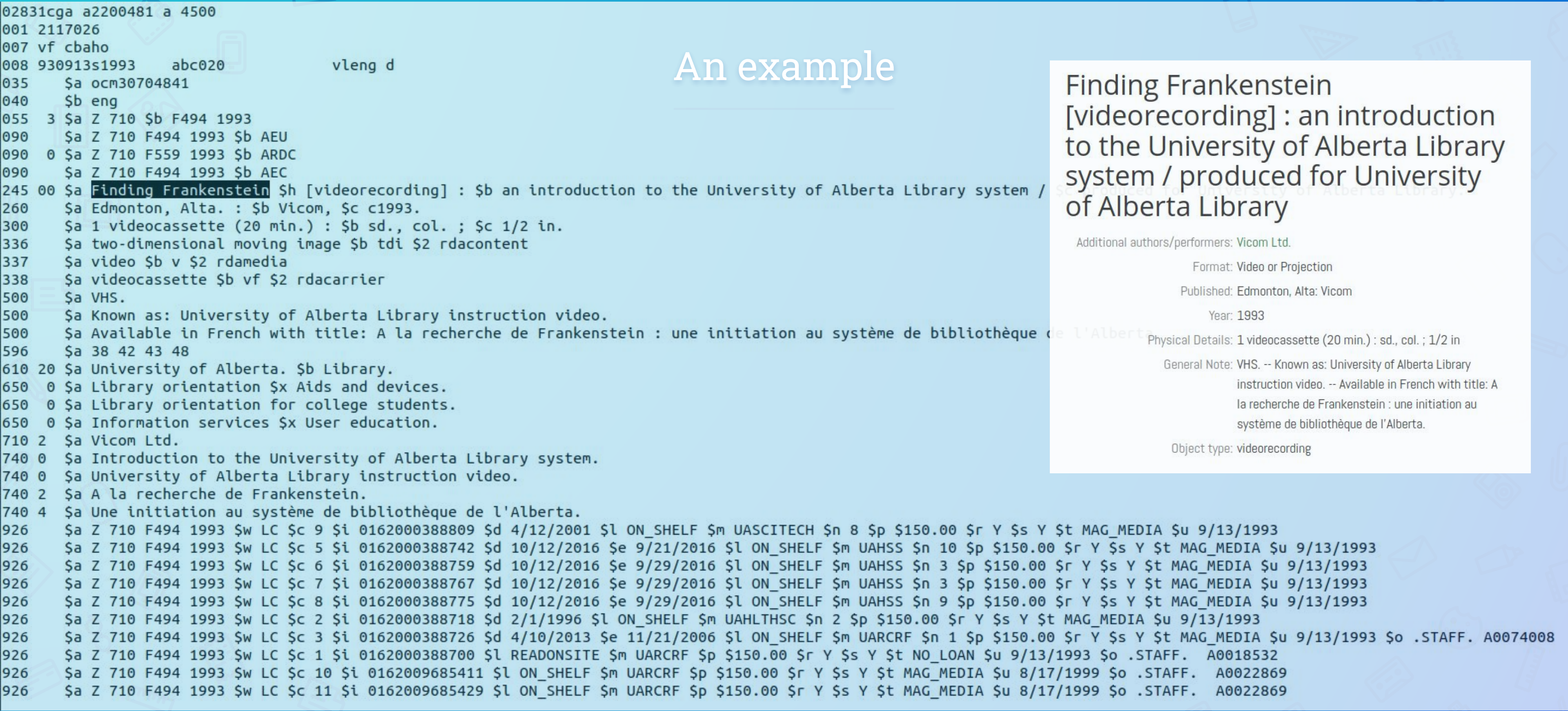
Inverted Index

A searchable index that lists every word and the documents that contain those words, similar to an index in the back of a book which lists words and the pages on which they can be found. Finding the term before the document saves processing resources and time.

Stemming

A stemmer is basically a set of mapping rules that maps the various forms of a word back to the base, or stem, word from which they derive.

An example



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007 vf cbaho
008 930913s1993    abc020           vleng d
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040     $b eng
055  3 $a Z 710 $b F494 1993
090     $a Z 710 F494 1993 $b AEU
090  0 $a Z 710 F559 1993 $b ARDC
090     $a Z 710 F494 1993 $b AEC
245 00 $a Finding Frankenstein $h [videorecording] : $b an introduction to the University of Alberta Library system / $c produced for University of Alberta Library.
260     $a Edmonton, Alta. : $b Vicom, $c c1993.
300     $a 1 videocassette (20 min.) : $b sd., col. ; $c 1/2 in.
336     $a two-dimensional moving image $b tdi $2 rdacontent
337     $a video $b v $2 rdamedia
338     $a videocassette $b vf $2 rdacarrier
500     $a VHS.
500     $a Known as: University of Alberta Library instruction video.
500     $a Available in French with title: A la recherche de Frankenstein : une initiation au système de bibliothèque de l'Alberta.
596     $a 38 42 43 48
610 20 $a University of Alberta. $b Library.
650  0 $a Library orientation $x Aids and devices.
650  0 $a Library orientation for college students.
650  0 $a Information services $x User education.
710 2  $a Vicom Ltd.
740 0  $a Introduction to the University of Alberta Library system.
740 0  $a University of Alberta Library instruction video.
740 2  $a A la recherche de Frankenstein.
740 4  $a Une initiation au système de bibliothèque de l'Alberta.
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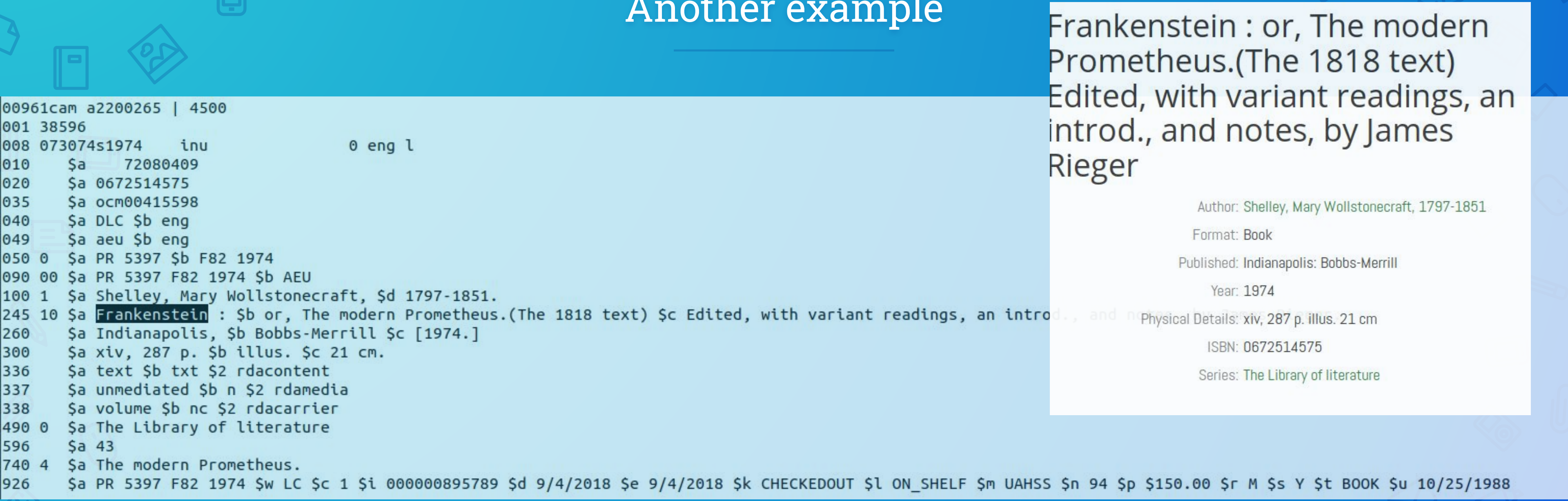
```

Finding Frankenstein [videorecording] : an introduction to the University of Alberta Library system / produced for University of Alberta Library

Additional authors/performers:	Vicom Ltd.
Format:	Video or Projection
Published:	Edmonton, Alta: Vicom
Year:	1993
Physical Details:	1 videocassette (20 min.) : sd., col. ; 1/2 in
General Note:	VHS. -- Known as: University of Alberta Library instruction video. -- Available in French with title: A la recherche de Frankenstein : une initiation au système de bibliothèque de l'Alberta.
Object type:	videorecording

https://search.library.ualberta.ca/catalog/2117026

Another example



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001 38596
008 073074s1974    inu               0 eng l
010    $a    72080409
020    $a 0672514575
035    $a ocm00415598
040    $a DLC $b eng
049    $a aeu $b eng
050 0  $a PR 5397 $b F82 1974
090 00 $a PR 5397 F82 1974 $b AEU
100 1  $a Shelley, Mary Wollstonecraft, $d 1797-1851.
245 10 $a Frankenstein : $b or, The modern Prometheus.(The 1818 text) $c Edited, with variant readings, an introd., and notes, by James Rieger.
260    $a Indianapolis, $b Bobbs-Merrill $c [1974.]
300    $a xiv, 287 p. $b illus. $c 21 cm.
336    $a text $b txt $2 rdacontent
337    $a unmediated $b n $2 rdamedia
338    $a volume $b nc $2 rdacarrier
490 0  $a The Library of literature
596    $a 43
740 4  $a The modern Prometheus.
926    $a PR 5397 F82 1974 $w LC $c 1 $i 000000895789 $d 9/4/2018 $e 9/4/2018 $k CHECKEDOUT $l ON_SHELF $m UAHSS $n 94 $p $150.00 $r M $s Y $t BOOK $u 10/25/1988
```

Frankenstein : or, The modern Prometheus.(The 1818 text) Edited, with variant readings, an introd., and notes, by James Rieger

Author: Shelley, Mary Wollstonecraft, 1797-1851

Format: Book

Published: Indianapolis: Bobbs-Merrill

Year: 1974

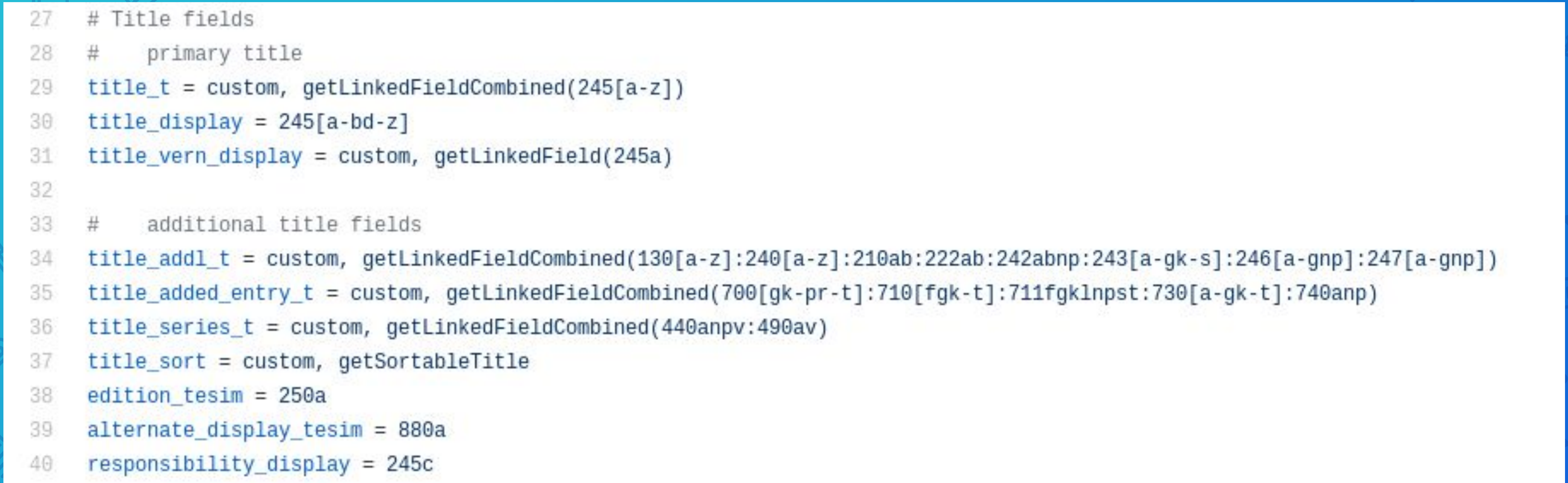
Physical Details: xiv, 287 p. illus. 21 cm

ISBN: 0672514575

Series: The Library of literature

https://search.library.ualberta.ca/catalog/38596

Marc Mapping



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# Title fields
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title_display = 245[a-bd-z]
title_vern_display = custom, getLinkedField(245a)

#    additional title fields
title_addl_t = custom, getLinkedFieldCombined(130[a-z]:240[a-z]:210ab:222ab:242abnp:243[a-gk-s]:246[a-gnp]:247[a-gnp])
title_added_entry_t = custom, getLinkedFieldCombined(700[gk-pr-t]:710[fgk-t]:711fgklnpst:730[a-gk-t]:740anp)
title_series_t = custom, getLinkedFieldCombined(440anpv:490av)
title_sort = custom, getSortableTitle
edition_tesim = 250a
alternate_display_tesim = 880a
responsibility_display = 245c
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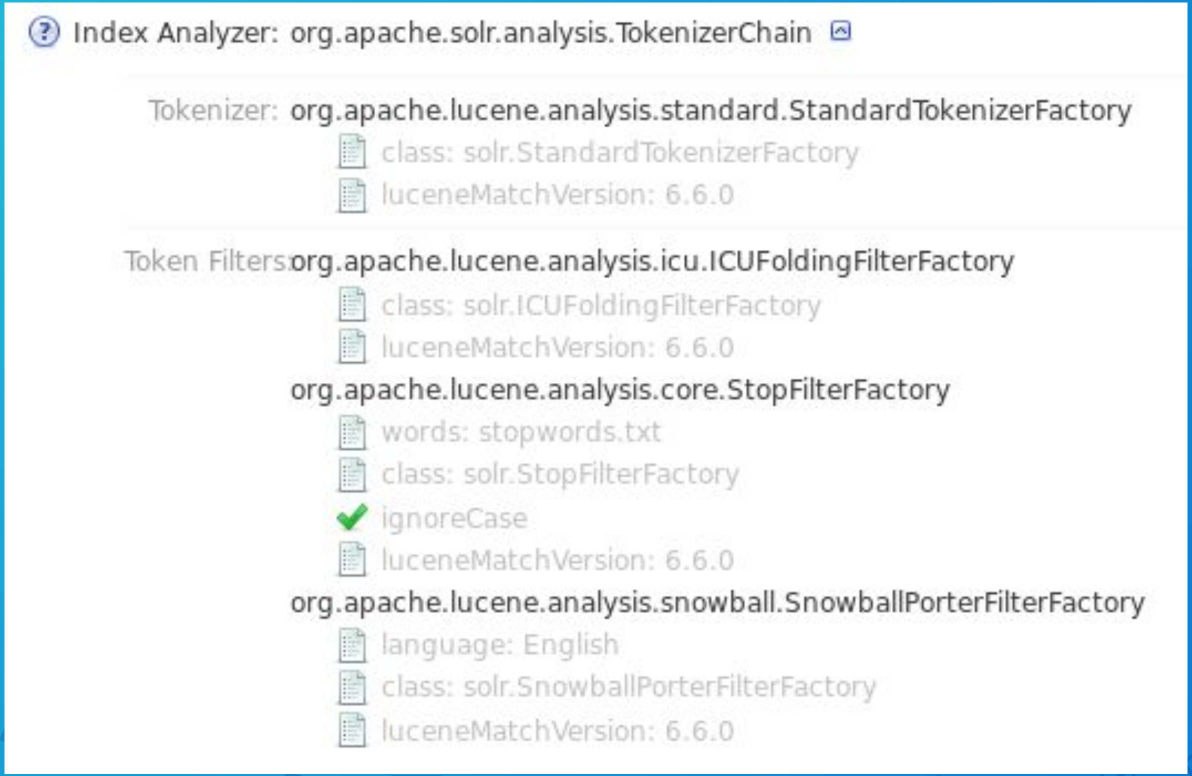
https://github.com/ualbertalib/discovery/blob/master/config/SolrMarc/symphony_index.properties

Analysis Chain



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Index Analyzer: org.apache.solr.analysis.TokenizerChain

    Tokenizer: org.apache.lucene.analysis.standard.StandardTokenizerFactory
                   class: solr.StandardTokenizerFactory
                   luceneMatchVersion: 6.6.0

Token Filters: org.apache.lucene.analysis.icu.ICUFoldingFilterFactory
                   class: solr.ICUFoldingFilterFactory
                   luceneMatchVersion: 6.6.0
               org.apache.lucene.analysis.core.StopFilterFactory
                   words: stopwords.txt
                   class: solr.StopFilterFactory
                 ✓ ignoreCase
                   luceneMatchVersion: 6.6.0
               org.apache.lucene.analysis.snowball.SnowballPorterFilterFactory
                   language: English
                   class: solr.SnowballPorterFilterFactory
                   luceneMatchVersion: 6.6.0
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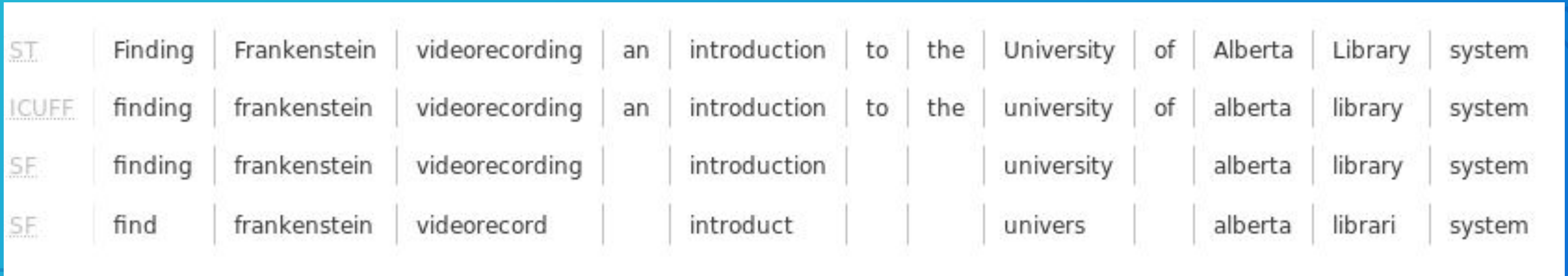
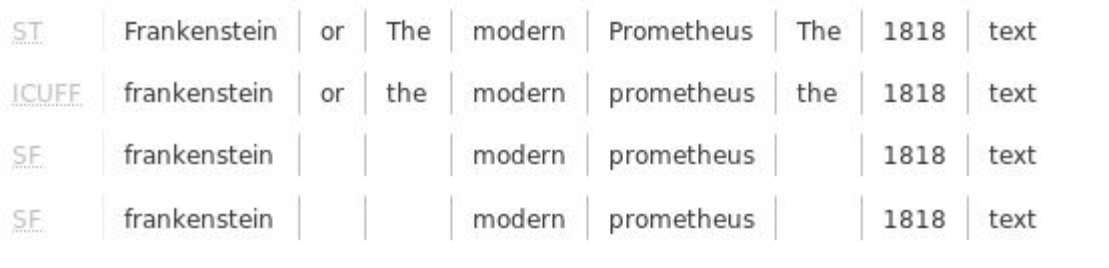
Finding Frankenstein [videorecording] : an introduction to the University of Alberta Library system



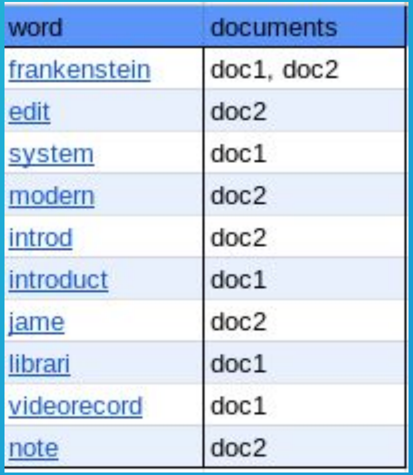
ST	Finding	Frankenstein	videorecording	an	introduction	to	the	University	of	Alberta	Library	system
ICUFF	finding	frankenstein	videorecording	an	introduction	to	the	university	of	alberta	library	system
SF	finding	frankenstein	videorecording		introduction			university		alberta	library	system
SF	find	frankenstein	videorecord		introduct			univers		alberta	librari	system

Frankenstein : or, The modern Prometheus.(The 1818 text)

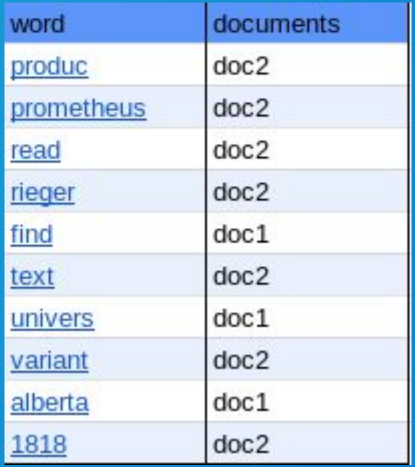


ST	Frankenstein	or	The	modern	Prometheus	The	1818	text
ICUFF	frankenstein	or	the	modern	prometheus	the	1818	text
SF	frankenstein			modern	prometheus		1818	text
SF	frankenstein			modern	prometheus		1818	text

Inverted Index

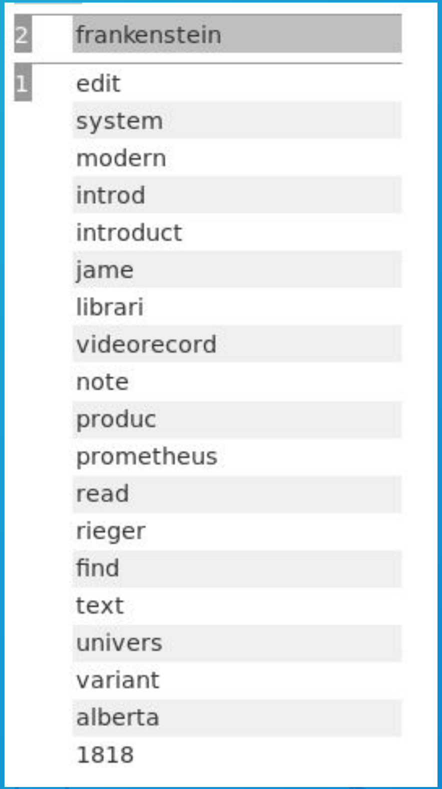


word	documents
frankenstein	doc1, doc2
edit	doc2
system	doc1
modern	doc2
introd	doc2
introduct	doc1
jame	doc2
librari	doc1
videorecord	doc1
note	doc2



word	documents
produc	doc2
prometheus	doc2
read	doc2
rieger	doc2
find	doc1
text	doc2
univers	doc1
variant	doc2
alberta	doc1
1818	doc2

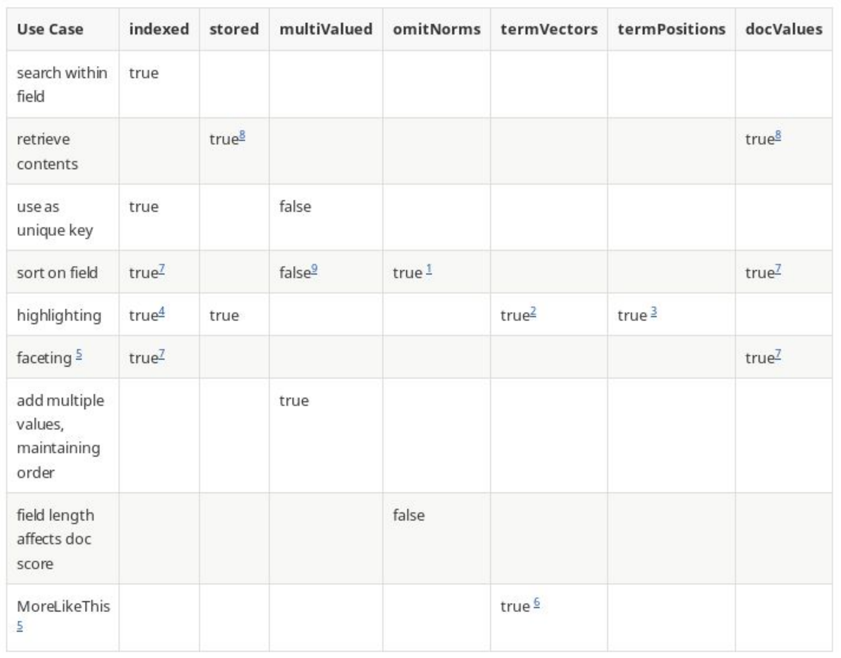
Document Term Frequency



2	frankenstein
1	edit
	system
	modern
	introd
	introduct
	jame
	librari
	videorecord
	note
	produc
	prometheus
	read
	rieger
	find
	text
	univers
	variant
	alberta
	1818

Now repeat for many different attributes

We use a dynamic schema which defines many common types that can be used for searching, display and faceting. We apply these to title, author, subject, etc.



Use Case	indexed	stored	multiValued	omitNorms	termVectors	termPositions	docValues
search within field	true						
retrieve contents		true[8]					true[8]
use as unique key	true		false				
sort on field	true[7]		false[9]	true [1]			true[7]
highlighting	true[4]	true			true[2]	true [3]	
faceting [5]	true[7]						true[7]
add multiple values, maintaining order			true				
field length affects doc score				false			
MoreLikeThis [5]					true [6]		

Search Concepts

DisMax

DisMax stands for Maximum Disjunction. The DisMax query parser takes responsibility for building a good query from the user's input using Boolean clauses containing multiple queries across fields and any configured boosts.

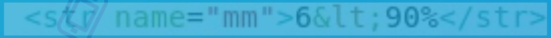
Boosting

Applying different weights based on the significance of each field.

DisMax

mm

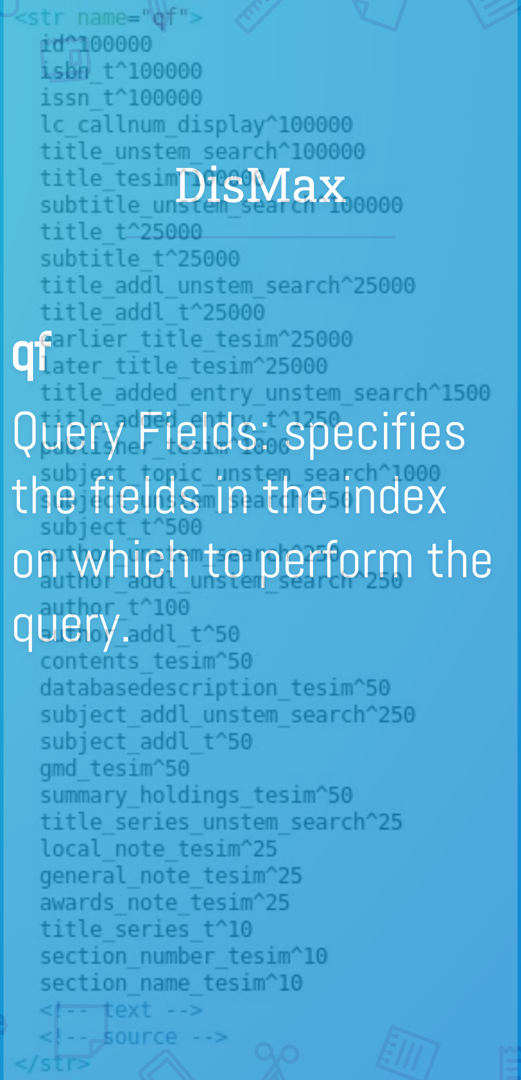
Minimum "Should" Match: specifies a minimum number of clauses that must match in a query.



```
<str name="mm">6&lt;90%</str>
```

qf

Query Fields: specifies the fields in the index on which to perform the query.



```
<str name="qf">
  id^100000
  isbn_t^100000
  issn_t^100000
  lc_callnum_display^100000
  title_unstem_search^100000
  title_tesim^100000
  subtitle_unstem_search^100000
  title_t^25000
  subtitle_t^25000
  title_addl_unstem_search^25000
  title_addl_t^25000
  earlier_title_tesim^25000
  later_title_tesim^25000
  title_added_entry_unstem_search^1500
  title_added_entry_t^1250
  publisher_tesim^1000
  subject_topic_unstem_search^1000
  subject_unstem_search^750
  subject_t^500
  author_unstem_search^250
  author_addl_unstem_search^250
  author_t^100
  author_addl_t^50
  contents_tesim^50
  databasedescription_tesim^50
  subject_addl_unstem_search^250
  subject_addl_t^50
  gmd_tesim^50
  summary_holdings_tesim^50
  title_series_unstem_search^25
  local_note_tesim^25
  general_note_tesim^25
  awards_note_tesim^25
  title_series_t^10
  section_number_tesim^10
  section_name_tesim^10
  <!-- text -->
  <!-- source -->
</str>
```

q

Defines the raw input strings for the query.

i.e. frankenstein

Simplified Dismax

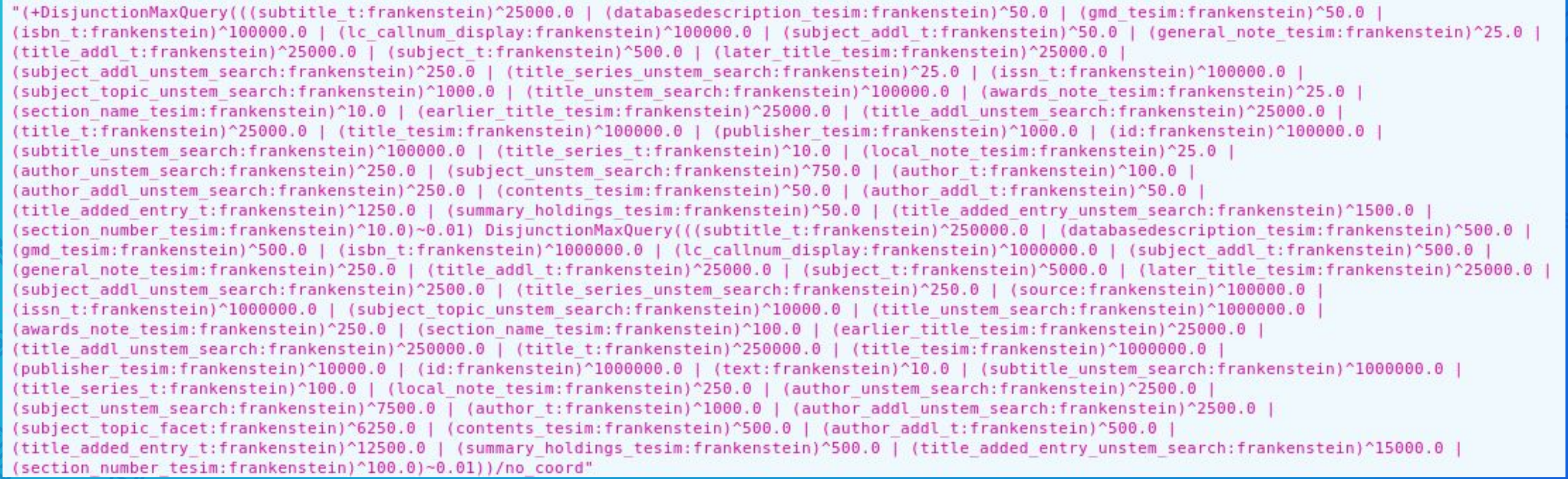
frankenstein ○

title^100000
subject^1000
author^250

=

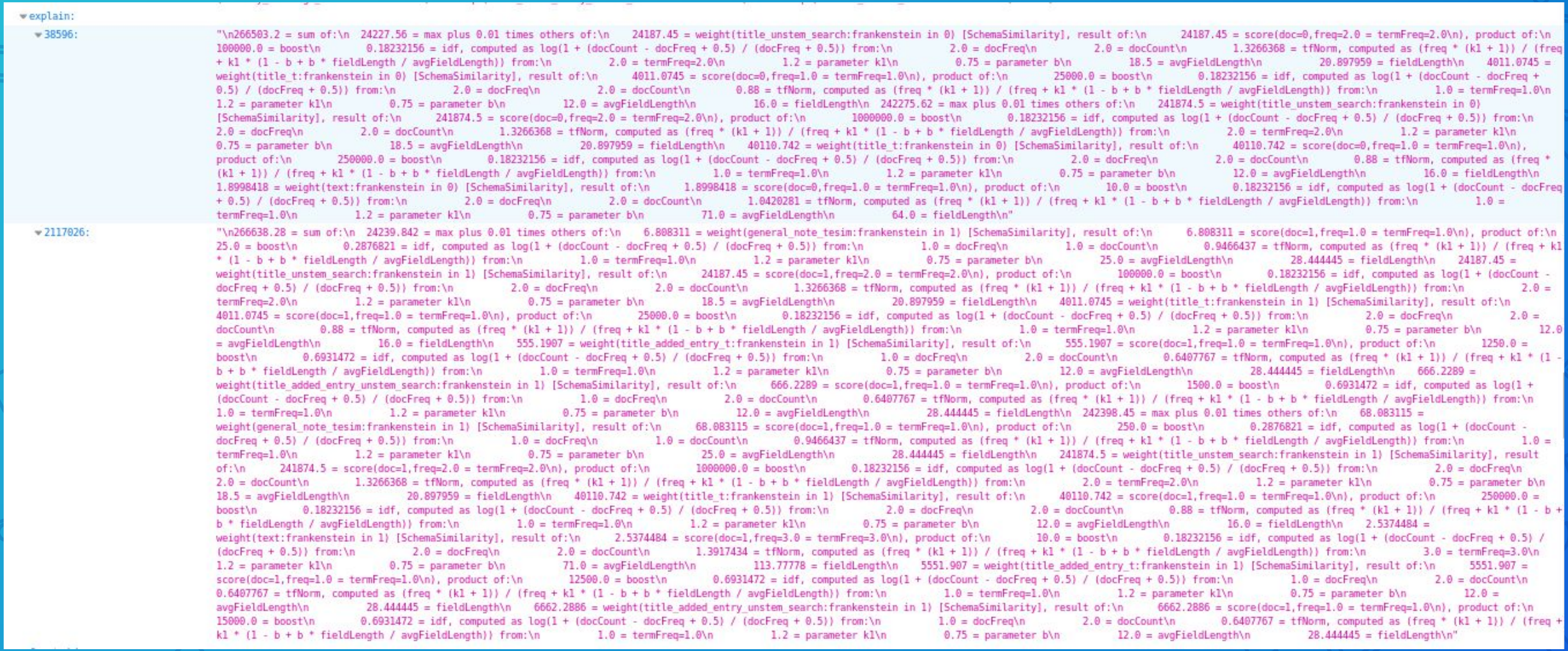
title:frankenstein^100000 OR
subject:frankenstein^1000 OR
author:frankenstein^250

frankenstein



```
"(+DisjunctionMaxQuery(((subtitle_t:frankenstein)^25000.0 | (databasedescription_tesim:frankenstein)^50.0 | (gmd_tesim:frankenstein)^50.0 |
(isbn_t:frankenstein)^100000.0 | (lc_callnum_display:frankenstein)^100000.0 | (subject_addl_t:frankenstein)^50.0 | (general_note_tesim:frankenstein)^25.0 |
(title_addl_t:frankenstein)^25000.0 | (subject_t:frankenstein)^500.0 | (later_title_tesim:frankenstein)^25000.0 |
(subject_addl_unstem_search:frankenstein)^250.0 | (title_series_unstem_search:frankenstein)^25.0 | (issn_t:frankenstein)^100000.0 |
(subject_topic_unstem_search:frankenstein)^1000.0 | (title_unstem_search:frankenstein)^100000.0 | (awards_note_tesim:frankenstein)^25.0 |
(section_name_tesim:frankenstein)^10.0 | (earlier_title_tesim:frankenstein)^25000.0 | (title_addl_unstem_search:frankenstein)^25000.0 |
(title_t:frankenstein)^25000.0 | (title_tesim:frankenstein)^100000.0 | (publisher_tesim:frankenstein)^1000.0 | (id:frankenstein)^100000.0 |
(subtitle_unstem_search:frankenstein)^100000.0 | (title_series_t:frankenstein)^10.0 | (local_note_tesim:frankenstein)^25.0 |
(author_unstem_search:frankenstein)^250.0 | (subject_unstem_search:frankenstein)^750.0 | (author_t:frankenstein)^100.0 |
(author_addl_unstem_search:frankenstein)^250.0 | (contents_tesim:frankenstein)^50.0 | (author_addl_t:frankenstein)^50.0 |
(title_added_entry_t:frankenstein)^1250.0 | (summary_holdings_tesim:frankenstein)^50.0 | (title_added_entry_unstem_search:frankenstein)^1500.0 |
(section_number_tesim:frankenstein)^10.0)~0.01) DisjunctionMaxQuery(((subtitle_t:frankenstein)^250000.0 | (databasedescription_tesim:frankenstein)^500.0 |
(gmd_tesim:frankenstein)^500.0 | (isbn_t:frankenstein)^1000000.0 | (lc_callnum_display:frankenstein)^1000000.0 | (subject_addl_t:frankenstein)^500.0 |
(general_note_tesim:frankenstein)^250.0 | (title_addl_t:frankenstein)^25000.0 | (subject_t:frankenstein)^5000.0 | (later_title_tesim:frankenstein)^25000.0 |
(subject_addl_unstem_search:frankenstein)^2500.0 | (title_series_unstem_search:frankenstein)^250.0 | (source:frankenstein)^100000.0 |
(issn_t:frankenstein)^1000000.0 | (subject_topic_unstem_search:frankenstein)^10000.0 | (title_unstem_search:frankenstein)^1000000.0 |
(awards_note_tesim:frankenstein)^250.0 | (section_name_tesim:frankenstein)^100.0 | (earlier_title_tesim:frankenstein)^25000.0 |
(title_addl_unstem_search:frankenstein)^250000.0 | (title_t:frankenstein)^250000.0 | (title_tesim:frankenstein)^1000000.0 |
(publisher_tesim:frankenstein)^10000.0 | (id:frankenstein)^1000000.0 | (text:frankenstein)^10.0 | (subtitle_unstem_search:frankenstein)^1000000.0 |
(title_series_t:frankenstein)^100.0 | (local_note_tesim:frankenstein)^250.0 | (author_unstem_search:frankenstein)^2500.0 |
(subject_unstem_search:frankenstein)^7500.0 | (author_t:frankenstein)^1000.0 | (author_addl_unstem_search:frankenstein)^2500.0 |
(subject_topic_facet:frankenstein)^6250.0 | (contents_tesim:frankenstein)^500.0 | (author_addl_t:frankenstein)^500.0 |
(title_added_entry_t:frankenstein)^12500.0 | (summary_holdings_tesim:frankenstein)^500.0 | (title_added_entry_unstem_search:frankenstein)^15000.0 |
(section_number_tesim:frankenstein)^100.0)~0.01))/no_coord"
```

Show Your Work



```
explain:
  38596:
"\n266503.2 = sum of:\n  24227.56 = max plus 0.01 times others of:\n    24187.45 = weight(title_unstem_search:frankenstein in 0) [SchemaSimilarity], result of:\n      24187.45 = score(doc=0,freq=2.0 = termFreq=2.0\n), product of:\n
100000.0 = boost\n        0.18232156 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n          2.0 = docFreq\n          2.0 = docCount\n        1.3266368 = tfNorm, computed as (freq * (k1 + 1)) / (freq
+ k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n          2.0 = termFreq=2.0\n          1.2 = parameter k1\n          0.75 = parameter b\n          18.5 = avgFieldLength\n          20.897959 = fieldLength\n    4011.0745 =
weight(title_t:frankenstein in 0) [SchemaSimilarity], result of:\n      4011.0745 = score(doc=0,freq=1.0 = termFreq=1.0\n), product of:\n        25000.0 = boost\n        0.18232156 = idf, computed as log(1 + (docCount - docFreq +
0.5) / (docFreq + 0.5)) from:\n          2.0 = docFreq\n          2.0 = docCount\n        0.88 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n          1.0 = termFreq=1.0\n
1.2 = parameter k1\n          0.75 = parameter b\n          12.0 = avgFieldLength\n          16.0 = fieldLength\n  242275.62 = max plus 0.01 times others of:\n    241874.5 = weight(title_unstem_search:frankenstein in 0)
[SchemaSimilarity], result of:\n      241874.5 = score(doc=0,freq=2.0 = termFreq=2.0\n), product of:\n        1000000.0 = boost\n        0.18232156 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n
2.0 = docFreq\n          2.0 = docCount\n        1.3266368 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n          2.0 = termFreq=2.0\n          1.2 = parameter k1\n
0.75 = parameter b\n          18.5 = avgFieldLength\n          20.897959 = fieldLength\n    40110.742 = weight(title_t:frankenstein in 0) [SchemaSimilarity], result of:\n      40110.742 = score(doc=0,freq=1.0 = termFreq=1.0\n),
product of:\n        250000.0 = boost\n        0.18232156 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n          2.0 = docFreq\n          2.0 = docCount\n        0.88 = tfNorm, computed as (freq *
(k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n          1.0 = termFreq=1.0\n          1.2 = parameter k1\n          0.75 = parameter b\n          12.0 = avgFieldLength\n          16.0 = fieldLength\n
1.8998418 = weight(text:frankenstein in 0) [SchemaSimilarity], result of:\n      1.8998418 = score(doc=0,freq=1.0 = termFreq=1.0\n), product of:\n        10.0 = boost\n        0.18232156 = idf, computed as log(1 + (docCount - docFreq
+ 0.5) / (docFreq + 0.5)) from:\n          2.0 = docFreq\n          2.0 = docCount\n        1.0420281 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n          1.0 =
termFreq=1.0\n          1.2 = parameter k1\n          0.75 = parameter b\n          71.0 = avgFieldLength\n          64.0 = fieldLength\n"
  2117026:
"\n266638.28 = sum of:\n  24239.842 = max plus 0.01 times others of:\n    6.808311 = weight(general_note_tesim:frankenstein in 1) [SchemaSimilarity], result of:\n      6.808311 = score(doc=1,freq=1.0 = termFreq=1.0\n), product of:\n
25.0 = boost\n        0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n          1.0 = docFreq\n          1.0 = docCount\n        0.9466437 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1
* (1 - b + b * fieldLength / avgFieldLength)) from:\n          1.0 = termFreq=1.0\n          1.2 = parameter k1\n          0.75 = parameter b\n          25.0 = avgFieldLength\n          28.444445 = fieldLength\n    24187.45 =
weight(title_unstem_search:frankenstein in 1) [SchemaSimilarity], result of:\n      24187.45 = score(doc=1,freq=2.0 = termFreq=2.0\n), product of:\n        100000.0 = boost\n        0.18232156 = idf, computed as log(1 + (docCount -
docFreq + 0.5) / (docFreq + 0.5)) from:\n          2.0 = docFreq\n          2.0 = docCount\n        1.3266368 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n          2.0 =
termFreq=2.0\n          1.2 = parameter k1\n          0.75 = parameter b\n          18.5 = avgFieldLength\n          20.897959 = fieldLength\n    4011.0745 = weight(title_t:frankenstein in 1) [SchemaSimilarity], result of:\n
4011.0745 = score(doc=1,freq=1.0 = termFreq=1.0\n), product of:\n        25000.0 = boost\n        0.18232156 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n          2.0 = docFreq\n          2.0 =
docCount\n        0.88 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n          1.0 = termFreq=1.0\n          1.2 = parameter k1\n          0.75 = parameter b\n          12.0
= avgFieldLength\n          16.0 = fieldLength\n    555.1907 = weight(title_added_entry_t:frankenstein in 1) [SchemaSimilarity], result of:\n      555.1907 = score(doc=1,freq=1.0 = termFreq=1.0\n), product of:\n        1250.0 =
boost\n        0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n          1.0 = docFreq\n          2.0 = docCount\n        0.6407767 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 -
b + b * fieldLength / avgFieldLength)) from:\n          1.0 = termFreq=1.0\n          1.2 = parameter k1\n          0.75 = parameter b\n          12.0 = avgFieldLength\n          28.444445 = fieldLength\n    666.2289 =
weight(title_added_entry_unstem_search:frankenstein in 1) [SchemaSimilarity], result of:\n      666.2289 = score(doc=1,freq=1.0 = termFreq=1.0\n), product of:\n        1500.0 = boost\n        0.6931472 = idf, computed as log(1 +
(docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n          1.0 = docFreq\n          2.0 = docCount\n        0.6407767 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n
1.0 = termFreq=1.0\n          1.2 = parameter k1\n          0.75 = parameter b\n          12.0 = avgFieldLength\n          28.444445 = fieldLength\n  242398.45 = max plus 0.01 times others of:\n    68.083115 =
weight(general_note_tesim:frankenstein in 1) [SchemaSimilarity], result of:\n      68.083115 = score(doc=1,freq=1.0 = termFreq=1.0\n), product of:\n        250.0 = boost\n        0.2876821 = idf, computed as log(1 + (docCount -
docFreq + 0.5) / (docFreq + 0.5)) from:\n          1.0 = docFreq\n          1.0 = docCount\n        0.9466437 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n          1.0 =
termFreq=1.0\n          1.2 = parameter k1\n          0.75 = parameter b\n          25.0 = avgFieldLength\n          28.444445 = fieldLength\n    241874.5 = weight(title_unstem_search:frankenstein in 1) [SchemaSimilarity], result
of:\n      241874.5 = score(doc=1,freq=2.0 = termFreq=2.0\n), product of:\n        1000000.0 = boost\n        0.18232156 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n          2.0 = docFreq\n
2.0 = docCount\n        1.3266368 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n          2.0 = termFreq=2.0\n          1.2 = parameter k1\n          0.75 = parameter b\n
18.5 = avgFieldLength\n          20.897959 = fieldLength\n    40110.742 = weight(title_t:frankenstein in 1) [SchemaSimilarity], result of:\n      40110.742 = score(doc=1,freq=1.0 = termFreq=1.0\n), product of:\n        250000.0 =
boost\n        0.18232156 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n          2.0 = docFreq\n          2.0 = docCount\n        0.88 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b +
b * fieldLength / avgFieldLength)) from:\n          1.0 = termFreq=1.0\n          1.2 = parameter k1\n          0.75 = parameter b\n          12.0 = avgFieldLength\n          16.0 = fieldLength\n    2.5374484 =
weight(text:frankenstein in 1) [SchemaSimilarity], result of:\n      2.5374484 = score(doc=1,freq=3.0 = termFreq=3.0\n), product of:\n        10.0 = boost\n        0.18232156 = idf, computed as log(1 + (docCount - docFreq + 0.5) /
(docFreq + 0.5)) from:\n          2.0 = docFreq\n          2.0 = docCount\n        1.3917434 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n          3.0 = termFreq=3.0\n
1.2 = parameter k1\n          0.75 = parameter b\n          71.0 = avgFieldLength\n          113.77778 = fieldLength\n    5551.907 = weight(title_added_entry_t:frankenstein in 1) [SchemaSimilarity], result of:\n      5551.907 =
score(doc=1,freq=1.0 = termFreq=1.0\n), product of:\n        12500.0 = boost\n        0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n          1.0 = docFreq\n          2.0 = docCount\n
0.6407767 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n          1.0 = termFreq=1.0\n          1.2 = parameter k1\n          0.75 = parameter b\n          12.0 =
avgFieldLength\n          28.444445 = fieldLength\n    6662.2886 = weight(title_added_entry_unstem_search:frankenstein in 1) [SchemaSimilarity], result of:\n      6662.2886 = score(doc=1,freq=1.0 = termFreq=1.0\n), product of:\n
15000.0 = boost\n        0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n          1.0 = docFreq\n          2.0 = docCount\n        0.6407767 = tfNorm, computed as (freq * (k1 + 1)) / (freq +
k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n          1.0 = termFreq=1.0\n          1.2 = parameter k1\n          0.75 = parameter b\n          12.0 = avgFieldLength\n          28.444445 = fieldLength\n"
```

Boolean Model + Vector Space Model

Boolean query

A document either matches or does not match a query.
AND, OR, NOT

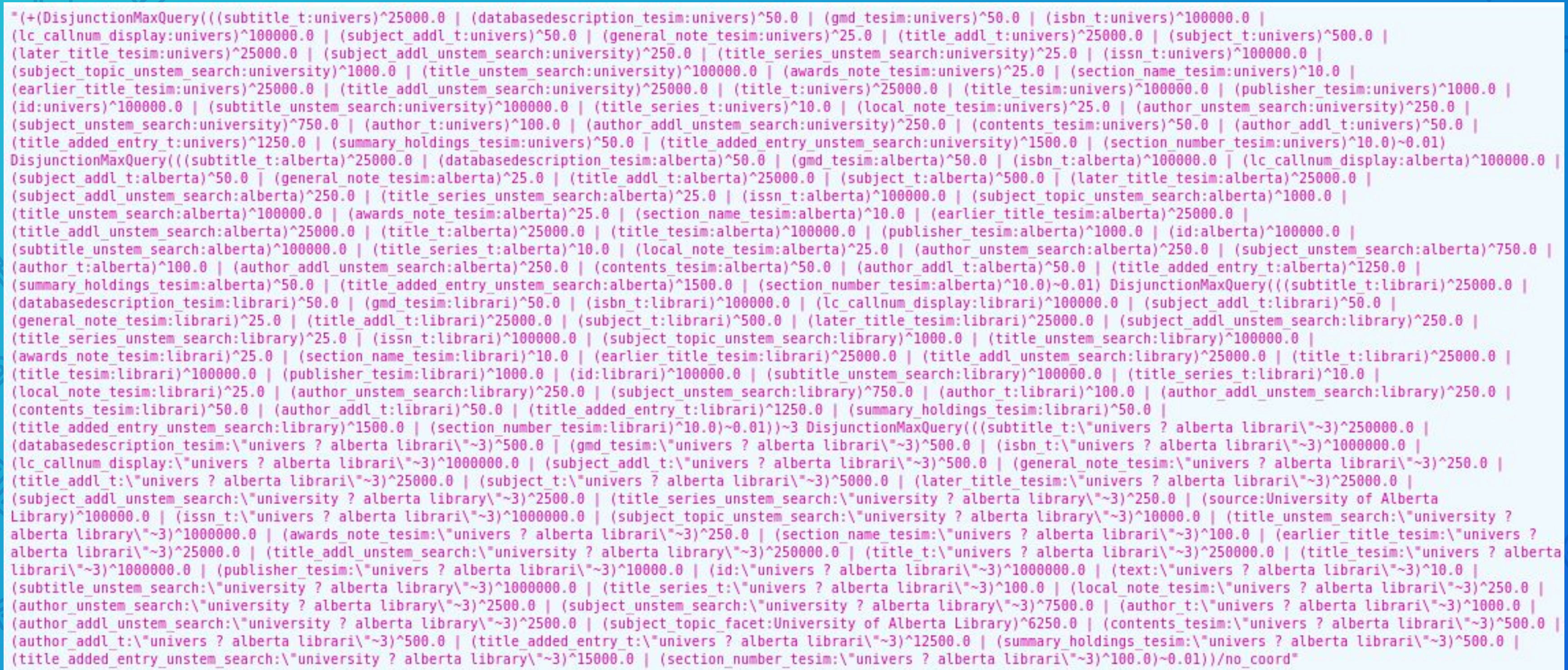
IDF

Inverse document frequency deals with the problem of terms that occur too often in the collection to be meaningful for relevance determination.

TF

Term frequency is the number of times a term occurs in a document. A document that mentions a query term more often has more to do with that query and therefore should receive a higher score.

University of Alberta Library



```
"(+(DisjunctionMaxQuery(((subtitle_t:univers)^25000.0 | (databasedescription_tesim:univers)^50.0 | (gmd_tesim:univers)^50.0 | (isbn_t:univers)^100000.0 |
(lc_callnum_display:univers)^100000.0 | (subject_addl_t:univers)^50.0 | (general_note_tesim:univers)^25.0 | (title_addl_t:univers)^25000.0 | (subject_t:univers)^500.0 |
(later_title_tesim:univers)^25000.0 | (subject_addl_unstem_search:university)^250.0 | (title_series_unstem_search:university)^25.0 | (issn_t:univers)^100000.0 |
(subject_topic_unstem_search:university)^1000.0 | (title_unstem_search:university)^100000.0 | (awards_note_tesim:univers)^25.0 | (section_name_tesim:univers)^10.0 |
(earlier_title_tesim:univers)^25000.0 | (title_addl_unstem_search:university)^25000.0 | (title_t:univers)^25000.0 | (title_tesim:univers)^100000.0 | (publisher_tesim:univers)^1000.0 |
(id:univers)^100000.0 | (subtitle_unstem_search:university)^100000.0 | (title_series_t:univers)^10.0 | (local_note_tesim:univers)^25.0 | (author_unstem_search:university)^250.0 |
(subject_unstem_search:university)^750.0 | (author_t:univers)^100.0 | (author_addl_unstem_search:university)^250.0 | (contents_tesim:univers)^50.0 | (author_addl_t:univers)^50.0 |
(title_added_entry_t:univers)^1250.0 | (summary_holdings_tesim:univers)^50.0 | (title_added_entry_unstem_search:university)^1500.0 | (section_number_tesim:univers)^10.0)~0.01)
DisjunctionMaxQuery(((subtitle_t:alberta)^25000.0 | (databasedescription_tesim:alberta)^50.0 | (gmd_tesim:alberta)^50.0 | (isbn_t:alberta)^100000.0 | (lc_callnum_display:alberta)^100000.0 |
(subject_addl_t:alberta)^50.0 | (general_note_tesim:alberta)^25.0 | (title_addl_t:alberta)^25000.0 | (subject_t:alberta)^500.0 | (later_title_tesim:alberta)^25000.0 |
(subject_addl_unstem_search:alberta)^250.0 | (title_series_unstem_search:alberta)^25.0 | (issn_t:alberta)^100000.0 | (subject_topic_unstem_search:alberta)^1000.0 |
(title_unstem_search:alberta)^100000.0 | (awards_note_tesim:alberta)^25.0 | (section_name_tesim:alberta)^10.0 | (earlier_title_tesim:alberta)^25000.0 |
(title_addl_unstem_search:alberta)^25000.0 | (title_t:alberta)^25000.0 | (title_tesim:alberta)^100000.0 | (publisher_tesim:alberta)^1000.0 | (id:alberta)^100000.0 |
(subtitle_unstem_search:alberta)^100000.0 | (title_series_t:alberta)^10.0 | (local_note_tesim:alberta)^25.0 | (author_unstem_search:alberta)^250.0 | (subject_unstem_search:alberta)^750.0 |
(author_t:alberta)^100.0 | (author_addl_unstem_search:alberta)^250.0 | (contents_tesim:alberta)^50.0 | (author_addl_t:alberta)^50.0 | (title_added_entry_t:alberta)^1250.0 |
(summary_holdings_tesim:alberta)^50.0 | (title_added_entry_unstem_search:alberta)^1500.0 | (section_number_tesim:alberta)^10.0)~0.01) DisjunctionMaxQuery(((subtitle_t:librari)^25000.0 |
(databasedescription_tesim:librari)^50.0 | (gmd_tesim:librari)^50.0 | (isbn_t:librari)^100000.0 | (lc_callnum_display:librari)^100000.0 | (subject_addl_t:librari)^50.0 |
(general_note_tesim:librari)^25.0 | (title_addl_t:librari)^25000.0 | (subject_t:librari)^500.0 | (later_title_tesim:librari)^25000.0 | (subject_addl_unstem_search:library)^250.0 |
(title_series_unstem_search:library)^25.0 | (issn_t:librari)^100000.0 | (subject_topic_unstem_search:library)^1000.0 | (title_unstem_search:library)^100000.0 |
(awards_note_tesim:librari)^25.0 | (section_name_tesim:librari)^10.0 | (earlier_title_tesim:librari)^25000.0 | (title_addl_unstem_search:library)^25000.0 | (title_t:librari)^25000.0 |
(title_tesim:librari)^100000.0 | (publisher_tesim:librari)^1000.0 | (id:librari)^100000.0 | (subtitle_unstem_search:library)^100000.0 | (title_series_t:librari)^10.0 |
(local_note_tesim:librari)^25.0 | (author_unstem_search:library)^250.0 | (subject_unstem_search:library)^750.0 | (author_t:librari)^100.0 | (author_addl_unstem_search:library)^250.0 |
(contents_tesim:librari)^50.0 | (author_addl_t:librari)^50.0 | (title_added_entry_t:librari)^1250.0 | (summary_holdings_tesim:librari)^50.0 |
(title_added_entry_unstem_search:library)^1500.0 | (section_number_tesim:librari)^10.0)~0.01))~3 DisjunctionMaxQuery(((subtitle_t:\"univers ? alberta librari\"~3)^250000.0 |
(databasedescription_tesim:\"univers ? alberta librari\"~3)^500.0 | (gmd_tesim:\"univers ? alberta librari\"~3)^500.0 | (isbn_t:\"univers ? alberta librari\"~3)^1000000.0 |
(lc_callnum_display:\"univers ? alberta librari\"~3)^1000000.0 | (subject_addl_t:\"univers ? alberta librari\"~3)^500.0 | (general_note_tesim:\"univers ? alberta librari\"~3)^250.0 |
(title_addl_t:\"univers ? alberta librari\"~3)^25000.0 | (subject_t:\"univers ? alberta librari\"~3)^5000.0 | (later_title_tesim:\"univers ? alberta librari\"~3)^25000.0 |
(subject_addl_unstem_search:\"university ? alberta library\"~3)^2500.0 | (title_series_unstem_search:\"university ? alberta library\"~3)^250.0 | (source:University of Alberta
Library)^100000.0 | (issn_t:\"univers ? alberta librari\"~3)^1000000.0 | (subject_topic_unstem_search:\"university ? alberta library\"~3)^10000.0 | (title_unstem_search:\"university ?
alberta library\"~3)^1000000.0 | (awards_note_tesim:\"univers ? alberta librari\"~3)^250.0 | (section_name_tesim:\"univers ? alberta librari\"~3)^100.0 | (earlier_title_tesim:\"univers ?
alberta librari\"~3)^25000.0 | (title_addl_unstem_search:\"university ? alberta library\"~3)^250000.0 | (title_t:\"univers ? alberta librari\"~3)^250000.0 | (title_tesim:\"univers ? alberta
librari\"~3)^1000000.0 | (publisher_tesim:\"univers ? alberta librari\"~3)^10000.0 | (id:\"univers ? alberta librari\"~3)^1000000.0 | (text:\"univers ? alberta librari\"~3)^10.0 |
(subtitle_unstem_search:\"university ? alberta library\"~3)^1000000.0 | (title_series_t:\"univers ? alberta librari\"~3)^100.0 | (local_note_tesim:\"univers ? alberta librari\"~3)^250.0 |
(author_unstem_search:\"university ? alberta library\"~3)^2500.0 | (subject_unstem_search:\"university ? alberta library\"~3)^7500.0 | (author_t:\"univers ? alberta librari\"~3)^1000.0 |
(author_addl_unstem_search:\"university ? alberta library\"~3)^2500.0 | (subject_topic_facet:University of Alberta Library)^6250.0 | (contents_tesim:\"univers ? alberta librari\"~3)^500.0 |
(author_addl_t:\"univers ? alberta librari\"~3)^500.0 | (title_added_entry_t:\"univers ? alberta librari\"~3)^12500.0 | (summary_holdings_tesim:\"univers ? alberta librari\"~3)^500.0 |
(title_added_entry_unstem_search:\"university ? alberta library\"~3)^15000.0 | (section_number_tesim:\"univers ? alberta librari\"~3)^100.0)~0.01))/no_coord"
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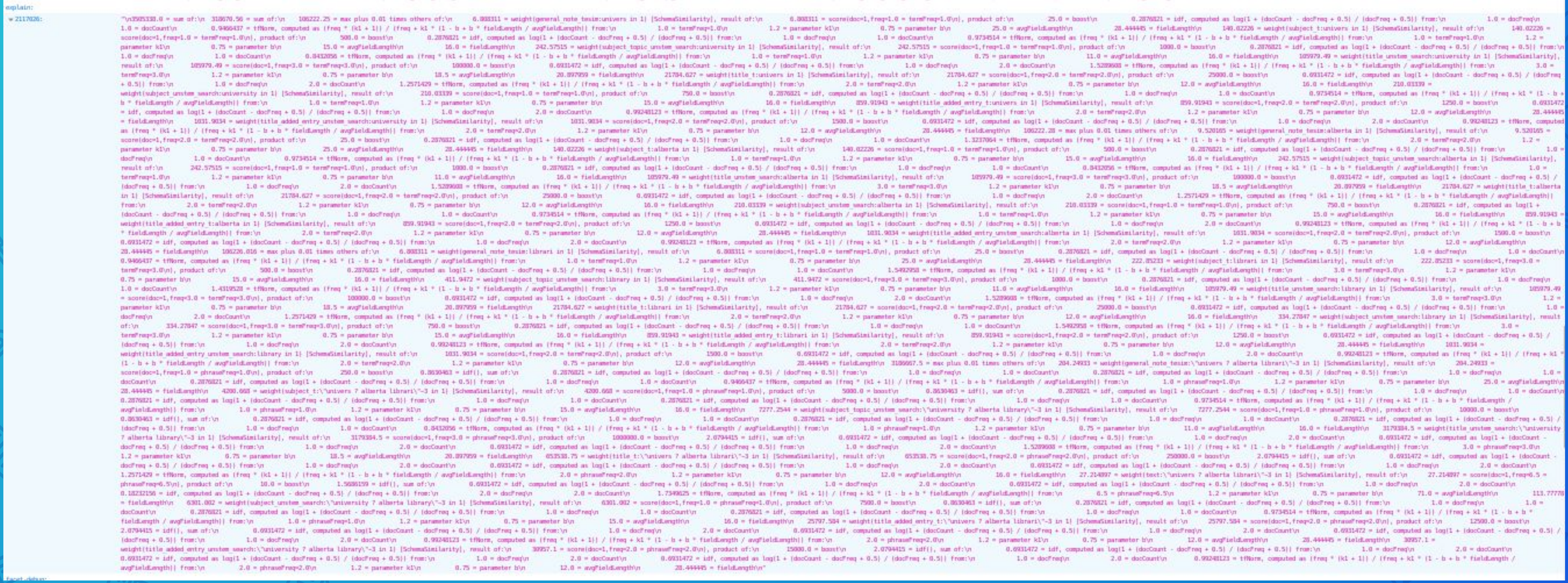
Show Your Work



```
explain:
▾ 2117026:    "\n3505330.0 = sum of:\n  318670.56 = sum of:\n    106222.25 = max plus 0.01 times others of:\n      6.808311 = weight(general_note_tesim:univers in 1) [SchemaSimilarity], result of:\n        6.808311 = score(doc=1,freq=1.0 = termFreq=1.0\n), product of:\n          25.0 = boost\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n
              1.0 = docCount\n          0.9466437 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            1.0 = termFreq=1.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            25.0 = avgFieldLength\n            28.444445 = fieldLength\n      140.02226 = weight(subject_t:univers in 1) [SchemaSimilarity], result of:\n        140.02226 =
              score(doc=1,freq=1.0 = termFreq=1.0\n), product of:\n          500.0 = boost\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 = docCount\n          0.9734514 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            1.0 = termFreq=1.0\n            1.2 =
              parameter k1\n            0.75 = parameter b\n            15.0 = avgFieldLength\n            16.0 = fieldLength\n      242.57515 = weight(subject_topic_unstem_search:university in 1) [SchemaSimilarity], result of:\n        242.57515 = score(doc=1,freq=1.0 = termFreq=1.0\n), product of:\n          1000.0 = boost\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n
              1.0 = docFreq\n            1.0 = docCount\n          0.8432056 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            1.0 = termFreq=1.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            11.0 = avgFieldLength\n            16.0 = fieldLength\n      105979.49 = weight(title_unstem_search:university in 1) [SchemaSimilarity],
              result of:\n        105979.49 = score(doc=1,freq=3.0 = termFreq=3.0\n), product of:\n          100000.0 = boost\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n          1.5289608 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            3.0 =
              termFreq=3.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            18.5 = avgFieldLength\n            20.897959 = fieldLength\n      21784.627 = weight(title_t:univers in 1) [SchemaSimilarity], result of:\n        21784.627 = score(doc=1,freq=2.0 = termFreq=2.0\n), product of:\n          25000.0 = boost\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq
              + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n          1.2571429 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            2.0 = termFreq=2.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            12.0 = avgFieldLength\n            16.0 = fieldLength\n      210.03339 =
              weight(subject_unstem_search:university in 1) [SchemaSimilarity], result of:\n        210.03339 = score(doc=1,freq=1.0 = termFreq=1.0\n), product of:\n          750.0 = boost\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 = docCount\n          0.9734514 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b +
              b * fieldLength / avgFieldLength)) from:\n            1.0 = termFreq=1.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            15.0 = avgFieldLength\n            16.0 = fieldLength\n      859.91943 = weight(title_added_entry_t:univers in 1) [SchemaSimilarity], result of:\n        859.91943 = score(doc=1,freq=2.0 = termFreq=2.0\n), product of:\n          1250.0 = boost\n          0.6931472
              = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n          0.99248123 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            2.0 = termFreq=2.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            12.0 = avgFieldLength\n            28.444445
              = fieldLength\n      1031.9034 = weight(title_added_entry_unstem_search:university in 1) [SchemaSimilarity], result of:\n        1031.9034 = score(doc=1,freq=2.0 = termFreq=2.0\n), product of:\n          1500.0 = boost\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n          0.99248123 = tfNorm, computed
              as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            2.0 = termFreq=2.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            12.0 = avgFieldLength\n            28.444445 = fieldLength\n    106222.28 = max plus 0.01 times others of:\n      9.520165 = weight(general_note_tesim:alberta in 1) [SchemaSimilarity], result of:\n        9.520165 =
              score(doc=1,freq=2.0 = termFreq=2.0\n), product of:\n          25.0 = boost\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 = docCount\n          1.3237064 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            2.0 = termFreq=2.0\n            1.2 =
              parameter k1\n            0.75 = parameter b\n            25.0 = avgFieldLength\n            28.444445 = fieldLength\n      140.02226 = weight(subject_t:alberta in 1) [SchemaSimilarity], result of:\n        140.02226 = score(doc=1,freq=1.0 = termFreq=1.0\n), product of:\n          500.0 = boost\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 =
              docFreq\n            1.0 = docCount\n          0.9734514 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            1.0 = termFreq=1.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            15.0 = avgFieldLength\n            16.0 = fieldLength\n      242.57515 = weight(subject_topic_unstem_search:alberta in 1) [SchemaSimilarity],
              result of:\n        242.57515 = score(doc=1,freq=1.0 = termFreq=1.0\n), product of:\n          1000.0 = boost\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 = docCount\n          0.8432056 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            1.0 =
              termFreq=1.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            11.0 = avgFieldLength\n            16.0 = fieldLength\n      105979.49 = weight(title_unstem_search:alberta in 1) [SchemaSimilarity], result of:\n        105979.49 = score(doc=1,freq=3.0 = termFreq=3.0\n), product of:\n          100000.0 = boost\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) /
              (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n          1.5289608 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            3.0 = termFreq=3.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            18.5 = avgFieldLength\n            20.897959 = fieldLength\n      21784.627 = weight(title_t:alberta
              in 1) [SchemaSimilarity], result of:\n        21784.627 = score(doc=1,freq=2.0 = termFreq=2.0\n), product of:\n          25000.0 = boost\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n          1.2571429 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength))
              from:\n            2.0 = termFreq=2.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            12.0 = avgFieldLength\n            16.0 = fieldLength\n      210.03339 = weight(subject_unstem_search:alberta in 1) [SchemaSimilarity], result of:\n        210.03339 = score(doc=1,freq=1.0 = termFreq=1.0\n), product of:\n          750.0 = boost\n          0.2876821 = idf, computed as log(1 +
              (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 = docCount\n          0.9734514 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            1.0 = termFreq=1.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            15.0 = avgFieldLength\n            16.0 = fieldLength\n      859.91943 =
              weight(title_added_entry_t:alberta in 1) [SchemaSimilarity], result of:\n        859.91943 = score(doc=1,freq=2.0 = termFreq=2.0\n), product of:\n          1250.0 = boost\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n          0.99248123 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b
              * fieldLength / avgFieldLength)) from:\n            2.0 = termFreq=2.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            12.0 = avgFieldLength\n            28.444445 = fieldLength\n      1031.9034 = weight(title_added_entry_unstem_search:alberta in 1) [SchemaSimilarity], result of:\n        1031.9034 = score(doc=1,freq=2.0 = termFreq=2.0\n), product of:\n          1500.0 = boost\n
              0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n          0.99248123 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            2.0 = termFreq=2.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            12.0 = avgFieldLength\n
              28.444445 = fieldLength\n    106226.016 = max plus 0.01 times others of:\n      6.808311 = weight(general_note_tesim:librari in 1) [SchemaSimilarity], result of:\n        6.808311 = score(doc=1,freq=1.0 = termFreq=1.0\n), product of:\n          25.0 = boost\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 = docCount\n
              0.9466437 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            1.0 = termFreq=1.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            25.0 = avgFieldLength\n            28.444445 = fieldLength\n      222.85233 = weight(subject_t:librari in 1) [SchemaSimilarity], result of:\n        222.85233 = score(doc=1,freq=3.0 =
              termFreq=3.0\n), product of:\n          500.0 = boost\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 = docCount\n          1.5492958 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            3.0 = termFreq=3.0\n            1.2 = parameter k1\n
              0.75 = parameter b\n            15.0 = avgFieldLength\n            16.0 = fieldLength\n      411.9472 = weight(subject_topic_unstem_search:library in 1) [SchemaSimilarity], result of:\n        411.9472 = score(doc=1,freq=3.0 = termFreq=3.0\n), product of:\n          1000.0 = boost\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n
              1.0 = docCount\n          1.4319528 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            3.0 = termFreq=3.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            11.0 = avgFieldLength\n            16.0 = fieldLength\n      105979.49 = weight(title_unstem_search:library in 1) [SchemaSimilarity], result of:\n        105979.49
              = score(doc=1,freq=3.0 = termFreq=3.0\n), product of:\n          100000.0 = boost\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n          1.5289608 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            3.0 = termFreq=3.0\n            1.2 =
              parameter k1\n            0.75 = parameter b\n            18.5 = avgFieldLength\n            20.897959 = fieldLength\n      21784.627 = weight(title_t:librari in 1) [SchemaSimilarity], result of:\n        21784.627 = score(doc=1,freq=2.0 = termFreq=2.0\n), product of:\n          25000.0 = boost\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 =
              docFreq\n            2.0 = docCount\n          1.2571429 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            2.0 = termFreq=2.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            12.0 = avgFieldLength\n            16.0 = fieldLength\n      334.27847 = weight(subject_unstem_search:library in 1) [SchemaSimilarity], result
              of:\n        334.27847 = score(doc=1,freq=3.0 = termFreq=3.0\n), product of:\n          750.0 = boost\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 = docCount\n          1.5492958 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            3.0 =
              termFreq=3.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            15.0 = avgFieldLength\n            16.0 = fieldLength\n      859.91943 = weight(title_added_entry_t:librari in 1) [SchemaSimilarity], result of:\n        859.91943 = score(doc=1,freq=2.0 = termFreq=2.0\n), product of:\n          1250.0 = boost\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) /
              (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n          0.99248123 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n            2.0 = termFreq=2.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            12.0 = avgFieldLength\n            28.444445 = fieldLength\n      1031.9034 =
              weight(title_added_entry_unstem_search:library in 1) [SchemaSimilarity], result of:\n        1031.9034 = score(doc=1,freq=2.0 = termFreq=2.0\n), product of:\n          1500.0 = boost\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n          0.99248123 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 *
              (1 - b + b * fieldLength / avgFieldLength)) from:\n            2.0 = termFreq=2.0\n            1.2 = parameter k1\n            0.75 = parameter b\n            12.0 = avgFieldLength\n            28.444445 = fieldLength\n  3186667.5 = max plus 0.01 times others of:\n    204.24933 = weight(general_note_tesim:\"univers ? alberta librari\"~3 in 1) [SchemaSimilarity], result of:\n      204.24933 =
              score(doc=1,freq=1.0 = phraseFreq=1.0\n), product of:\n        250.0 = boost\n        0.8630463 = idf(), sum of:\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 = docCount\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 =
              docCount\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 = docCount\n        0.9466437 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n          1.0 = phraseFreq=1.0\n          1.2 = parameter k1\n          0.75 = parameter b\n          25.0 = avgFieldLength\n
              28.444445 = fieldLength\n    4200.668 = weight(subject_t:\"univers ? alberta librari\"~3 in 1) [SchemaSimilarity], result of:\n      4200.668 = score(doc=1,freq=1.0 = phraseFreq=1.0\n), product of:\n        5000.0 = boost\n        0.8630463 = idf(), sum of:\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 = docCount\n
              0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 = docCount\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 = docCount\n        0.9734514 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength /
              avgFieldLength)) from:\n          1.0 = phraseFreq=1.0\n          1.2 = parameter k1\n          0.75 = parameter b\n          15.0 = avgFieldLength\n          16.0 = fieldLength\n    7277.2544 = weight(subject_topic_unstem_search:\"university ? alberta library\"~3 in 1) [SchemaSimilarity], result of:\n      7277.2544 = score(doc=1,freq=1.0 = phraseFreq=1.0\n), product of:\n        10000.0 = boost\n
              0.8630463 = idf(), sum of:\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 = docCount\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 = docCount\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) /
              (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 = docCount\n        0.8432056 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n          1.0 = phraseFreq=1.0\n          1.2 = parameter k1\n          0.75 = parameter b\n          11.0 = avgFieldLength\n          16.0 = fieldLength\n    3179384.5 = weight(title_unstem_search:\"university
              ? alberta library\"~3 in 1) [SchemaSimilarity], result of:\n      3179384.5 = score(doc=1,freq=3.0 = phraseFreq=3.0\n), product of:\n        1000000.0 = boost\n        2.0794415 = idf(), sum of:\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n          0.6931472 = idf, computed as log(1 + (docCount -
              docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n        1.5289608 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n          3.0 = phraseFreq=3.0\n
              1.2 = parameter k1\n          0.75 = parameter b\n          18.5 = avgFieldLength\n          20.897959 = fieldLength\n    653538.75 = weight(title_t:\"univers ? alberta librari\"~3 in 1) [SchemaSimilarity], result of:\n      653538.75 = score(doc=1,freq=2.0 = phraseFreq=2.0\n), product of:\n        250000.0 = boost\n        2.0794415 = idf(), sum of:\n          0.6931472 = idf, computed as log(1 + (docCount -
              docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n
              1.2571429 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n          2.0 = phraseFreq=2.0\n          1.2 = parameter k1\n          0.75 = parameter b\n          12.0 = avgFieldLength\n          16.0 = fieldLength\n    27.214897 = weight(text:\"univers ? alberta librari\"~3 in 1) [SchemaSimilarity], result of:\n      27.214897 = score(doc=1,freq=6.5 =
              phraseFreq=6.5\n), product of:\n        10.0 = boost\n        1.5686159 = idf(), sum of:\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n
              0.18232156 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            2.0 = docFreq\n            2.0 = docCount\n        1.7349625 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n          6.5 = phraseFreq=6.5\n          1.2 = parameter k1\n          0.75 = parameter b\n          71.0 = avgFieldLength\n          113.77778
              = fieldLength\n    6301.002 = weight(subject_unstem_search:\"university ? alberta library\"~3 in 1) [SchemaSimilarity], result of:\n      6301.002 = score(doc=1,freq=1.0 = phraseFreq=1.0\n), product of:\n        7500.0 = boost\n        0.8630463 = idf(), sum of:\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 =
              docCount\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 = docCount\n          0.2876821 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            1.0 = docCount\n        0.9734514 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b *
              fieldLength / avgFieldLength)) from:\n          1.0 = phraseFreq=1.0\n          1.2 = parameter k1\n          0.75 = parameter b\n          15.0 = avgFieldLength\n          16.0 = fieldLength\n    25797.584 = weight(title_added_entry_t:\"univers ? alberta librari\"~3 in 1) [SchemaSimilarity], result of:\n      25797.584 = score(doc=1,freq=2.0 = phraseFreq=2.0\n), product of:\n        12500.0 = boost\n
              2.0794415 = idf(), sum of:\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) /
              (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n        0.99248123 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength / avgFieldLength)) from:\n          2.0 = phraseFreq=2.0\n          1.2 = parameter k1\n          0.75 = parameter b\n          12.0 = avgFieldLength\n          28.444445 = fieldLength\n    30957.1 =
              weight(title_added_entry_unstem_search:\"university ? alberta library\"~3 in 1) [SchemaSimilarity], result of:\n      30957.1 = score(doc=1,freq=2.0 = phraseFreq=2.0\n), product of:\n        15000.0 = boost\n        2.0794415 = idf(), sum of:\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n
              0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n          0.6931472 = idf, computed as log(1 + (docCount - docFreq + 0.5) / (docFreq + 0.5)) from:\n            1.0 = docFreq\n            2.0 = docCount\n        0.99248123 = tfNorm, computed as (freq * (k1 + 1)) / (freq + k1 * (1 - b + b * fieldLength /
              avgFieldLength)) from:\n          2.0 = phraseFreq=2.0\n          1.2 = parameter k1\n          0.75 = parameter b\n          12.0 = avgFieldLength\n          28.444445 = fieldLength\n"
facet-debug:
```

Challenges

Precision vs Recall

Were the documents that were returned supposed to be returned? Were all of the documents returned that were supposed to be returned?

Phrase searching across fields

“Migrating library data a practical manual”

Length Norms

matches on a smaller field score higher than matches on a larger field. "Managerial accounting garrison"

Language

"L'armée furieuse" vs “armée furieuse"

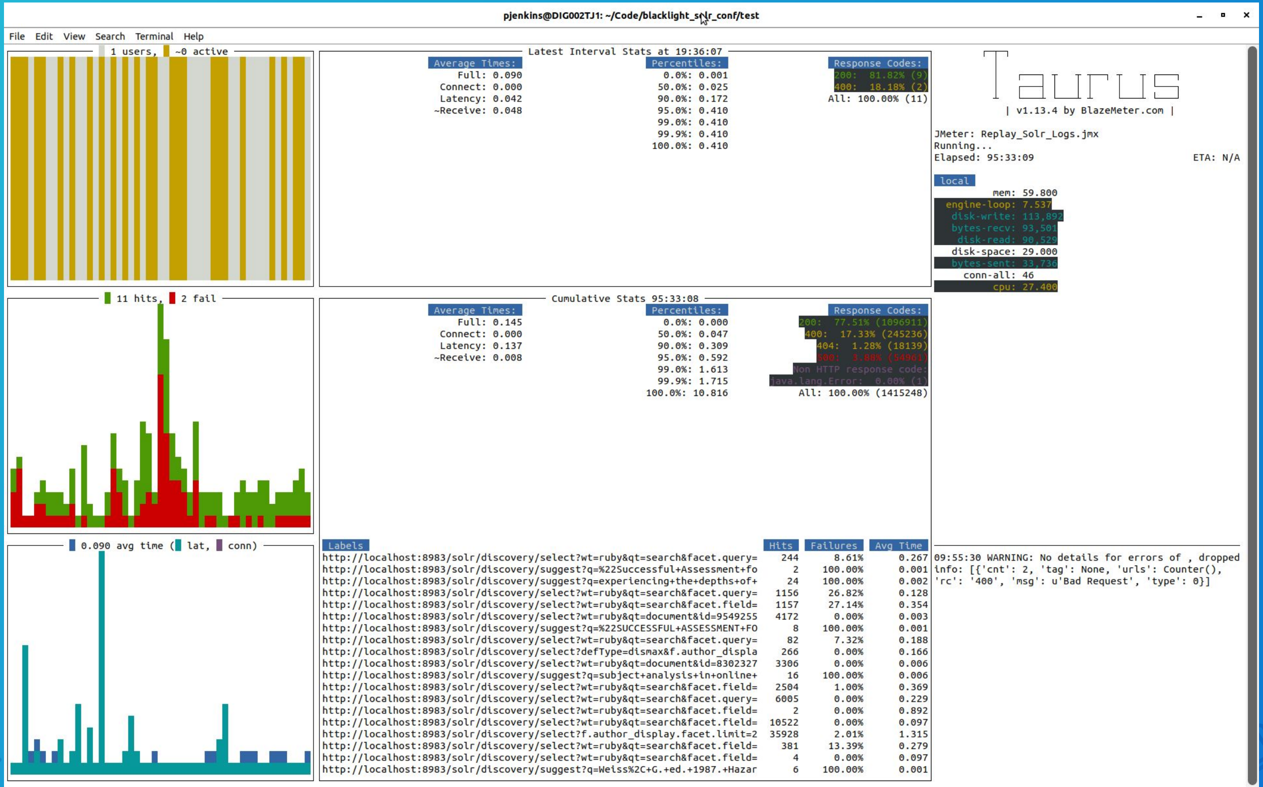
Minimum “Should” Match

british missions “south pacific”

Boosting

UAL content or recency.

Tuning


pjenkins@DIG002TJ1: ~/Code/blacklight_solr_conf/test
File
Edit
View
Search
Terminal
Help
1 users, ~0 active
11 hits, 2 fail
0.090 avg time (lat, conn)

```
              Latest Interval Stats at 19:36:07
Average Times:           Percentiles:          Response Codes:
   Full: 0.090            0.0%: 0.001          200:  81.82% (9)
Connect: 0.000           50.0%: 0.025          400:  18.18% (2)
Latency: 0.042           90.0%: 0.172          All: 100.00% (11)
~Receive: 0.048          95.0%: 0.410
                         99.0%: 0.410
                         99.9%: 0.410
                        100.0%: 0.410

              Cumulative Stats 95:33:08
Average Times:           Percentiles:          Response Codes:
   Full: 0.145            0.0%: 0.000          200:  77.51% (1096911)
Connect: 0.000           50.0%: 0.047          400:  17.33% (245236)
Latency: 0.137           90.0%: 0.309          404:   1.28% (18139)
~Receive: 0.008          95.0%: 0.592          500:   3.88% (54961)
                         99.0%: 1.613          Non HTTP response code:
                         99.9%: 1.715          java.lang.Error:  0.00% (1)
                        100.0%: 10.816         All: 100.00% (1415248)
```

```
Taurus
| v1.13.4 by BlazeMeter.com |

JMeter: Replay_Solr_Logs.jmx
Running...
Elapsed: 95:33:09                                ETA: N/A

local
         mem: 59.800
 engine-loop: 7.537
  disk-write: 113,892
  bytes-recv: 93,501
   disk-read: 90,529
  disk-space: 29.000
  bytes-sent: 33,736
    conn-all: 46
         cpu: 27.400
```

```
Labels                                                              Hits   Failures  Avg Time
http://localhost:8983/solr/discovery/select?wt=ruby&qt=search&facet.query=     244     8.61%     0.267
http://localhost:8983/solr/discovery/suggest?q=%22Successful+Assessment+fo       2   100.00%     0.001
http://localhost:8983/solr/discovery/suggest?q=experiencing+the+depths+of+      24   100.00%     0.002
http://localhost:8983/solr/discovery/select?wt=ruby&qt=search&facet.query=    1156    26.82%     0.128
http://localhost:8983/solr/discovery/select?wt=ruby&qt=search&facet.field=    1157    27.14%     0.354
http://localhost:8983/solr/discovery/select?wt=ruby&qt=document&id=9549255    4172     0.00%     0.003
http://localhost:8983/solr/discovery/suggest?q=%22SUCCESSFUL+ASSESSMENT+FO       8   100.00%     0.001
http://localhost:8983/solr/discovery/select?wt=ruby&qt=search&facet.query=      82     7.32%     0.188
http://localhost:8983/solr/discovery/select?defType=dismax&f.author_displa     266     0.00%     0.166
http://localhost:8983/solr/discovery/select?wt=ruby&qt=document&id=8302327    3306     0.00%     0.006
http://localhost:8983/solr/discovery/suggest?q=subject+analysis+in+online+      16   100.00%     0.006
http://localhost:8983/solr/discovery/select?wt=ruby&qt=search&facet.field=    2504     1.00%     0.369
http://localhost:8983/solr/discovery/select?wt=ruby&qt=search&facet.query=    6005     0.00%     0.229
http://localhost:8983/solr/discovery/select?wt=ruby&qt=search&facet.field=       2     0.00%     0.892
http://localhost:8983/solr/discovery/select?wt=ruby&qt=search&facet.field=   10522     0.00%     0.097
http://localhost:8983/solr/discovery/select?f.author_display.facet.limit=2   35928     2.01%     1.315
http://localhost:8983/solr/discovery/select?wt=ruby&qt=search&facet.field=     381    13.39%     0.279
http://localhost:8983/solr/discovery/select?wt=ruby&qt=search&facet.field=       4     0.00%     0.097
http://localhost:8983/solr/discovery/suggest?q=Weiss%2C+G.+ed.+1987.+Hazar       6   100.00%     0.001
```

```
09:55:30 WARNING: No details for errors of , dropped
info: [{'cnt': 2, 'tag': None, 'urls': Counter(),
'rc': '400', 'msg': u'Bad Request', 'type': 0}]
```

Thanks!

Any questions?

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