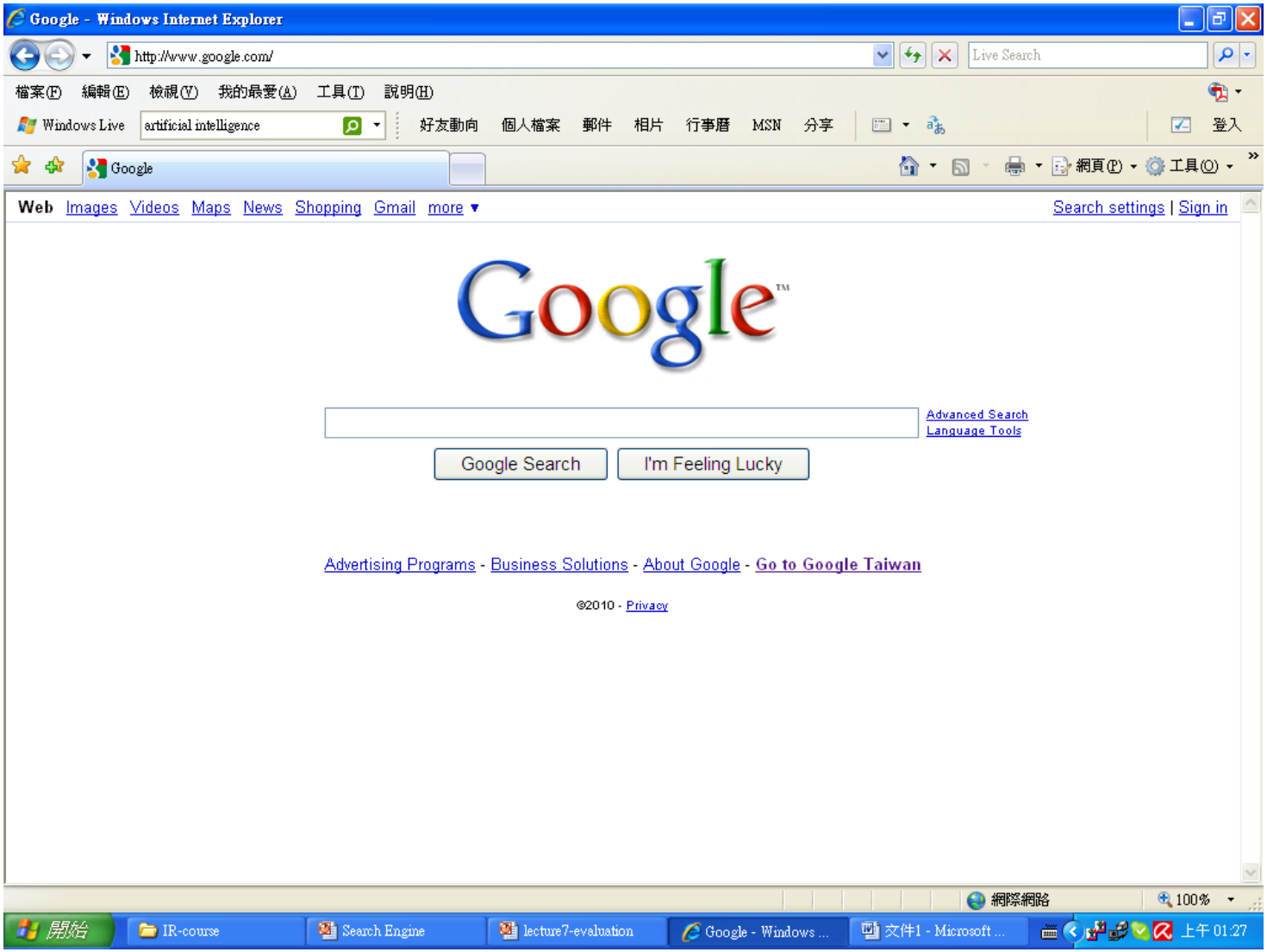
Google 與搜尋引擎的應用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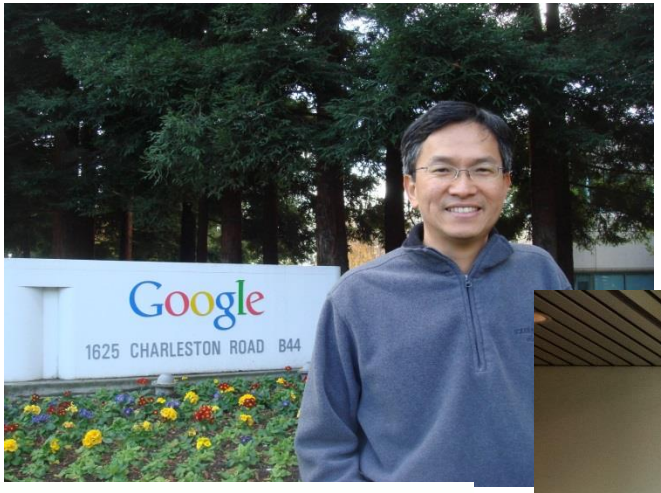
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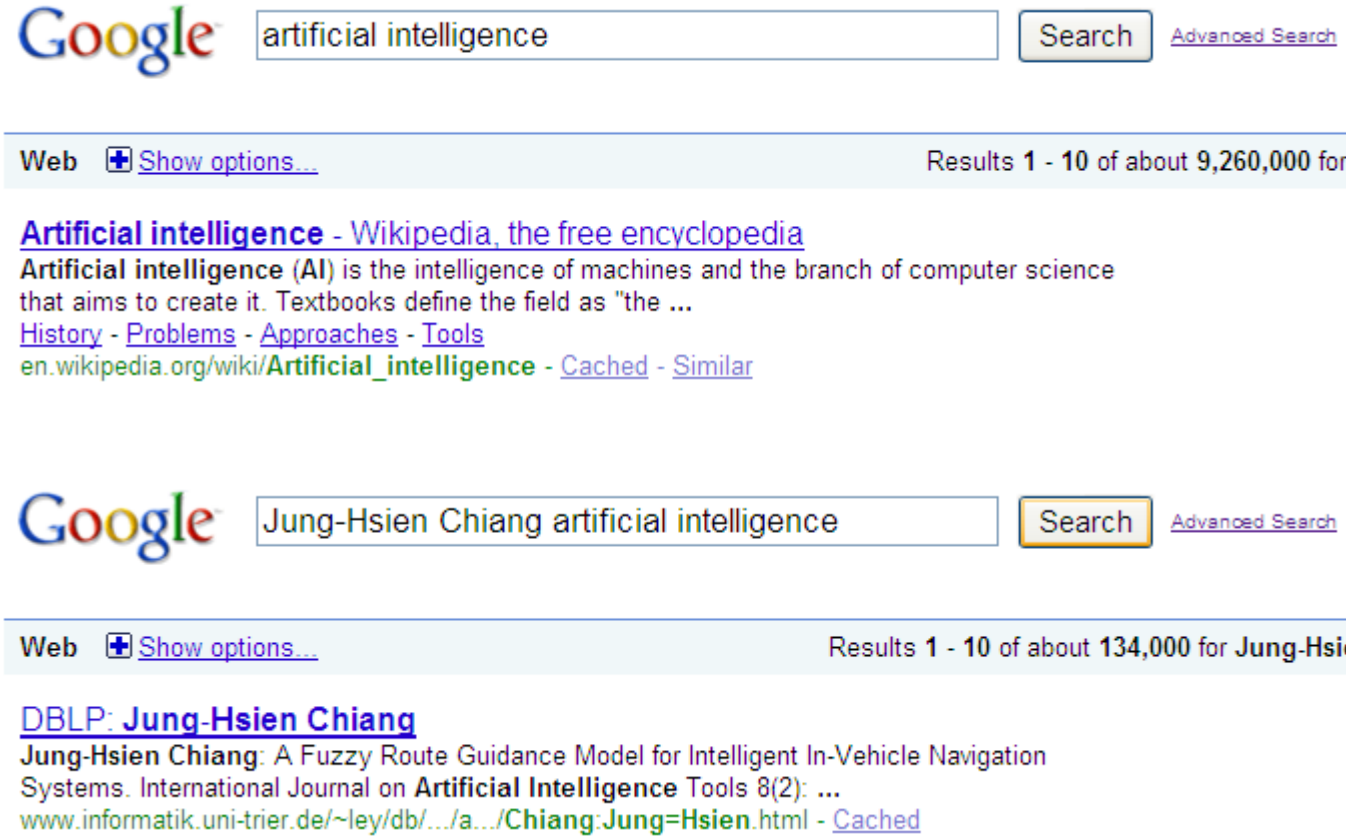

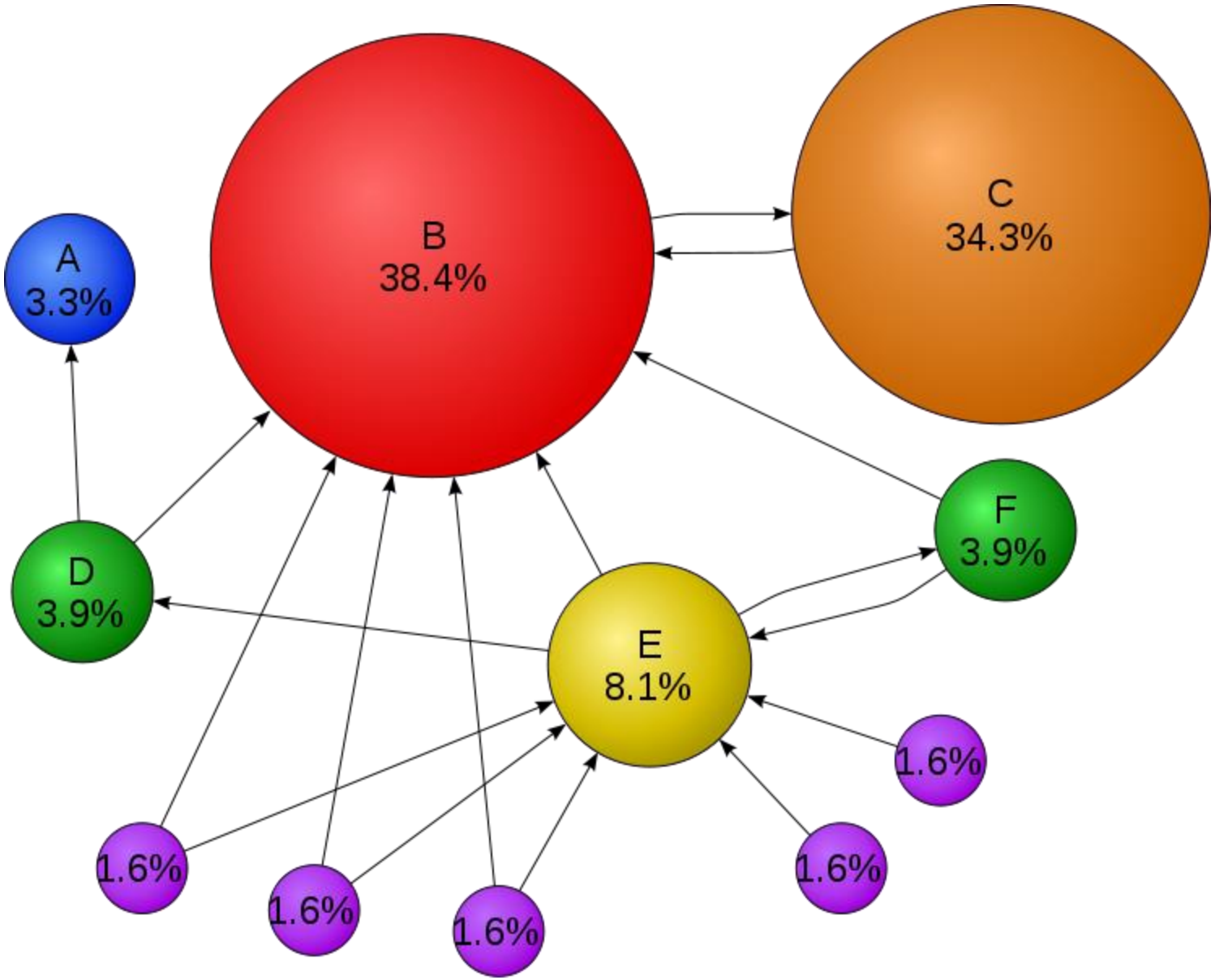
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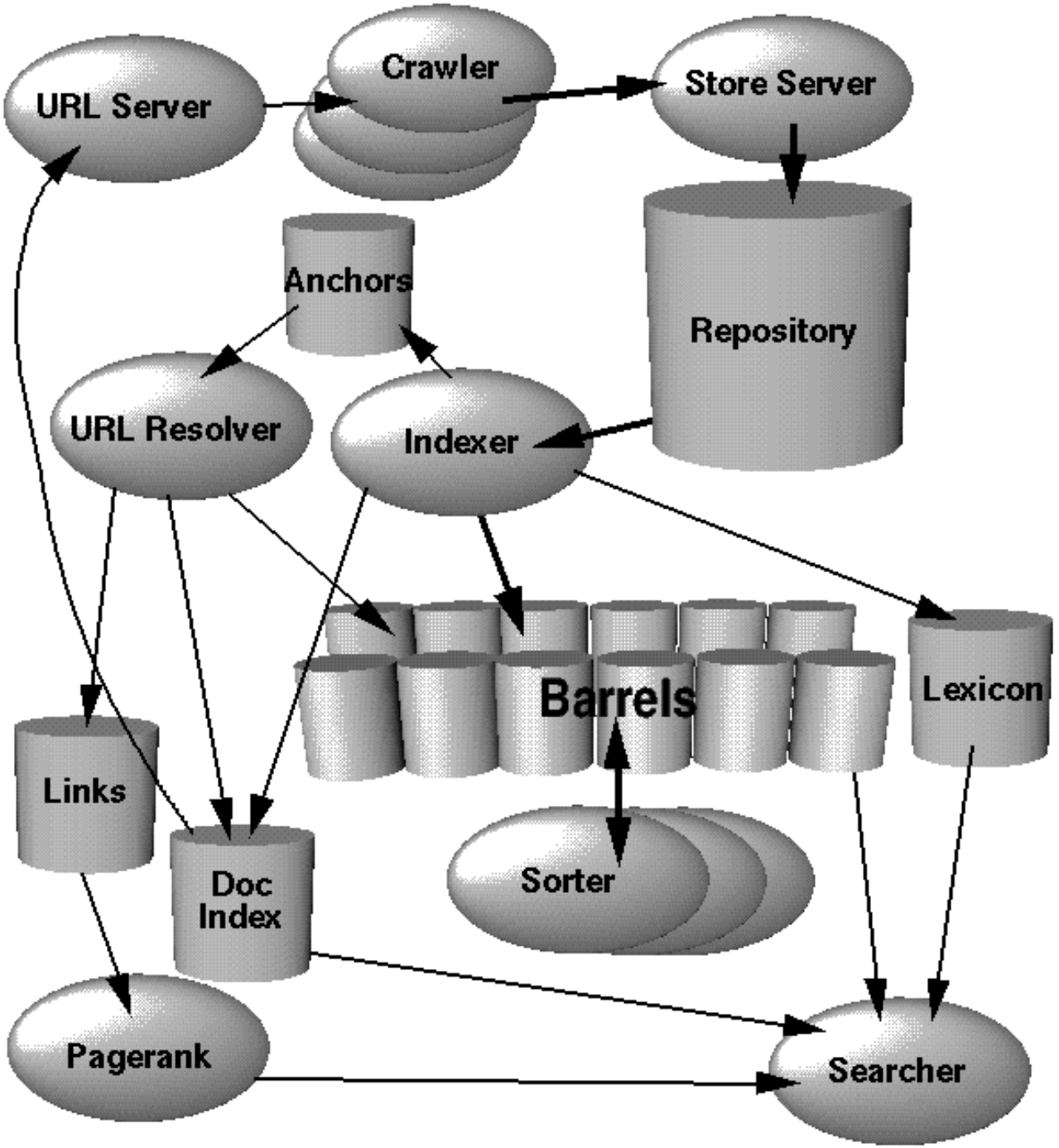
System Features

1. **PageRank**: bringing order to the Web
2. Anchor Text
   - Associate the text of a link with both the page that the link is on and the page the link points to (anchor propagation).
   - Anchors often provide more accurate descriptions of web pages than the pages themselves.

Google Architecture

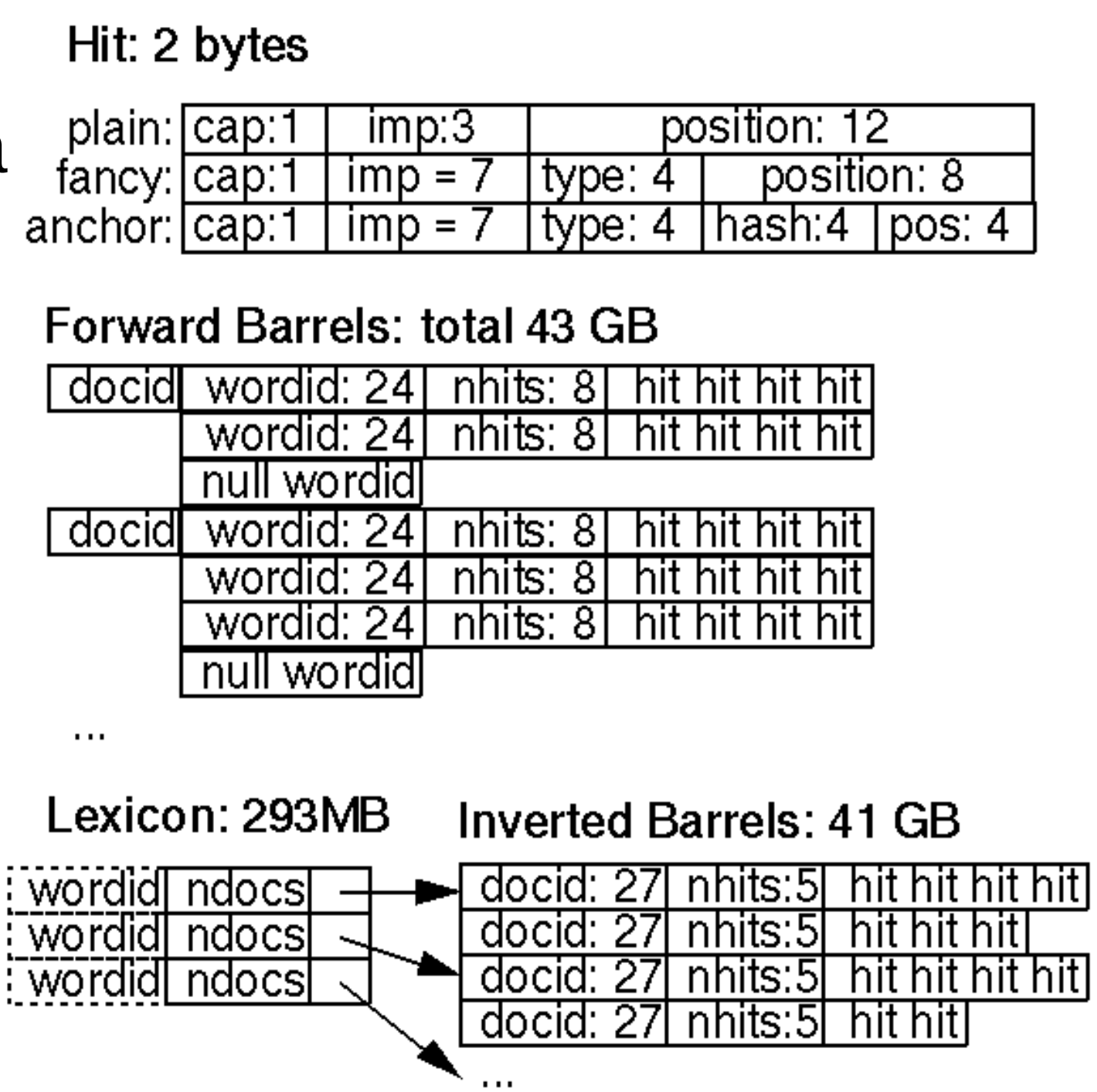


Major Data Structures
Hit Lists

- A **hit list** corresponds to a list of occurrences of a particular word in a particular document including position, font (relative), and capitalization information.
- Two types of hits:
  1. **Fancy hits**: hits occurring in a URL, title, anchor text, or meta tag.
  2. **Plain hits**: everything else.

Major Data Structures:

Forward and Reverse Indexes and the Lexicon

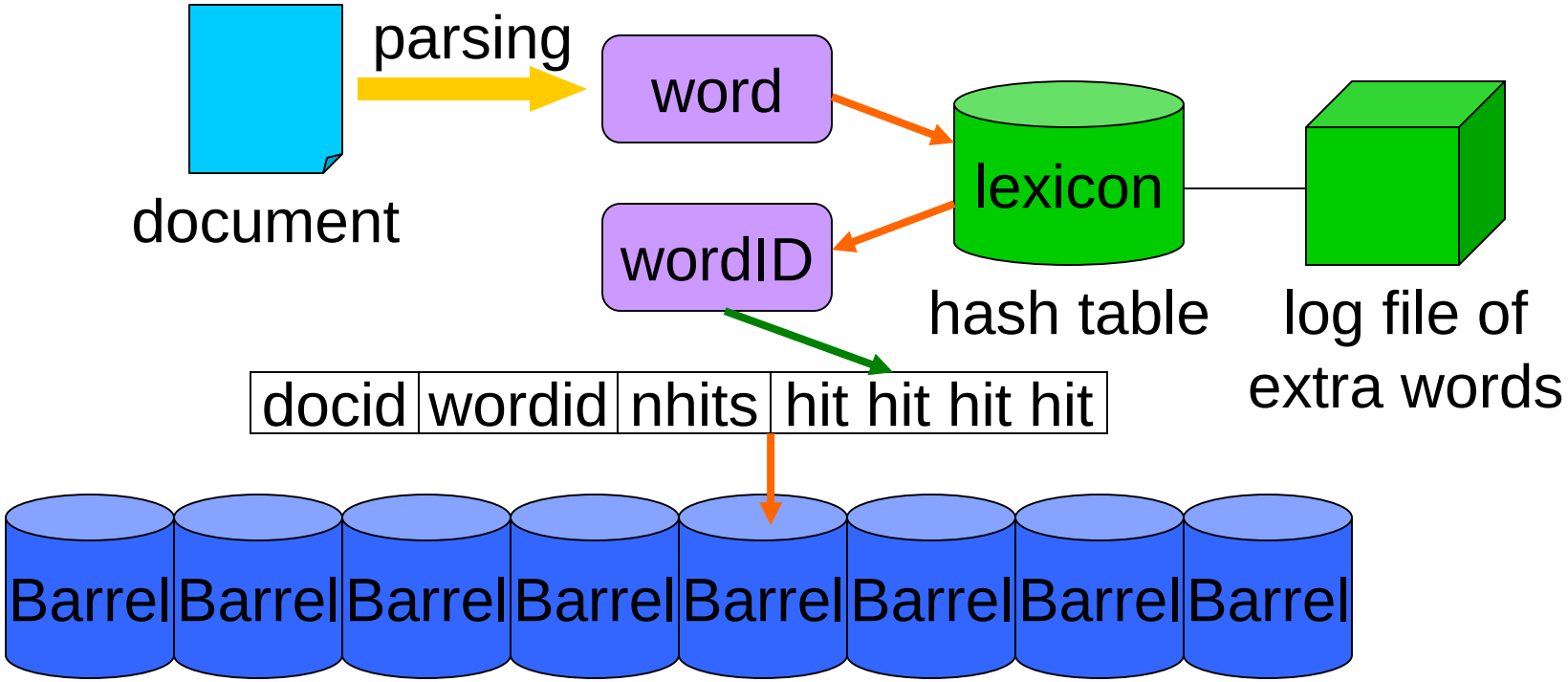


Crawling the Web

- Google has a fast distributed crawling system.
- A single URLserver serves lists of URLs to a number of crawlers.
- Each crawler keeps roughly 300 connections open at once.
- Connection states: looking up DNS, connecting to host, sending request, and receiving response.
- DNS cache

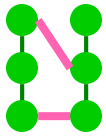
Indexing the Web
Forward Index

- Indexing documents into barrels



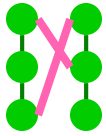
Indexing the Web
Inverted Index

- Issue: in what order the docID's should appear in the doclist



1. Sorted by docID

   This allows for quick merging of different doclists for multiple word queries.



2. Sorted by a ranking of the occurrence of the word in each document

   This makes answering one word queries trivial and makes it likely that the answers to multiple word queries are near the start.

Indexing the Web
Inverted Index

- A compromise between these options, keeping two sets of inverted barrels
  1. One set for hit lists which include title or anchor hits
  2. Another set for all hit lists.
- Check the first set of barrels first and if there are not enough matches within those barrels, check the larger ones.

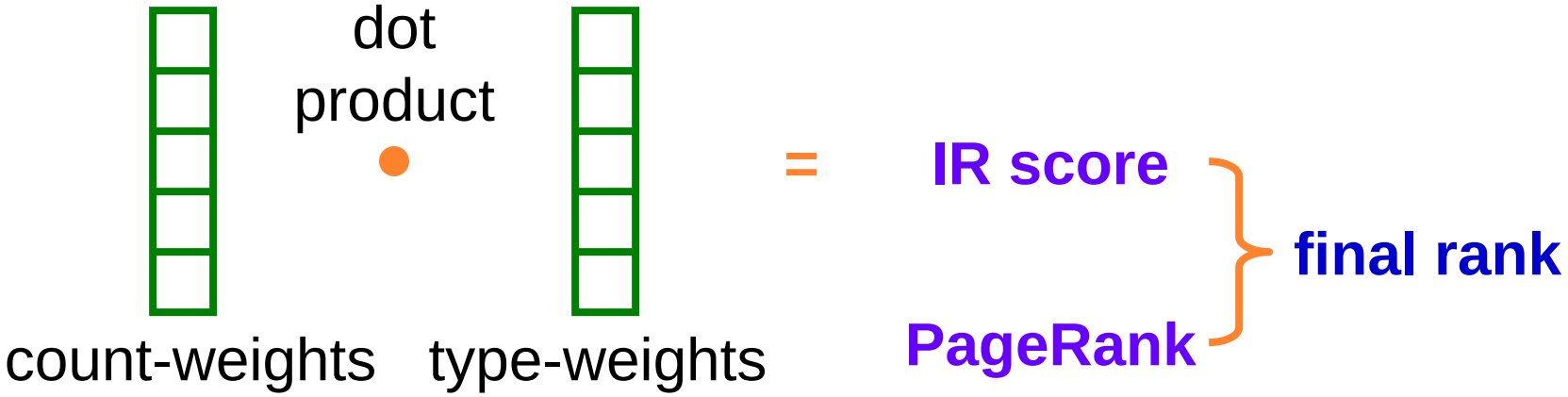
Searching

1. Parse the query.
2. Convert words into wordIDs.
3. Seek to the start of the doclist in the short barrel for every word.
4. Scan through the doclists until there is a document that matches all the search terms.
5. Compute the rank of that document for the query.
6. If we are in the short barrels and at the end of any doclist, seek to the start of the doclist in the full barrel for every word and go to step 4.
7. If we are not at the end of any doclist go to step 4.
8. Sort the documents that have matched by rank and return the top k.

The Ranking System

1. Single word query

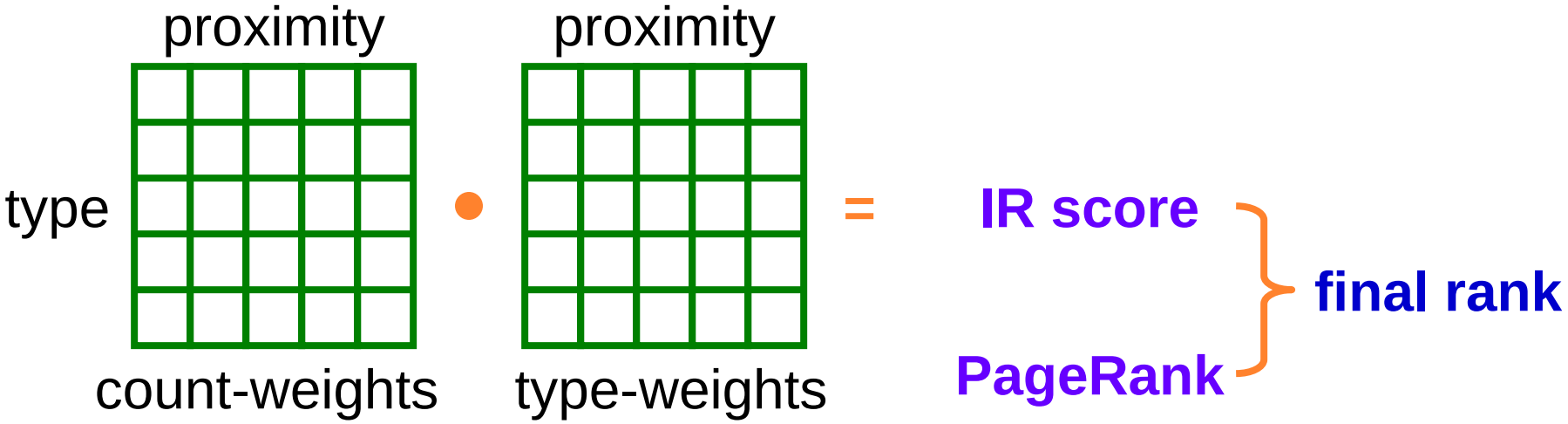
   Consider each hit to be one of several different types (title, anchor, URL, plain text large font, plain text small font, …).



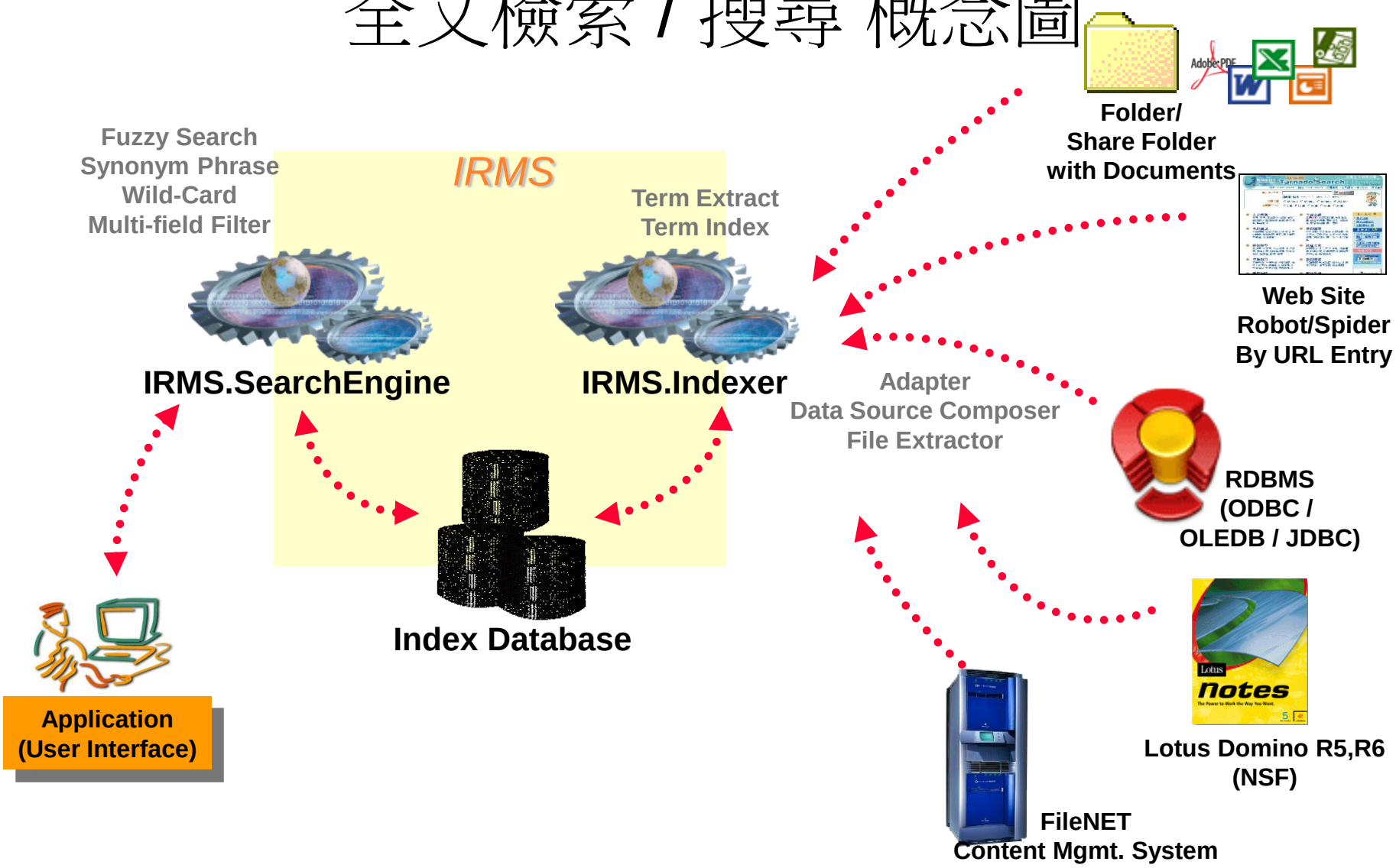
The Ranking System

2. Multi-word query

   Hits occurring close together in a document are weighted higher than hits occurring far apart.



全文檢索 / 搜尋 概念圖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Wild-Card
Multi-field Filter
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Term Extract
Term Index
IRMS.SearchEngine
IRMS.Indexer
Index Database
Application
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By URL Entry
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(NSF)
FileNET
Content Mgmt. System

搜尋引擎的定位與價值

- 資訊整合檢索
  - 將異質的資訊源進行整合的索引，以提供跨資訊源的搜尋服務。
- 非結構性文件之索引與搜尋
  - 針對非結構性文件、結構與半結構性的資訊可以透過檢索的技術來提供快速的搜尋。
- 搜尋效能與功能的滿足
  - 透過資訊索引相關的演算法，以達到快速搜尋以及特殊搜尋功能的滿足，彌補傳統循序搜尋於資料量大時的搜尋速度限制。

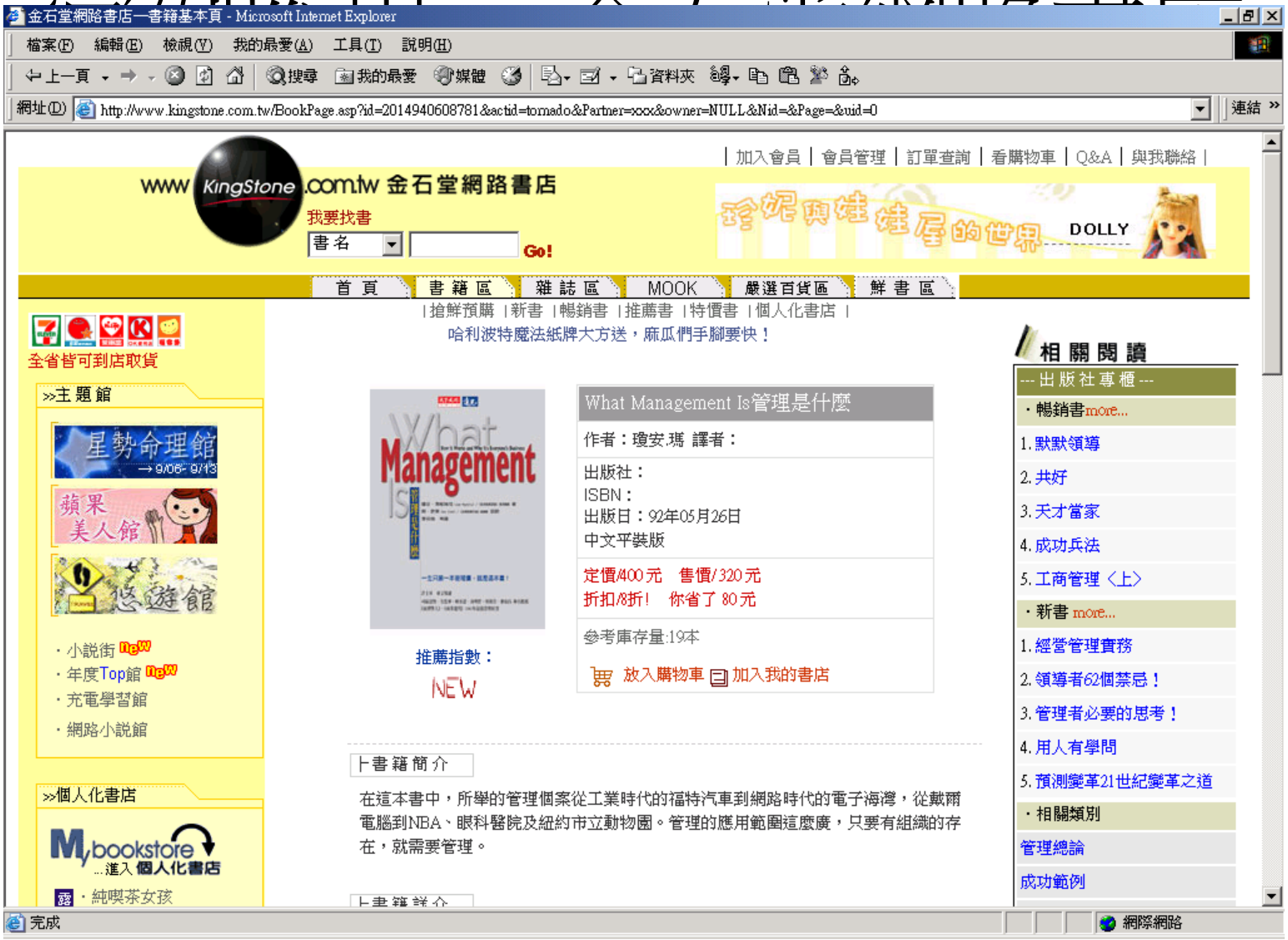
多國語言查詢與搜尋結果呈現

Korean

Japanese

Simplified Chinese

Traditional Chinese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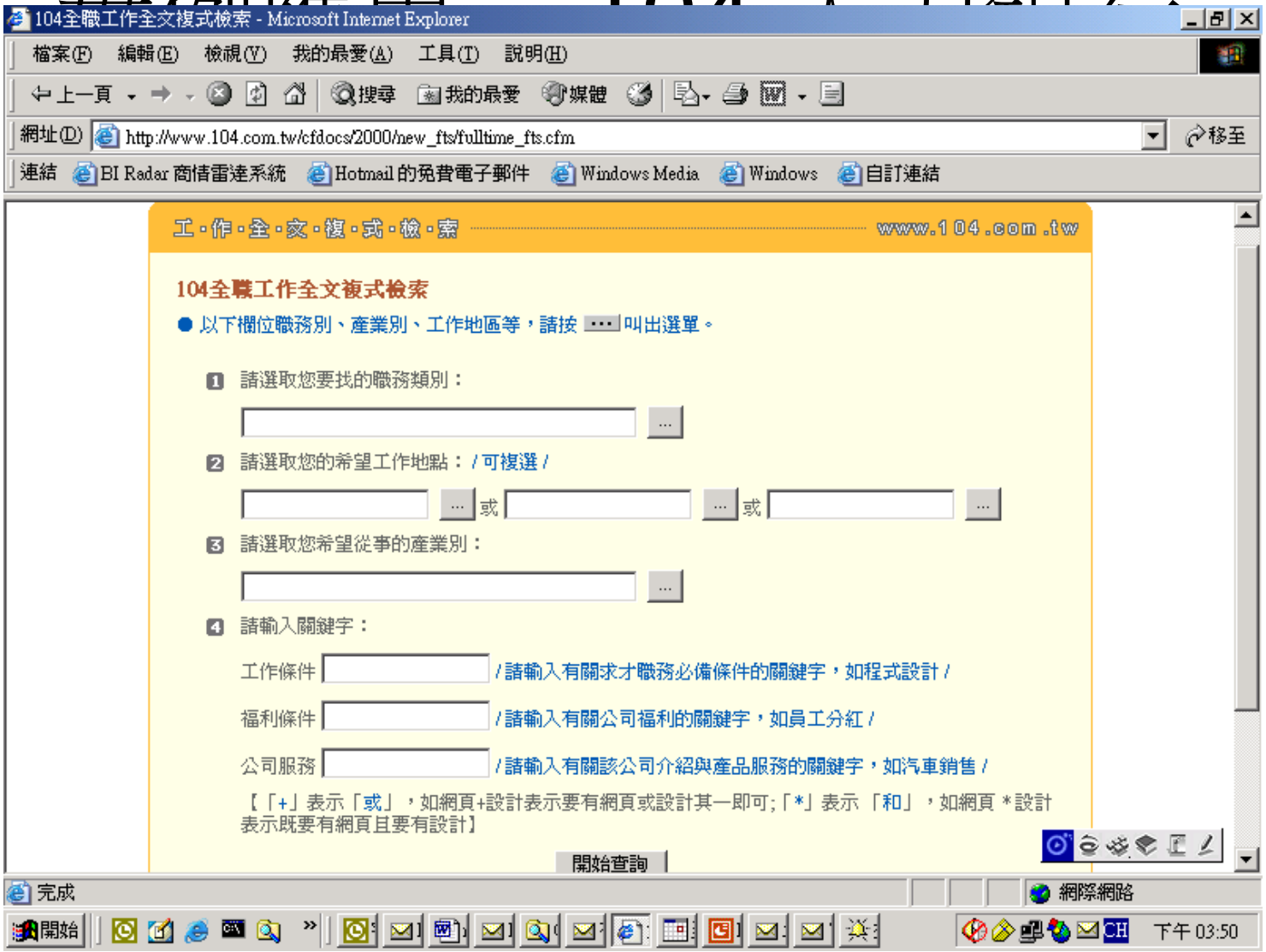

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