CSCI 572 - Information Retrieval and Web Search Engines

Homework 4 – Comparing Search Engine Ranking Algorithms

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1. Steps to complete the assignment

Step 1: Basic preparation

- Installed and set up Ubuntu Linux 16.04.6 LTS on my Mac using Oracle VM VirtualBox.

- Installed Apache Solr and tested the software following the online tutorial.

- Downloaded all crawled files with URLtoHTML_fox_news.csv from Google Drive for foxnews.

Step 2: Indexing HTML files in Solr

- Used command **bin/solr start** to start the Solr server.

- Used command **bin/solr create -c webindex** to create a core named **webindex**.

- Edited the file named **managed-schema** in the **conf** folder to map all text content properly.

- Used command **bin/post -c webindex -filetypes html foxnews/** to perform indexing.

- Checked the **Solr UI (http://localhost:8983/solr)** and all files had gotten indexed.

- Configured **Solr** to default querying from the field **_text_** by defining the default field in the **requestHandler** in the **solrconfig.xml** file.

- Tried 9 queries to test out Solr directly and ensured that Solr is working perfectly.

Step 3: Generating the web graph (Java)

- Constructed two mapping data structures (fileToUrl and urlToFile) from the file URLtoHTML_fox_news.csv to get a bidirectional mapping between page id and url.

- Used **JSoup** to extract the outgoing links of every webpage by traversing all crawled files to create the **edgeList.txt** file.

- Created a directed graph using the two maps and extracted URLs. Vertices in the graph are webpage files and detected edge between two files represents a link between them.

Step 4: Computing PageRank (Python3)

- Loaded the web graph generated from Step 3 to **networkx**.

- The python program parsed every line from edgeList.txt and computed PageRank (PR) values with the following configuration:

  alpha=0.85, personalization=None, max_iter=30, tol=1e-06, nstart=None, weight='weight', dangling=None

- Created **external_pageRankFile.txt** with format <document_id>=<page_rank_score>.

Step 5: Adding one more search algorithm in Solr

- Placed the external_pageRankFile.txt generated from Step 4 in the folder **solr-7.7.2/server/solr/webindex/** to use as external page rank file in Solr and added fieldType and field parameters in managed-schema which refers to the score.

- Modified the solrconfig.xml file to define eventListeners to reload the external file and reloaded the core webindex on the Solr Admin page.

- Queried with "pageRankFile desc" in the "sort" text field to get results based on page rank (PR) values for each webpage in descending order.

Step 6: Apache and PHP setting

- Used command **sudo apt-get install apache2** to install Apache on Ubuntu.

- Used command **sudo apt-get install libapache2-mod-php** to install PHP on Ubuntu and tested out how PHP works on Ubuntu using sample codes.

- Cloned the GitHub repository for solr-php-client and run sample code to see how it works.

Step 7: Running PHP server (PHP)

- Wrote the PHP code (index.php) to run queries using Solr based on two different ranking algorithms, retrieve results, and display them.

- The two ranking algorithms are the Solr default algorithm (Lucene) and Rank Page algorithm using external_rankPageFile.txt.

- Showed four fields of 10 results for each query including title, url, file id, and description of the news article. Title and url are clickable to original webpage. If the description is missed, showed "N/A". If the url is missed, fetched from the given map file (URLtoHTML_fox_news.csv).

- Used command **php -S 127.0.0.1:8080** to run PHP server locally.

Step 8: Starting querying and comparing two ranking algorithms

- Kept the PHP server running locally (port: 8080) and started Solr server locally (port: 8983)

- Run the set of queries using two ranking algorithms and saved the results.

- Compared the results of the two ranking algorithms.

- Self-checking (additional): Used Solr to run the same set of queries manually using default and page rank algorithms separately to check correctness.

Step 9: Terminating

- Recorded the results displayed on web browser and closed the PHP server and Solr server.

- Analyzed overlapping information from the results.

2. Explanation regarding why some pages have higher PageRank values

Some webpages have higher PageRank (PR) values because the algorithm computes PR for each page based on the number of incoming links to itself. In our exercise, all data is being fetched from the file edgeList.txt we generated from the given mapping file (URLtoHTML_fox_news.csv). PageRank algorithm works by counting the number and quality of links to a page to estimate how important it is roughly. The underlying assumption is more important websites are more likely to receive more links to them. Therefore, a page with large number of incoming links, namely linked by many pages, receive a high PR value.

3. The flow for any single query (Democrats)

Figure 1 Initial Page

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Solr Search Engine

Search: [Democrats] [Submit]   Ranking Algorithm: ● Lucene (Solr Default)   ○ External PageRank

Results 1 - 10 of 1762:

1.
Title	RNC Chair McDaniel: Democrats' impeachment vote is baseless political vendetta – Trump did nothing wrong	Fox News
URL	https://www.foxnews.com/opinion/rnc-chair-mcdaniel-democrats-impeachment-vote-is-baseless-political-vendetta-trump-did-nothing-wrong
ID	/Users/someone/solr-7.7.2/foxnews/54806d10-e13a-4427-bde1-6c8aee9779e7.html
Description	Democrats have rigged the impeachment process in favor of their highly partisan effort to overturn President Trump;s election.

2.
Title	Democrats aren't actually impeaching the President – yet, but they are digging deep	Fox News
URL	https://www.foxnews.com/politics/democrats-arent-actually-impeaching-the-president-yet-but-they-are-digging-deep
ID	/Users/someone/solr-7.7.2/foxnews/c0858e78-79d1-4493-a7cc-81f1b80573cc.html
Description	Those are some of the words one could use to describe what House Democrats are doing when it comes to impeachment.

3.
Title	David Bossie: Baseless Trump impeachment inquiry by desperate Democrats makes dramatic flip-flop	Fox News
URL	https://www.foxnews.com/opinion/david-bossie-baseless-trump-impeachment-inquiry-by-desperate-democrats-makes-dramatic-flip-flop
ID	/Users/someone/solr-7.7.2/foxnews/d91f4b72-971d-4045-ad28-a0b68006972b.html
Description	House Democrats are staging the kind of illegitimate and anti-democratic coup attempt you expect to see in a Third World country or the old Soviet Union – not the United States of America.

4.
Title	Federal judge sides with House Democrats over subpoena for Trump's financial records	Fox News
URL	https://www.foxnews.com/politics/federal-judge-house-democrats-mazars-subpoena-trump-financial-record
ID	/Users/someone/solr-7.7.2/foxnews/7f9b9a77-a3a8-4968-8589-5d6a7b9a2a24.html
Description	A Washington, D.C.-based federal judge has sided with House Oversight Committee Democrats seeking to enforce their subpoena of Trump accounting firm Mazars USA, in a major ruling that breathes new life into Democrats' ongoing efforts to probe the president's financial dealings.

5.
Title	Rep. Andy Biggs: Democrats seek Trump's impeachment to grab power – He didn't engage in impeachable conduct	Fox News
URL	https://www.foxnews.com/opinion/rep-andy-biggs-lipstick-impeachment
ID	/Users/someone/solr-7.7.2/foxnews/2d80467d-ef6d-49be-99ad-c8f6141789fc.html
Description	House Democrats have tried to dress up the pig that is their impeachment effort with the lipstick of a resolution that gives them even more power.

6.
Title	Left-wing elitists' 'disdain' for the working class will cost Democrats in 2020, says Don Jr.	Fox News
URL	https://www.foxnews.com/media/democrats-disdain-working-class-trump-jr-fox-friends
ID	/Users/someone/solr-7.7.2/foxnews/ec6a9e7a-c2ea-42d2-b269-858b305d2321.html
Description	The "disdain" that left-wing elitists have for the American working-class will cost Democrats the election in 2020 and only further empower President Trump, said Don Jr., on "Fox & Friends" Wednesday.

Figure 2 Query (Democrats) Result 1 - 6 Using Lucene (Default)

7.
Title	Liz Harrington: Democrats holding Soviet-style show trial to overthrow Trump – not an impeachment inquiry	Fox News
URL	https://www.foxnews.com/opinion/liz-harrington-democrats-holding-soviet-style-show-trial-to-overthrow-trump-not-an-impeachment-inquiry
ID	/Users/someone/solr-7.7.2/foxnews/73ba6e6c-acc0-4e01-abd5-455160ab6e8a.html
Description	An endeavor as monumental as impeaching the duly elected president deserves deference to longstanding rules and procedures.

8.
Title	Donald Trump, Jr.: Dems are losing immigration debate because of their radical ideology (not bad 'messaging')	Fox News
URL	https://www.foxnews.com/opinion/donald-trump-jr-democrats-immigration-radical-ideology
ID	/Users/someone/solr-7.7.2/foxnews/4c068c3e-b0fd-4474-a954-1bf38832dcb4.html
Description	President Trump is winning the immigration "messaging war" for a reason – Americans are tired of listening to the Democrats' lies about border security.

9.
Title	Hans von Spakovsky: In Trump impeachment probe, Democrats refuse to follow Nixon and Clinton precedents	Fox News
URL	https://www.foxnews.com/opinion/hans-von-spakovsky-in-trump-impeachment-probe-democrats-refuse-to-follow-nixon-and-clinton-precedents
ID	/Users/someone/solr-7.7.2/foxnews/8531a9d9-339e-4c2e-a6e5-ba569857d9ac.html
Description	In the impeachment inquiries of Presidents Nixon and Clinton, Democrats and Republicans took a very different position than House Speaker Nancy Pelosi is taking today.

10.
Title	David Bossie: Trump impeachment vote is Democratic declaration of war – Republicans must declare war on Dems	Fox News
URL	https://www.foxnews.com/opinion/david-bossie-trump-impeachment-vote-is-democratic-declaration-of-war-republicans-must-declare-war-on-dems
ID	/Users/someone/solr-7.7.2/foxnews/245b590d-e1d7-4929-a21d-0a45c0aa4bac.html
Description	With House passage Thursday of a resolution formalizing their blatantly partisan impeachment witch hunt against President Trump, House Speaker Nancy Pelosi and her fellow crazed radical Democrats have declared war on the duly elected president of the United States. Now it's time for Republicans to draw up their own declaration of war.against Democrats.

Figure 3 Query (Democrats) Result 7 - 10 Using Lucene (Default)

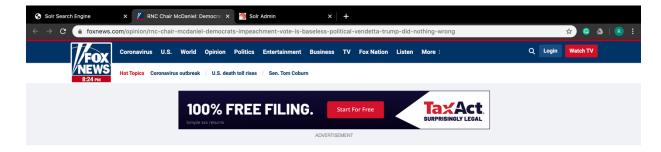**CSCI 572 - Information Retrieval and Web Search Engines**

Solr Search Engine

Search: Democrats [Submit]   Ranking Algorithm: ○ Lucene (Solr Default) ● External PageRank

Results 1 - 10 of 1762:

1.	Title	Dan Gainor: Anti-Trump media dream up their scariest Halloween nightmare	Fox News
	URL	https://www.foxnews.com/opinion/dan-gainor-anti-trump-media-dream-up-their-scariest-halloween-nightmare
	ID	/Users/someone/solr-7.7.2/foxnews/9ff93f36-44e8-437b-b0b0-279084695a27.html
	Description	With Halloween arriving on Thursday, some journalists let their imaginations go wild and wrote about the frightening nightmare that haunts them – the reelection of President Trump.
2.	Title	Daniel Turner: President Bloomberg? Uh, no thanks – America deserves much better	Fox News
	URL	https://www.foxnews.com/opinion/daniel-turner-bloomberg
	ID	/Users/someone/solr-7.7.2/foxnews/977218a6-966c-43c5-b577-556fc2f0cc2e.html
	Description	Michael Bloomberg wants to tell us how to live our lives and wants to destroy the jobs of people who work in industries he doesn't like. He think he know better than we do what is best for us.
3.	Title	Bernie Sanders' biggest star-studded backers: Mark Ruffalo, Danny DeVito and others	Fox News
	URL	https://www.foxnews.com/politics/bernie-sanders-biggest-star-studded-endorsements-mark-ruffalo-danny-devito-and-beyond
	ID	/Users/someone/solr-7.7.2/foxnews/f86a694b-6402-412e-bb9f-1cec1cb0cb78.html
	Description	Sen. Bernie Sanders announced his presidential bid in February and he's already been well supported.
4.	Title	Tucker Carlson: San Francisco bans words to hide its crime problem -- and to control your mind	Fox News
	URL	https://www.foxnews.com/opinion/tucker-carlson-san-francisco-bans-words-crime-democrats
	ID	/Users/someone/solr-7.7.2/foxnews/d641d1d3-dee6-487a-8624-529b88faaa9c.html
	Description	When the words disappear, so does our ability to think about the ideas the words represent.
5.	Title	Gregg Jarrett: Whistleblower not entitled to anonymity – He's an informant acting as a Democratic operative	Fox News
	URL	https://www.foxnews.com/opinion/gregg-jarrett-whistleblower-not-entitled-to-anonymity-hes-an-informant-acting-as-a-democratic-operative
	ID	/Users/someone/solr-7.7.2/foxnews/96a5e879-b7e4-4273-9d16-bde0d2ff30a2.html
	Description	The notion that the Ukraine "whistleblower" is somehow entitled to anonymity was probably first peddled by The Flat Earth Society. It is a myth and demonstrably so.
6.	Title	Legal experts weigh in as White House objects to impeachment inquiry	Fox News
	URL	https://www.foxnews.com/politics/legal-experts-weigh-in-as-white-house-objects-to-impeachment-inquiry
	ID	/Users/someone/solr-7.7.2/foxnews/8c644304-6fd8-4cdb-8abd-f93d32814877.html
	Description	As the White House pushes back hard against House Democrats' impeachment inquiry, legal experts are weighing in on the validity of the objections raised by the administration.

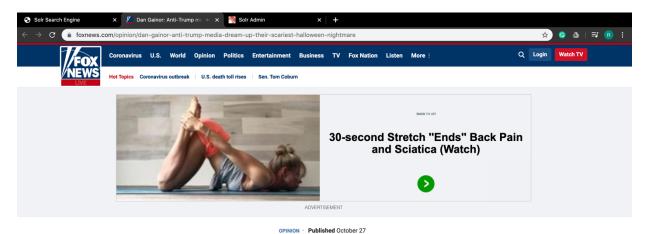*Figure 4 Query (Democrats) Result 1 - 6 Using PageRank*

7.	Title	Loesch: Dems' ideas for gun confiscation by police are recipe for disaster	Fox News
	URL	https://www.foxnews.com/media/dana-loesch-democrats-arent-willing-to-admit-that-they-would-send-police-to-go-door-to-door-to-take-firearms
	ID	/Users/someone/solr-7.7.2/foxnews/fdf50ffd-dc35-4214-b65e-c76f2b62fab2.html
	Description	After "The View" co-host Meghan McCain called out Sen. Corey Booker, D-N.J., for "dodging" her questions about gun confiscation, nationally syndicated radio host Dana Loesch said on Thursday that the situation was "usual."
8.	Title	Ex-CIA boss Brennan appears to partly back Hillary Clinton's theory Tulsi Gabbard is a Russian asset	Fox News
	URL	https://www.foxnews.com/politics/ex-cia-boss-brennan-appears-to-partly-back-hillary-clintons-theory-tulsi-gabbard-is-a-russian-asset
	ID	/Users/someone/solr-7.7.2/foxnews/04bccbd0-e0ae-46da-a583-9216f1429893.html
	Description	When it comes to Hillary Clinton's controversial comments about 2020 Democratic hopeful Tulsi Gabbard, it seems that maybe -- John Brennan is with her.
9.	Title	Tucker Carlson Tonight	Fox News
	URL	https://www.foxnews.com/shows/tucker-carlson-tonight
	ID	/Users/someone/solr-7.7.2/foxnews/4c20c9d6-b3ee-4caf-9ff4-812e36fd5a9b.html
	Description	Tucker Carlson Tonight' is the sworn enemy of lying, pomposity, smugness and group think. We ask the questions that you would ask - and demand answers. Catch us weeknights at 8 p.m. ET! #Tucker
10.	Title	Rep. Jim Banks: Trump was right on al-Baghdadi move – Dems could not be trusted with info about secret mission	Fox News
	URL	https://www.foxnews.com/opinion/al-baghdadi-trump-democrats-jim-banks
	ID	/Users/someone/solr-7.7.2/foxnews/dba5b143-caa6-4ffd-87d3-d59509e5be1f.html
	Description	How disturbing is it that our military and intelligence officials are too afraid to brief congressional Democrats on important intelligence matters because of fears the classified subject matter will be leaked and politicized.

Figure 5 Query (Democrats) Result 7 - 10 Using PageRank

Figure 6 1st Result Using Lucene (Default)

Figure 7 1st Result Using PageRank

4. Result Tables

a. Cannes	
Solr Default (Lucene)	PageRank
https://www.foxnews.com/category/entertainment/events/cannes-film-festival	https://www.foxnews.com/entertainment/selena-gomez-cannes-film-festival-red-carpet
https://www.foxnews.com/entertainment/selena-gomez-bill-murray-whispered-cannes-film-festival-reveal	https://www.foxnews.com/entertainment/burt-reynolds-smokey-and-the-bandit-year-later
https://www.foxnews.com/entertainment/selena-gomez-cannes-film-festival-red-carpet	https://www.foxnews.com/entertainment/michael-moore-endorses-bernie-sanders
https://www.foxnews.com/entertainment/ryan-gosling-eva-mendes-is-definitely-not-anti-sweatpants	https://www.foxnews.com/entertainment/mark-hamill-adam-driver-find-lost-dog
https://www.foxnews.com/entertainment/quentin-tarantino-once-upon-a-time-in-hollywood-trailer-release	https://www.foxnews.com/entertainment/rupert-sanders-reflects-on-kristen-stewart-affair-everyone-makes-mistakes
https://www.foxnews.com/entertainment/woody-allen-retire-family-politics	https://www.foxnews.com/entertainment/helen-mirren-yells-f-k-netflix-at-cinemacon-2019
https://www.foxnews.com/entertainment/whitney-houston-was-sexually-abused-during-childhood-new-documentary-claims	https://www.foxnews.com/entertainment/jon-favreau-marvel-debate-directors-express-opinions
https://www.foxnews.com/entertainment/elton-john-rocketman-biopic-drugs-addiction-eating-disorder	https://www.foxnews.com/entertainment/sharon-stone-rocks-bikini-see-her-many-ageless-looks
https://www.foxnews.com/opinion/a-joan-rivers-thanksgiving	https://www.foxnews.com/opinion/a-joan-rivers-thanksgiving
https://www.foxnews.com/entertainment/selena-gomez-new-dog-instagram	https://www.foxnews.com/entertainment/salma-hayek-through-the-years-always-a-beauty

b. Congress	
Solr Default (Lucene)	PageRank
https://www.foxnews.com/us/navy-vet-donates-gold-star-families-stories-to-library-of-congress	https://www.foxnews.com/category/tech/technologies/email
https://www.foxnews.com/opinion/judge-andrew-napolitano-congress-constitutional-power-declare-war	https://www.foxnews.com/opinion/gregg-jarrett-whistleblower-not-entitled-to-anonymity-hes-an-informant-acting-as-a-democratic-operative
https://www.foxnews.com/politics/jon-stewart-blasts-congress-over-9-11-fund-hearing-drove-me-nuts-there-were-empty-seats	https://www.foxnews.com/opinion/newt-gingrich-china-students-american-secrets
https://www.foxnews.com/opinion/rep-andy-biggs-congress-debt-ceiling-budget-deal	https://www.foxnews.com/politics/legal-experts-weigh-in-as-white-house-objects-to-impeachment-inquiry
https://www.foxnews.com/opinion/gutfeld-congress-attacking-zuckerberg	https://www.foxnews.com/media/dana-loesch-democrats-arent-willing-to-admit-that-they-would-send-police-to-go-door-to-door-to-take-firearms
https://www.foxnews.com/opinion/andy-biggs-congress-judges-immigration-laws	https://www.foxnews.com/opinion/al-baghdadi-trump-democrats-jim-banks

https://www.foxnews.com/faith-values/bible-school-drew-brees-day-congress	https://www.foxnews.com/tech/5g-is-a-bigger-deal-and-china-is-a-bigger-threat-than-you-think-think-tank-says
https://www.foxnews.com/category/us/congress	https://www.foxnews.com/opinion/reps-jim-jordan-and-mark-meadows-build-the-wall-do-what-we-said-wed-do
https://www.foxnews.com/opinion/bradley-blakeman-trade-pact-with-canada-and-mexico-offers-incredible-benefits-congress-should-approve-it	https://www.foxnews.com/politics/2020-republican-challenger-files-ethics-complaint-against-adam-schiff-for-purporting-to-obtain-comprising-pictures-of-president-trump
https://www.foxnews.com/politics/trump-tells-congress-to-immediately-approve-mexico-canada-trade-deal-says-us-moving-past-stupid-years-of-trade-policy	https://www.foxnews.com/opinion/newt-gingrich-left-viciously-attacks-mcconnell-because-hes-successful-senate-leader-and-trump-ally

c. Democrats	
Solr Default (Lucene)	PageRank
https://www.foxnews.com/opinion/rnc-chair-mcdaniel-democrats-impeachment-vote-is-baseless-political-vendetta-trump-did-nothing-wrong	https://www.foxnews.com/opinion/dan-gainor-anti-trump-media-dream-up-their-scariest-halloween-nightmare
https://www.foxnews.com/politics/democrats-arent-actually-impeaching-the-president-yet-but-they-are-digging-deep	https://www.foxnews.com/opinion/daniel-turner-bloomberg
https://www.foxnews.com/opinion/david-bossie-baseless-trump-impeachment-inquiry-by-desperate-democrats-makes-dramatic-flip-flop	https://www.foxnews.com/politics/bernie-sanders-biggest-star-studded-endorsements-mark-ruffalo-danny-devito-and-beyond
https://www.foxnews.com/politics/federal-judge-house-democrats-mazars-subpoena-trump-financial-record	https://www.foxnews.com/opinion/tucker-carlson-san-francisco-bans-words-crime-democrats
https://www.foxnews.com/opinion/rep-andy-biggs-lipstick-impeachment	https://www.foxnews.com/opinion/gregg-jarrett-whistleblower-not-entitled-to-anonymity-hes-an-informant-acting-as-a-democratic-operative
https://www.foxnews.com/media/democrats-disdain-working-class-trump-jr-fox-friends	https://www.foxnews.com/politics/legal-experts-weigh-in-as-white-house-objects-to-impeachment-inquiry
https://www.foxnews.com/opinion/liz-harrington-democrats-holding-soviet-style-show-trial-to-overthrow-trump-not-an-impeachment-inquiry	https://www.foxnews.com/media/dana-loesch-democrats-arent-willing-to-admit-that-they-would-send-police-to-go-door-to-door-to-take-firearms
https://www.foxnews.com/opinion/donald-trump-jr-democrats-immigration-radical-ideology	https://www.foxnews.com/politics/ex-cia-boss-brennan-appears-to-partly-back-hillary-clintons-theory-tulsi-gabbard-is-a-russian-asset
https://www.foxnews.com/opinion/hans-von-spakovsky-in-trump-impeachment-probe-democrats-refuse-to-follow-nixon-and-clinton-precedents	https://www.foxnews.com/shows/tucker-carlson-tonight
https://www.foxnews.com/opinion/david-bossie-trump-impeachment-vote-is-democratic-declaration-of-war-republicans-must-declare-war-on-dems	https://www.foxnews.com/opinion/al-baghdadi-trump-democrats-jim-banks

d. Patriot Movement	
Solr Default (Lucene)	PageRank
https://www.foxnews.com/politics/trump-antifa-terrorist-portland-protests	https://www.foxnews.com/politics/bernie-sanders-biggest-star-studded-endorsements-mark-ruffalo-danny-devito-and-beyond
https://www.foxnews.com/world/iranian-cruise-missiles-drones-saudi-oil	https://www.foxnews.com/politics/facebook-temporarily-suspends-candace-owens-over-post-about-liberal-supremacy
https://www.foxnews.com/media/fox-nation-patriot-awards-american-heroes-st-petersburg	https://www.foxnews.com/entertainment/meghan-mccain-trump-jr-family
https://www.foxnews.com/media/fox-nation-patriot-awards	https://www.foxnews.com/entertainment/woody-allen-metoo-movement-allegations-molestation
https://www.foxnews.com/media/marine-vet-most-valuable-patriot-awards-congress	https://www.foxnews.com/entertainment/britney-spears-workout-weight-loss
https://www.foxnews.com/faith-values/veterans-serve-disaster-relief	https://www.foxnews.com/faith-values/high-school-tennis-religious-liberty
https://www.foxnews.com/media/tomi-lahren-patriot-awards-fox-nation	https://www.foxnews.com/food-drink/internet-evangelist-says-starbucks-holiday-cups-are-red-because-they-hate-jesus
https://www.foxnews.com/entertainment/netflix-pulls-patriot-act-with-hasan-minhaj-episode-after-getting-valid-legal-complaint-from-saudi-arabia	https://www.foxnews.com/category/us/education/patriotism
https://www.foxnews.com/media/vice-president-mike-pence-fox-nation-patriot-awards	https://www.foxnews.com/category/person/emmanuel-macron
https://www.foxnews.com/tech/netflix-defends-pulling-patriot-act-episode-in-saudi-arabia	https://www.foxnews.com/sports/dolphins-kenny-stills-nfl-partnership-jay-z

e. Republicans	
Solr Default (Lucene)	PageRank
https://www.foxnews.com/politics/house-republicans-storm-impeachment-inquiry-deposition-what-went-down	https://www.foxnews.com/opinion/dan-gainor-anti-trump-media-dream-up-their-scariest-halloween-nightmare
https://www.foxnews.com/opinion/tom-del-beccaro-republicans-must-win-the-impeachment-trial-and-they-can-by-following-these-five-steps	https://www.foxnews.com/politics/legal-experts-weigh-in-as-white-house-objects-to-impeachment-inquiry
https://www.foxnews.com/politics/republicans-hunter-biden-ukraine-whisteleblower-impeachment-witness	https://www.foxnews.com/opinion/al-baghdadi-trump-democrats-jim-banks
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f. Senate	
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g. Olympics 2020	
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h. Stock	
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i. Virus	
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5. Overlap (table and graph)

Overlap Table		
Query No.	Query	No. of Overlaps
a	Cannes	2
b	Congress	0
c	Democrats	0
d	Patriot Movement	0
e	Republicans	0
f	Senate	0
g	Olympics 2020	0
h	Stock	1
i	Virus	1

Overlap Graph