

ASSIGNMENT 4

Indexing the Web Using Apache Solr

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1. Virtual Box and Ubuntu Installation:
 - a. Installed Virtual box and Ubuntu 18.04
 - b. Installed Solr-7.5.0
 - c. Apache Server(XAMPP) on Ubuntu
 - d. PHP installation on Ubuntu
 - e. Downloaded files from the given google drive link – Mercury News
2. Indexing given html files with Solr:
 - a. Start solr server
 - b. Create a core into the /solr-7.5.0 directory and using command: bin/solr -c create mercurynews
 - c. Index the given html files using: bin/post -c corename-filetypes html <path to crawl data>/
 - d. Checked the Solr UI to verify the indexing of files at <http://localhost:8983/solr/#/mercurynews/>

The screenshot shows the Apache Solr Admin UI for the 'mercurynews' core. The interface includes a sidebar with navigation links and a main content area with two sections: 'Statistics' and 'Replication (Master)'.

Statistics

- Last Modified: 3 minutes ago
- Num Docs: 11594
- Max Doc: 11594
- Heap Memory: -1
- Usage:
- Deleted Docs: 0
- Version: 274
- Segment: 13
- Count:
- Current: ✔

Replication (Master)

	Version	Gen	Size
Master (Searching)	1542083520477	44	172.31 MB
Master (Replicable)	1542083520477	44	-

At the bottom of the page, there are links for 'Documentation' and 'Issue Tracker'.

- e. Created pagerank.php from given sample code to make the form submission page with radio buttons for two search engines: Lucene and PageRank
- f. Executed the queries in the browser.

3. External Page Ranking Algorithm:

- a. Calculating Edge List
 - Developed and executed java program to extract link structure for downloaded web pages to compute EdgeList.txt file using JSoup library.
- b. Calculate Page Rank
 - To convert edgeList.txt to external_PageRankFile.txt
 - Parameters used in the pagerank() are
alpha=0.85, personalization=None, max_iter=30, tol=1e-06, nstart=None, weight='weight', dangling=None

- c. Changed managed-schema and solrconfig.xml:

- Added below code managed-schema:

```
<fieldType name="external" keyField="id" defVal="0" class="solr.ExternalFileField" />  
<field name="pageRankFile" type="external" stored="false" indexed="false" />
```

- Added below code to solrconfig.xml:

```
<listener event="newSearcher" class="org.apache.solr.schema.ExternalFileFieldReloader" />  
<listener event="firstSearcher" class="org.apache.solr.schema.ExternalFileFieldReloader" />
```

- d. Reloaded the core from Solr Admin.

4. Screenshots for the process:

- Query Page:

The screenshot shows a web browser window with two tabs: 'CSCI 572_HW 4' and 'Solr Admin'. The active tab is 'CSCI 572_HW 4', and the address bar shows 'localhost/PageRank.php'. The page content is titled 'Solr/Lucene Search Engine'. Below the title, there is a search form with the following elements:

- A label 'Search:' followed by a text input field.
- Two radio buttons: 'Lucene' and 'PageRank'. The 'PageRank' radio button is selected.
- A 'Submit' button.

- **Query – LA Lakers**

Screenshot for query results using *Lucene* Algorithm

Solr/Lucene Search Engine

Search:

☒ Lucene ☐ PageRank

Results 1 - 10 of 799:

id	/home/crawl_mercury/mercurynews/917a325f-d6c1-4ea5-9744-9ad72e71410a.html
title	The impossibility of Kevin Durant was brought into focus in the Warriors' Game 4 win
URL	https://www.mercurynews.com/2018/05/06/nba-playoffs-2018-golden-state-warriors-kevin-durant-game-4-highlights-video-new-orleans-pelicans-stephen-curry-score-schedule-time/
id	/home/crawl_mercury/mercurynews/d5f46cfa-0a8e-4b02-836c-f14451862e3a.html
title	Staff and news service reports – Page 2 – The Mercury News
URL	https://www.mercurynews.com/author/staff-and-news-service-reports/page/2/
id	/home/crawl_mercury/mercurynews/445a840f-b819-4a6f-98a3-65313b8c769b.html
title	The Warriors need the 'Death Lineup' to live up its name once again
URL	https://www.mercurynews.com/2018/05/05/nba-playoffs-2018-golden-state-warriors-new-orleans-pelicans-game-schedule-channel-stream-draymond-green-gsw-stephen-curry-rajon-rondo/
id	/home/crawl_mercury/mercurynews/0e9a6a46-0751-450f-ae41-d261e1161ec9.html
title	Andre Iguodala's impact on the Warriors' Death Lineup is hard to spot but impossible to ignore
URL	https://www.mercurynews.com/2018/05/07/nba-playoffs-2018-golden-state-warriors-new-orleans-pelicans-andre-iguodala-draymond-green-hamptons-five-5-death-lineup-schedule-time-gsw/
id	/home/crawl_mercury/mercurynews/c9848aa7-b0b2-47ac-84c6-8b0e8172b141.html
title	The Warriors — synonymous with 3-pointers — are finding success by going against the trend
URL	https://www.mercurynews.com/2018/05/08/golden-state-warriors-new-orleans-pelicans-houston-rockets-stream-time-channel-nba-playoffs-2018-western-conference-finals-kevin-durant/
id	/home/crawl_mercury/mercurynews/a0010937-58ca-407c-98d0-bfaa09e144f3.html
title	Warriors live coverage of games by The Mercury News
URL	https://www.mercurynews.com/tag/warriors-live/
id	/home/crawl_mercury/mercurynews/acf74150-4666-4245-948e-eb43df93f6ac.html
title	Live preseason updates: Warriors vs. Lakers, Friday at 7:30 p.m.
URL	https://www.mercurynews.com/2018/10/12/live-preseason-updates-warriors-vs-lakers-friday-at-730-p-m/amp/
id	/home/crawl_mercury/mercurynews/4774a2b0-afb6-4554-95e3-15825b11a974.html
title	Jason Kidd fired as Milwaukee Bucks' head coach
URL	https://www.mercurynews.com/2018/01/22/jason-kidd-fired-as-milwaukee-bucks-head-coach/
id	/home/crawl_mercury/mercurynews/f27b5236-67c2-4701-8b21-28aa19d8c4f6.html
title	Golden State Warriors: Lessons from the preseason finale
URL	https://www.mercurynews.com/2018/10/13/golden-state-warriors-vs-los-angeles-lakers-highlights-video-lebron-james-news-contract-salary-rumors-stephen-curry-twitter-steve-kerr/amp/
id	/home/crawl_mercury/mercurynews/a676cd22-364f-494c-a98b-d0cfffde7e70.html
title	Latest Bay Area sports news, commentary, analysis, live reports, photos and videos - The Mercury News
URL	https://www.mercurynews.com/sports/

Screenshot for query results using *PageRank* Algorithm Solr/Lucene Search Engine

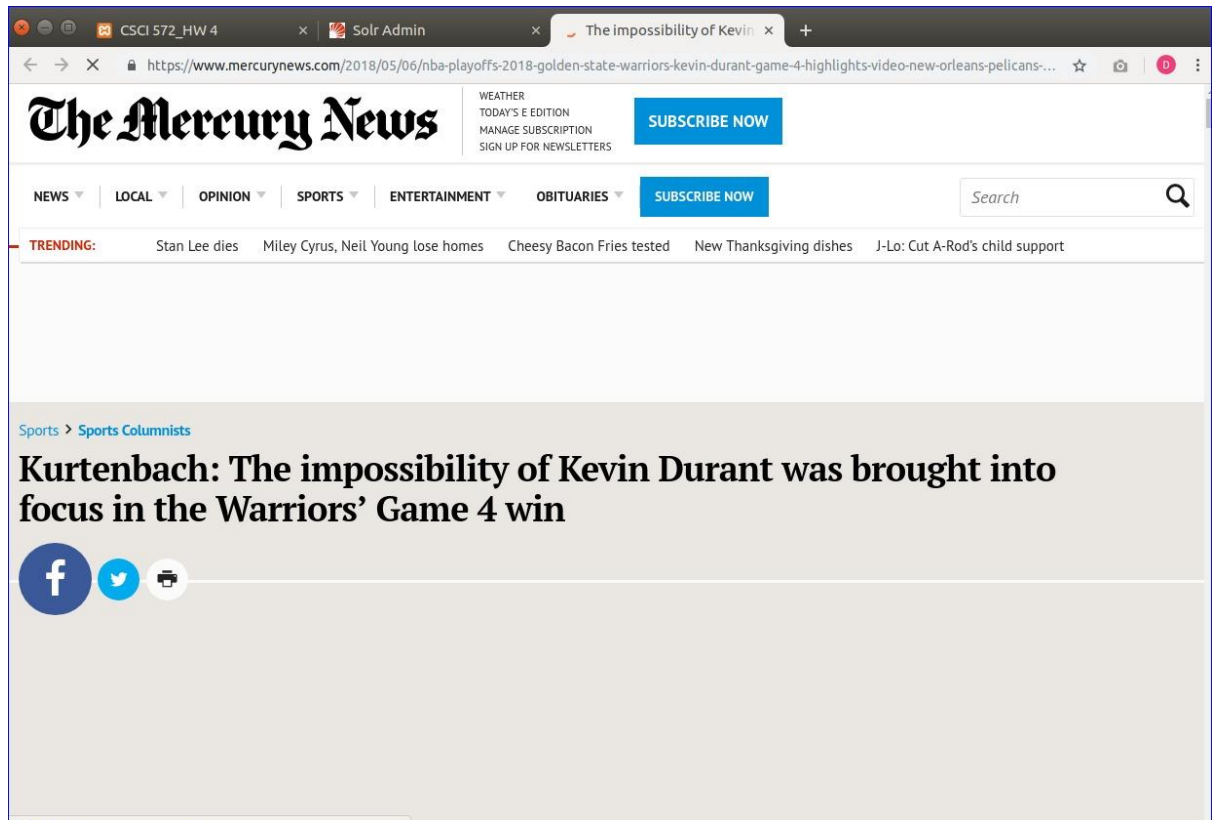
Search:

☐ Lucene ☒ PageRank

Results 1 - 10 of 799:

- id /home/crawl_mercury/mercurynews/4ce32157-87da-4e82-ad25-4b6e6d6f5caa.html
title [Photos show the devastating fire after 6 days in Wine Country.](#)
URL <https://www.mercurynews.com/2017/10/14/heartbreaking-photos-reveal-5-days-of-devastation-from-wine-country-fire/>
- id /home/crawl_mercury/mercurynews/31a7ac06-b24f-4507-8ba6-fabb7f053ca4.html
title [Highlight reel: Week's high school standouts](#)
URL <https://www.mercurynews.com/2018/10/10/highlight-reel-weeks-high-school-standouts-44/>
- id /home/crawl_mercury/mercurynews/fb2818c3-7cad-4a4b-bbff-1e352b1b8e27.html
title [LaVar Ball to coach sons' pro team in Lithuania](#)
URL <https://www.mercurynews.com/2018/01/29/lavar-ball-to-coach-sons-pro-team-in-lithuania/>
- id /home/crawl_mercury/mercurynews/ce42cc9b-c54b-48d9-b84e-6c19b09fa492.html
title ['Lion King' holds no magic for theater critic's kid](#)
URL <https://www.mercurynews.com/2016/12/12/commentary-a-theater-critics-dream-gets-stomped-on-at-lion-king/>
- id /home/crawl_mercury/mercurynews/1fb4ce34-ff57-4d57-836d-198797455d36.html
title [Sports: On air highlights – The Mercury News](#)
URL <https://www.mercurynews.com/2018/10/09/sports-on-air-highlights-259/amp/>
- id /home/crawl_mercury/mercurynews/3445db38-af20-46d0-976d-0f9166db69dc.html
title [The Pac-8 almost blew itself up trying to add Arizona and ASU](#)
URL <https://www.mercurynews.com/2018/08/29/40-years-ago-the-arizona-schools-joined-the-pac-8-an-insiders-account-of-the-process-that-nearly-destroyed-the-conference/>
- id /home/crawl_mercury/mercurynews/8ae8d9a2-0349-4f39-a395-b466bfab6869.html
title [Movin' On Up: Keeping track of former prep athletes](#)
URL <https://www.mercurynews.com/2018/04/18/movin-on-up-keeping-track-of-former-prep-athletes-27/>
- id /home/crawl_mercury/mercurynews/02202443-98bb-4471-9279-7364d373754.html
title [California porn star Yurizan Beltran died primarily of drug overdose, says L.A. coroner](#)
URL <https://www.mercurynews.com/2018/04/17/porn-star-yurizan-beltran-died-primarily-of-drug-overdose-says-la-coroner/>
- id /home/crawl_mercury/mercurynews/f9311b95-3266-4fce-bc94-8a62405ff342.html
title [Steph Curry gives generously to golfer's cancer-stricken wife](#)
URL <https://www.mercurynews.com/2018/08/13/steph-curry-makes-huge-donation-to-pro-golfers-cancer-stricken-wife/>
- id /home/crawl_mercury/mercurynews/327a8e3c-3226-4886-9360-ae2583b0544a.html
title [LiAngelo Ball declares for the NBA draft](#)
URL <https://www.mercurynews.com/2018/03/27/liangelo-ball-declares-for-the-nba-draft/>

Screenshot for actual web page that opens when clicking on one of the result's link.



Question: Explanation regarding why some pages have higher PageRank values than others.

Answer:

PageRank algorithm works by assigning a numeric score to each element of a hyper linked structure of documents, such as the World Wide Web, with the purpose of measuring its relative importance. This is achieved by measuring the number of outgoing links for a website.

Thus, some pages may have a higher page rank if they are pointed by other pages with higher scores and relatively fewer outlines.

Comparison of top 10 results for Lucene and Page Rank algorithms:

1. Donald Trump

Lucene	PageRank
https://www.mercurynews.com/2018/09/28/kimberly-guilfoyle-didnt-join-donald-trump-jr-s-twitter-attacks-on-christine-blasey-fords-credibility/	https://www.mercurynews.com/2018/09/28/a-young-woman-was-gunned-down-in-a-richmond-park-fate-of-both-defendants-may-hinge-on-gov-browns-pen/
https://www.mercurynews.com/tag/celebrity-politics/page/2/	https://www.mercurynews.com/2018/04/23/teslas-not-the-only-silicon-valley-company-to-get-a-bad-report-card/
https://www.mercurynews.com/2016/08/31/who-is-kevin-macdonald-alt-right-californian-retweeted-by-donald-trump-jr/	https://www.mercurynews.com/tag/california-legislative-elections/
https://www.mercurynews.com/2018/10/05/ivanka-trump-self-proclaimed-advocate-for-women-is-fine-with-brett-kavanaughs-confirmation-report-says/	https://www.mercurynews.com/2018/09/27/social-media-lights-up-as-kavanaugh-faces-his-accuser-in-high-stakes-senate-showdown/
https://www.mercurynews.com/2018/07/18/did-queen-elizabeth-wage-brooch-warfare-against-donald-trump/	https://www.mercurynews.com/2018/08/06/tensions-flare-in-brazil-as-it-considers-loosening-abortion-laws/
https://www.mercurynews.com/2018/09/24/more-ivanka-trump-complicity-first-daughter-stays-silent-on-brett-kavanaugh-controversy/	https://www.mercurynews.com/2018/04/23/poll-amid-strikes-americans-back-raises-for-teachers/
https://www.mercurynews.com/2018/08/28/political-cartoons-donald-trump-and-the-john-mccain-tributes/amp/	https://www.mercurynews.com/2018/02/27/state-county-proposals-aim-to-fast-track-rape-kit-analysis/
https://www.mercurynews.com/2018/08/30/political-cartoons-donald-trump-blasts-google/amp/	https://www.mercurynews.com/2017/06/15/verizon-small-cell-plan-evokes-cheers-jeers-from-residents/
https://www.mercurynews.com/2018/09/21/opinion-evangelicals-puzzling-devotion-to-donald-trump/amp/	https://www.mercurynews.com/2018/09/28/the-latest-aba-urges-senate-to-slow-down-on-kavanaugh-votes/
https://www.mercurynews.com/2018/09/21/opinion-evangelicals-puzzling-devotion-to-donald-trump/	https://www.mercurynews.com/2018/05/18/national-owner-closing-san-joses-gordon-biersch-restaurant/

2. LA Lakers

LA Lakers	
https://www.mercurynews.com/2018/05/06/nba-playoffs-2018-golden-state-warriors-kevin-durant-game-4-highlights-video-new-orleans-pelicans-stephen-curry-score-schedule-time/	https://www.mercurynews.com/2017/10/14/heartbreaking-photos-reveal-5-days-of-devastation-from-wine-country-fire/
https://www.mercurynews.com/author/staff-and-news-service-reports/page/2/	https://www.mercurynews.com/2018/10/10/highlight-reel-weeks-high-school-standouts-44/
https://www.mercurynews.com/2018/05/05/nba-playoffs-2018-golden-state-warriors-new-orleans-pelicans-game-schedule-channel-stream-draymond-green-gsw-stephen-curry-rajon-rondo/	https://www.mercurynews.com/2018/01/29/lavar-ball-to-coach-sons-pro-team-in-lithuania/
https://www.mercurynews.com/2018/05/07/nba-playoffs-2018-golden-state-warriors-new-orleans-pelicans-andre-iguodala-draymond-green-hamptons-five-5-death-lineup-schedule-time-gsw/	https://www.mercurynews.com/2016/12/12/commentary-a-theater-critics-dream-gets-stomped-on-at-lion-king/
https://www.mercurynews.com/2018/05/08/golden-state-warriors-new-orleans-pelicans-houston-rockets-stream-time-channel-nba-playoffs-2018-western-conference-finals-kevin-durant/	https://www.mercurynews.com/2018/10/09/sports-on-air-highlights-259/amp/
https://www.mercurynews.com/tag/warriors-live/	https://www.mercurynews.com/2018/08/29/40-years-ago-the-arizona-schools-joined-the-pac-8-an-insiders-account-of-the-process-that-nearly-destroyed-the-conference/

https://www.mercurynews.com/2018/10/12/live-preseason-updates-warriors-vs-lakers-friday-at-730-p-m/amp/	https://www.mercurynews.com/2018/04/18/movin-on-up-keeping-track-of-former-prep-athletes-27/
https://www.mercurynews.com/2018/01/22/jason-kidd-fired-as-milwaukee-bucks-head-coach/	https://www.mercurynews.com/2018/04/17/porn-star-yurizan-beltran-died-primarily-of-drug-overdose-says-la-coroner/
https://www.mercurynews.com/2018/10/13/golden-state-warriors-vs-los-angeles-lakers-highlights-video-lebron-james-news-contract-salary-rumors-stephen-curry-twitter-steve-kerr/amp/	https://www.mercurynews.com/2018/08/13/steph-curry-makes-huge-donation-to-pro-golfers-cancer-stricken-wife/
https://www.mercurynews.com/sports/	https://www.mercurynews.com/2018/03/27/liangelo-ball-declares-for-the-nba-draft/

3. Star Wars

Star Wars	
https://www.mercurynews.com/tag/star-wars/	https://www.mercurynews.com/2018/04/23/teslas-not-the-only-silicon-valley-company-to-get-a-bad-report-card/
https://www.mercurynews.com/2017/12/14/fans-line-up-for-star-wars-the-last-jedi-at-the-tech-museum/	https://www.mercurynews.com/2018/08/30/campbell-crime-report-for-the-week-of-sept-7/
https://www.mercurynews.com/2018/10/08/disneyland-star-wars-galaxys-edge-preview/	https://www.mercurynews.com/2018/10/15/not-so-silent-night-concert-finally-returns-to-san-jose-with-huge-lineup/
https://www.mercurynews.com/2018/10/08/disneyland-star-wars-galaxys-edge-preview/amp/	https://www.mercurynews.com/2018/09/27/social-media-lights-up-as-kavanaugh-faces-his-accuser-in-high-stakes-senate-showdown/
https://www.mercurynews.com/2018/08/30/disneyland-will-sell-alcohol-for-the-first-time-when-star-wars-land-opens-in-2019/	https://www.mercurynews.com/tag/high-school-basketball/page/3/
https://www.mercurynews.com/2018/08/01/star-wars-filmmaker-j-j-abrams-sends-his-first-ever-tweet-heres-what-it-said/	https://www.mercurynews.com/2018/10/03/heavy-metal-hero-oszy-osbourne-brings-farewell-tour-to-s-f-bay-area/amp/
https://www.mercurynews.com/2018/09/21/disneyland-is-quietly-removing-seating-and-planters-for-star-wars-land-access/amp/	https://www.mercurynews.com/2018/10/08/disneyland-star-wars-galaxys-edge-preview/
https://www.mercurynews.com/2018/08/22/star-wars-actress-defies-racists-with-return-to-instagram/	https://www.mercurynews.com/author/Tatiana-Sanchez/
https://www.mercurynews.com/author/marla-jo-fisher/	https://www.mercurynews.com/tag/colleges/page/2/
https://www.mercurynews.com/2018/09/21/disneyland-is-quietly-removing-seating-and-planters-for-star-wars-land-access/	https://www.mercurynews.com/2018/09/27/arizona-president-robert-robbins-on-wildcats-athletics-pac-12-media-strategy-gretzky-vision-emphasizing-football-and-more/amp/

4. Lebron James

Lebron James	
https://www.mercurynews.com/tag/lebron-james/page/2/	https://www.mercurynews.com/2018/09/28/a-young-woman-was-gunned-down-in-a-richmond-park-fate-of-both-defendants-may-hinge-on-gov-browns-pen/
https://www.mercurynews.com/tag/lebron-james/	https://www.mercurynews.com/2018/04/23/teslas-not-the-only-silicon-valley-company-to-get-a-bad-report-card/
https://www.mercurynews.com/author/tarek-fattal/	https://www.mercurynews.com/2018/08/06/tensions-flare-in-brazil-as-it-considers-loosening-abortion-laws/
https://www.mercurynews.com/tag/cleveland-cavaliers/	https://www.mercurynews.com/2018/04/23/poll-amid-strikes-americans-back-raises-for-teachers/
https://www.mercurynews.com/2018/08/04/president-trump-rips-lebron-james-says-i-like-mike/amp/	https://www.mercurynews.com/location/california/bay-area/east-bay/alameda-county/
https://www.mercurynews.com/2018/05/30/nba-finals-2018-golden-sta-warriors-lebron-james-cleveland-cavaliers-game-1-time-schedule-roster-stephen-curry/	https://www.mercurynews.com/2018/02/27/state-county-proposals-aim-to-fast-track-rape-kit-analysis/
https://www.mercurynews.com/2018/08/04/president-trump-rips-lebron-james-says-i-like-mike/	https://www.mercurynews.com/2018/09/28/the-latest-aba-urges-senate-to-slow-down-on-kavanaugh-votes/
https://www.mercurynews.com/2018/10/01/did-javale-mcgee-upstage-lebron-james-in-their-laker-debuts/	https://www.mercurynews.com/2018/05/18/national-owner-closing-san-joses-gordon-biersch-restaurant/
https://www.mercurynews.com/2018/10/10/report-lebron-james-wont-face-warriors-in-san-jose-friday/amp/	https://www.mercurynews.com/2018/07/14/feinstein-de-leon-california-democratic-party-endorsement-executive-board-oakland/
https://www.mercurynews.com/2018/08/29/lebron-talks-about-fatherhood-double-standards-and-the-n-word-in-hbo-premiere/	https://www.mercurynews.com/2018/08/16/hanson-american-people-losing-confidence-in-justice-that-seems-ad-hoc/

5. 2018 World Cup

2018 World Cup	
https://www.mercurynews.com/2018/04/26/high-school-baseball-monta-vista-beats-lynbrook-3-1/	https://www.mercurynews.com/author/mya-hammond/
https://www.mercurynews.com/tag/world-cup/page/2/	https://www.mercurynews.com/2018/08/24/sunnyvale-community-briefs-for-the-week-of-aug-24/
https://www.mercurynews.com/tag/soccer/page/3/	https://www.mercurynews.com/2018/08/24/letter-should-water-flow-to-fight-fires-at-verizon-be-throttled/
https://www.mercurynews.com/tag/world-cup/	https://www.mercurynews.com/2018/04/23/teslas-not-the-only-silicon-valley-company-to-get-a-bad-report-card/
https://www.mercurynews.com/2018/09/30/us-looking-for-another-historic-comeback-at-the-ryder-cup/amp/	https://www.mercurynews.com/2018/08/05/quick-cook-salmon-fillets-caramelized-shallots-and-no-clean-up/
https://www.mercurynews.com/2018/07/13/world-cup-final-what-time-do-france-and-croatia-play-for-soccer-title/	https://www.mercurynews.com/tag/california-legislative-elections/
https://www.mercurynews.com/2018/07/16/world-cup-rewind-why-this-brit-and-many-like-him-are-bloody-angry-and-still-hurt/	https://www.mercurynews.com/2018/10/10/letter-dont-compare-struggles-of-black-people-women/amp/
https://www.mercurynews.com/2018/05/11/startup-world-cup-competition-decides-best-of-28-startups-from-around-the-globe/amp/	https://www.mercurynews.com/2018/08/24/martins-beach-california-moves-closer-to-taking-public-pathway-from-billionaire-vinod-khosla/
https://www.mercurynews.com/tag/sailing/	https://www.mercurynews.com/2018/08/30/campbell-crime-report-for-the-week-of-sept-7/

https://www.mercurynews.com/2018/09/30/us-looking-for-another-historic-comeback-at-the-ryder-cup/	https://www.mercurynews.com/2018/09/28/a-young-woman-was-gunned-down-in-a-richmond-park-fate-of-both-defendants-may-hinge-on-gov-browns-pen/
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6. North Korea

North Korea	
https://www.mercurynews.com/2018/04/27/two-koreas-agree-to-end-war-this-year-pursue-denuclearization/	https://www.mercurynews.com/2018/09/28/a-young-woman-was-gunned-down-in-a-richmond-park-fate-of-both-defendants-may-hinge-on-gov-browns-pen/
https://www.mercurynews.com/2018/10/02/seoul-north-korea-estimated-to-have-20-60-nuclear-weapons/	https://www.mercurynews.com/2018/08/24/sunnyvale-community-briefs-for-the-week-of-aug-24/
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Overlap:

Query	Overlap
Donald Trump	0
LA Lakers	0
Star Wars	0
Lebron James	0
2018 World Cup	0
North Korea	0
Hurricane Florence	0
Paul Allen	0

There were no Over laps