

CL-II 5 (2)

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[ ]: '''NAME:Aher Swami Sandip
ROLL NO.01
COURSE: AI&DS
CLASS: BE
SUB:Computer Laboratory-II (Information Retrival)'''
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[2]: import os
import math
import requests
from bs4 import BeautifulSoup
import networkx as nx

# Step 1: Crawling - Collect links from a page
def get_links_from_url(url):
    try:
        response = requests.get(url)
        soup = BeautifulSoup(response.text, 'html.parser')
        links = set()
        for a_tag in soup.find_all('a', href=True):
            href = a_tag['href']
            if href.startswith("http"):
                links.add(href)
        return links
    except:
        return set()

# Step 2: Build a directed graph from a list of URLs
def build_web_graph(seed_urls, max_depth=1):
    graph = {}
    visited = set()

    def crawl(url, depth):
        if depth > max_depth or url in visited:
            return
        visited.add(url)
        links = get_links_from_url(url)
        graph[url] = links
```

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        for link in links:
            crawl(link, depth + 1)

    for seed in seed_urls:
        crawl(seed, 0)

    return graph

# Step 3: Compute PageRank using simplified algorithm
def compute_pagerank(graph, damping=0.85, max_iterations=100, tol=1e-6):
    pages = list(graph.keys())
    n = len(pages)
    ranks = {page: 1.0 / n for page in pages}

    for _ in range(max_iterations):
        new_ranks = {}
        for page in pages:
            incoming_links = [p for p in pages if page in graph[p]]
            rank_sum = sum(ranks[p] / len(graph[p]) for p in incoming_links if
↪graph[p])
            new_ranks[page] = (1 - damping) / n + damping * rank_sum

        # Check convergence
        delta = sum(abs(new_ranks[page] - ranks[page]) for page in pages)
        ranks = new_ranks
        if delta < tol:
            break

    return ranks

# Step 4: Run everything together
if __name__ == "__main__":
    seed_urls = [
        "https://en.wikipedia.org/wiki/Web_crawler",
        "https://en.wikipedia.org/wiki/PageRank"
    ]

    print("Building web graph...")
    web_graph = build_web_graph(seed_urls, max_depth=1)

    print("Computing PageRank...")
    pagerank_scores = compute_pagerank(web_graph)

    print("\nPageRank Results:")
    for page, score in sorted(pagerank_scores.items(), key=lambda x: x[1],
↪reverse=True):
        print(f"{page}: {score:.5f}")

```

Building web graph...
Computing PageRank...

PageRank Results:

<https://www.mediawiki.org/>: 0.00160
<https://www.wikimedia.org/>: 0.00154
<https://developer.wikimedia.org/>: 0.00151
https://foundation.wikimedia.org/wiki/Special:MyLanguage/Policy:Universal_Code_of_Conduct: 0.00150
https://foundation.wikimedia.org/wiki/Special:MyLanguage/Policy:Cookie_statement: 0.00139
https://foundation.wikimedia.org/wiki/Special:MyLanguage/Policy:Privacy_policy: 0.00127
https://foundation.wikimedia.org/wiki/Special:MyLanguage/Policy:Terms_of_Use: 0.00115
<https://de.wikipedia.org/wiki/Webcrawler>: 0.00093
https://es.wikipedia.org/wiki/Ara%C3%B1a_web: 0.00091
https://en.wikipedia.org/wiki/Web_crawler: 0.00091
<https://nn.wikipedia.org/wiki/S%C3%B8kerobot>: 0.00091
<https://et.wikipedia.org/wiki/Veebi%C3%A4mblik>: 0.00091
<https://sr.wikipedia.org/wiki/Veb-popisiva%C4%8D>: 0.00091
https://ar.wikipedia.org/wiki/%D8%B2%D8%A7%D8%AD%D9%81_%D9%88%D9%8A%D8%A8: 0.00091
<https://zh.wikipedia.org/wiki/%E7%B6%B2%E8%B7%AF%E7%88%AC%E8%9F%B2>: 0.00091
https://ta.wikipedia.org/wiki/%E0%AE%B5%E0%AE%B2%E0%AF%88_%E0%AE%8A%E0%AE%B0%E0%AF%8D%E0%AE%A4%E0%AE%BF: 0.00091
<https://it.wikipedia.org/wiki/Crawler>: 0.00091
https://ko.wikipedia.org/wiki/%EC%9B%B9_%ED%81%AC%EB%A1%A4%EB%9F%AC: 0.00091
<https://no.wikipedia.org/wiki/S%C3%B8kerobot>: 0.00091
https://cs.wikipedia.org/wiki/Web_crawler: 0.00091
https://az.wikipedia.org/wiki/Axtar%C4%B1%C5%9F_botu: 0.00091
https://uk.wikipedia.org/wiki/%D0%9F%D0%BE%D1%88%D1%83%D0%BA%D0%BE%D0%B2%D0%B8%D0%B9_%D1%80%D0%BE%D0%B1%D0%BE%D1%82: 0.00091
https://pl.wikipedia.org/wiki/Robot_internetowy: 0.00091
<https://ja.wikipedia.org/wiki/%E3%82%AF%E3%83%AD%E3%83%BC%E3%83%A9>: 0.00091
https://ca.wikipedia.org/wiki/Aranya_web: 0.00091
https://he.wikipedia.org/wiki/%D7%96%D7%97%D7%9C%D7%9F_%D7%A8%D7%A9%D7%AA: 0.00091
https://hy.wikipedia.org/wiki/%D5%88%D6%80%D5%B8%D5%B6%D5%B8%D5%B2%D5%A1%D5%AF%D5%A1%D5%B6_%D5%BC%D5%B8%D5%A2%D5%B8%D5%BF: 0.00091
https://fr.wikipedia.org/wiki/Robot_d%27indexation: 0.00091
https://lv.wikipedia.org/wiki/T%C4%ABmek%C4%BCa_r%C4%81pu%C4%BCprogramma: 0.00091
<https://th.wikipedia.org/wiki/%E0%B9%80%E0%B8%A7%E0%B9%87%E0%B8%9A%E0%B8%84%E0%B8%A3%E0%B8%AD%E0%B8%A7%E0%B9%8C%E0%B9%80%E0%B8%A5%E0%B8%AD%E0%B8%A3%E0%B9%8C>: 0.00091
https://tr.wikipedia.org/wiki/Arama_robotu: 0.00091
https://id.wikipedia.org/wiki/Perayap_web: 0.00091

https://ru.wikipedia.org/wiki/%D0%9F%D0%BE%D0%B8%D1%81%D0%BA%D0%BE%D0%B2%D1%8B%D0%B9_%D1%80%D0%BE%D0%B1%D0%BE%D1%82: 0.00091

https://eu.wikipedia.org/wiki/Web_crawler: 0.00091

[https://ary.wikipedia.org/wiki/%D8%B1%D8%AA%D9%8A%D9%84%D8%A9_\(%D8%A8%D9%88%D8%AA\):](https://ary.wikipedia.org/wiki/%D8%B1%D8%AA%D9%8A%D9%84%D8%A9_(%D8%A8%D9%88%D8%AA):) 0.00091

<https://fi.wikipedia.org/wiki/Hakurobotti>: 0.00091

https://fa.wikipedia.org/wiki/%D8%AE%D8%B2%D9%86%D8%AF%D9%87_%D9%88%D8%A8: 0.00091

https://el.wikipedia.org/wiki/%CE%91%CE%BD%CE%B9%CF%87%CE%BD%CE%B5%CF%85%CF%84%CE%AE%CF%82_%CE%B9%CF%83%CF%84%CE%BF%CF%8D: 0.00091

<https://bar.wikipedia.org/wiki/Webcrawler>: 0.00091

https://ro.wikipedia.org/wiki/Robot_de_c%C4%83utare: 0.00091

https://ms.wikipedia.org/wiki/Perangkak_web: 0.00091

<https://hu.wikipedia.org/wiki/Keres%C5%91robot>: 0.00091

<https://nl.wikipedia.org/wiki/Spider>: 0.00091

https://hr.wikipedia.org/wiki/Web_pauk: 0.00091

<https://zh-classical.wikipedia.org/wiki/%E7%88%AC%E7%B6%B2%E8%9F%B2%E6%A2%B0:> 0.00091

https://pt.wikipedia.org/wiki/Rastreador_web: 0.00091

https://qu.wikipedia.org/wiki/Web_aysakuq: 0.00091

https://ia.wikipedia.org/wiki/Rastreator_de_rete: 0.00091

<https://af.wikipedia.org/wiki/Webkruiper>: 0.00091

https://simple.wikipedia.org/wiki/Web_crawler: 0.00091

https://lt.wikipedia.org/wiki/Interneto_robotas: 0.00091

https://cy.wikipedia.org/wiki/Ymgripiwr_gwe: 0.00091

https://mhr.wikipedia.org/wiki/%D0%9A%D1%8B%D1%87%D0%B0%D0%BB%D1%88%D0%B5_%D1%80%D0%BE%D0%B1%D0%BE%D1%82: 0.00091

<https://nds-nl.wikipedia.org/wiki/Webkroeper>: 0.00091

[https://sv.wikipedia.org/wiki/Spindel_\(internet\):](https://sv.wikipedia.org/wiki/Spindel_(internet):) 0.00091

<https://www.wikidata.org/wiki/Special:EntityPage/Q45842>: 0.00090

<https://www.wikidata.org/wiki/Special:EntityPage/Q45842#sitelinks-wikipedia:> 0.00090

<https://en.wikipedia.org/wiki/PageRank>: 0.00081

<https://commons.wikimedia.org/wiki/Category:PageRank>: 0.00081

<https://www.wikidata.org/wiki/Special:EntityPage/Q184316>: 0.00080

<https://hi.wikipedia.org/wiki/%E0%A4%AA%E0%A5%87%E0%A4%9C%E0%A4%B0%E0%A5%88%E0%A4%82%E0%A4%95:> 0.00079

<https://zh.wikipedia.org/wiki/PageRank>: 0.00079

<https://ru.wikipedia.org/wiki/PageRank>: 0.00079

<https://kn.wikipedia.org/wiki/%E0%B2%AA%E0%B3%87%E0%B2%9C%E0%B3%8D%E2%80%8D%E0%B2%B0%E0%B3%8D%E0%B2%AF%E0%B2%BE%E0%B2%82%E0%B2%95%E0%B3%8D:> 0.00079

https://ta.wikipedia.org/wiki/%E0%AE%AA%E0%AF%87%E0%AE%9C%E0%AF%8D_%E0%AE%A4%E0%AE%B0%E0%AE%B5%E0%AE%B0%E0%AE%BF%E0%AE%9A%E0%AF%88: 0.00079

<https://uk.wikipedia.org/wiki/PageRank>: 0.00079

<https://fr.wikipedia.org/wiki/PageRank>: 0.00079

<https://tr.wikipedia.org/wiki/PageRank>: 0.00079

<https://de.wikipedia.org/wiki/PageRank>: 0.00079

<https://ms.wikipedia.org/wiki/PageRank>: 0.00079

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<https://pl.wikipedia.org/wiki/PageRank>: 0.00079
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<https://zh-yue.wikipedia.org/wiki/PageRank>: 0.00079
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<https://ko.wikipedia.org/wiki/%ED%8E%98%EC%9D%B4%EC%A7%80%EB%9E%AD%ED%81%AC>: 0.00079
<https://lt.wikipedia.org/wiki/PageRank>: 0.00079
<https://fa.wikipedia.org/wiki/%D9%BE%DB%8C%D8%AC%E2%80%8C%D8%B1%D9%86%DA%A9>: 0.00079
<https://sk.wikipedia.org/wiki/PageRank>: 0.00079
https://gu.wikipedia.org/wiki/%E0%AA%AA%E0%AB%87%E0%AA%9C_%E0%AA%B0%E0%AB%87%E0%AA%A8%E0%AB%8D%E0%AA%95: 0.00079
<https://da.wikipedia.org/wiki/PageRank>: 0.00079
<https://kk.wikipedia.org/wiki/PageRank>: 0.00079
<https://nl.wikipedia.org/wiki/PageRank>: 0.00079
https://el.wikipedia.org/wiki/%CE%91%CE%BB%CE%B3%CF%8C%CF%81%CE%B9%CE%B8%CE%BC%CE%BF%CF%82_PageRank: 0.00079
https://az.wikipedia.org/wiki/Page_Rank: 0.00079
<https://sv.wikipedia.org/wiki/Pagerank>: 0.00079
<https://www.wikidata.org/wiki/Special:EntityPage/Q184316#sitelinks-wikipedia>: 0.00078
<https://wikimediafoundation.org/>: 0.00061
<https://d-nb.info/gnd/4796298-7>: 0.00056
<https://web.archive.org/web/20091213213920/http://wiki.foaf-project.org/w/Scutter>: 0.00056

http://www.redorbit.com/news/education/318480/stanford_earns_336_million_off_google_stock/: 0.00044
<http://infolab.stanford.edu/~backrub/google.html>: 0.00044
<http://www.stanfordalumni.org/news/magazine/2004/novdec/features/startingup.html>: 0.00042
<https://web.archive.org/web/20211206205907/https://webbrowsersintroduction.com/>: 0.00042
<https://www.wikidata.org/wiki/Q45842#identifiers>: 0.00042
http://chato.cl/research/crawling_thesis: 0.00042
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<http://www.cs.washington.edu/homes/pedrod/papers/nips01b.pdf>: 0.00041
<http://dbpubs.stanford.edu:8090/pub/showDoc.Fulltext?lang=en&doc=1999-66&format=pdf&compression=:> 0.00041
<https://web.archive.org/web/20060427013310/http://dbpubs.stanford.edu:8090/pub/showDoc.Fulltext?lang=en&doc=1999-66&format=pdf&compression=:> 0.00041
<https://web.archive.org/web/20040903174942/http://archive.ncsa.uiuc.edu/SDG/IT94/Proceedings/Agents/spetka/spetka.html>: 0.00040
<https://web.archive.org/web/20111104131332/https://www.google.com/competition/howgooglesearchworks.html>: 0.00040
<https://web.archive.org/web/20130702063520/https://www.google.com/competition/howgooglesearchworks.html>: 0.00040
<http://www.wiley.com/legacy/compbooks/sonnenreich/history.html>: 0.00040
<https://web.archive.org/web/20090310190153/http://www.stanfordalumni.org/news/magazine/2004/novdec/features/startingup.html>: 0.00040
<https://www.google.com/competition/howgooglesearchworks.html>: 0.00040
<http://oak.cs.ucla.edu/~cho/research/crawl.html>: 0.00040
<http://wiki.foaf-project.org/w/Scutter>: 0.00040
<https://patents.google.com/patent/US6285999>: 0.00040
<http://www.cs.duke.edu/nicl/netecon06/papers/ne06-sybil.pdf>: 0.00040
<http://searchengineland.com/google-has-confirmed-they-are-removing-toolbar-pagerank-244230>: 0.00039
<https://www.slideshare.net/denshe/icwe13-tutorial-webcrawling>: 0.00039
<http://searchengineland.com/what-is-google-pagerank-a-guide-for-searchers-webmasters-11068>: 0.00039
<https://web.archive.org/web/20160703031514/http://searchengineland.com/what-is-google-pagerank-a-guide-for-searchers-webmasters-11068>: 0.00039
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<https://web.archive.org/web/20171224210412/http://www10.org/cdrom/papers/pdf/p208.pdf>: 0.00039
<http://www-cs-students.stanford.edu/~taherh/papers/secondeigenvalue.pdf>: 0.00039
<https://doi.org/10.1145%2F358923.358934>: 0.00039
<https://www.google.com/press/funfacts.html>: 0.00039
<https://web.archive.org/web/20010715123343/https://www.google.com/press/funfacts.html>: 0.00039
<https://patents.google.com/patent/US7058628B1/en>: 0.00039
<https://en.wikiquote.org/wiki/PageRank>: 0.00039

<http://infolab.stanford.edu/pub/papers/google.pdf>: 0.00039
<https://support.apple.com/en-us/HT204683>: 0.00039
<http://ilpubs.stanford.edu:8090/422/1/1999-66.pdf>: 0.00039
<http://vigna.dsi.unimi.it/ftp/papers/UbiCrawler.pdf>: 0.00039
<http://vigna.dsi.unimi.it/ftp/papers/ParadoxicalPageRank.pdf>: 0.00039
<https://web.archive.org/web/20040317210216/http://www.fxpall.com/people/vdberg/pubs/www8/www1999f.pdf>: 0.00039
<http://www.robotstxt.org/wc/exclusion.html>: 0.00039
<https://www.slideshare.net/denshe/intelligent-crawling-shestakovviiat13>: 0.00039
<http://www2003.org/cdrom/papers/refereed/p007/p7-abiteboul.html>: 0.00038
<http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PT02&Sect2=HITOFF&u=%2Fnetahtml%2FPT0%2Fsearch-adv.htm&r=1&p=1&f=G&l=50&d=PTXT&S1=7,058,628.PN.&OS=pn/7,058,628&RS=PN/7,058,628>: 0.00038
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<http://googleblog.blogspot.com/2005/01/preventing-comment-spam.html>: 0.00038
<https://doi.org/10.1145%2F1062745.1062789>: 0.00038
<https://doi.org/10.1145%2F342009.335391>: 0.00038
<http://patft.uspto.gov/netacgi/nph-Parser?patentnumber=6,285,999>: 0.00038
<https://doi.org/10.1002%2Fspe.587>: 0.00038
<https://web.archive.org/web/20100821011759/http://www.cs.duke.edu/nicl/netecon06/papers/ne06-sybil.pdf>: 0.00038
<https://web.archive.org/web/20090320030833/http://vigna.dsi.unimi.it/ftp/papers/UbiCrawler.pdf>: 0.00038
<http://www.cs.brown.edu/courses/cs227/2002/cache/Cho.pdf>: 0.00038
<http://www-cs-students.stanford.edu/~taherh/papers/comparison.pdf>: 0.00038
<https://www.google.com/technology/>: 0.00038
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<https://web.archive.org/web/20080623233116/http://www.google.com/technology/>: 0.00038
<http://www.rankdex.com/about.html>: 0.00038
<http://bradlove.org/blog/cogsci-page-rank>: 0.00038
http://bradlove.org/papers/love_sloman_1995.pdf: 0.00038
<http://oak.cs.ucla.edu/~cho/papers/cho-thesis.pdf>: 0.00038
<https://web.archive.org/web/20071107021800/http://www.robotstxt.org/wc/exclusion.html>: 0.00038
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<https://web.archive.org/web/20050422045839/http://www.robotstxt.org/wc/guidelines.html>: 0.00038
<http://searchengineland.com/google-toolbar-pagerank-officially-goes-dark-247553>: 0.00038
<https://doi.org/10.1016%2FS0169-7552%2898%2900110-X>: 0.00038
<http://www.matcutts.com/blog/how-to-report-paid-links/>: 0.00038
<https://web.archive.org/web/20140829134755/http://patft.uspto.gov/netacgi/nph->

Parser?patentnumber=6,285,999: 0.00038
https://web.archive.org/web/20180331090147/http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2: 0.00038
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http://dbpubs.stanford.edu:8091/diglib/pub/projectdir/google.html: 0.00038
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https://web.archive.org/web/20190828223450/http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&u=%2Fnetahtml%2FPTO%2Fsearch-adv.htm&r=1&p=1&f=G&l=50&d=PTXT&S1=7%2C058%2C628.PN.&OS=pn%2F7%2C058%2C628&RS=PN%2F7%2C058%2C628: 0.00038
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http://www.mattcutts.com/blog/seo-for-bloggers/: 0.00038
http://www.seomoz.org/article/search-ranking-factors: 0.00038
https://web.archive.org/web/20171211160207/http://bradlove.org/blog/cogsci-page-rank: 0.00038
https://doi.org/10.1145%2F775152.775192: 0.00037
https://arxiv.org/abs/cs/0503069: 0.00037
https://github.com/bedirhan/wivet: 0.00037
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https://doi.org/10.1002%2Fasi.20078: 0.00037
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