

Welcome to "Little Bits to Big Ideas"

Lab 6: Directional Graphs, PageRank, and
The Halting Problem

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Can a computer solve all possible problems?

There is a famous problem that a computer can't solve....



Can a computer solve all possible problems? No

There is a famous problem that a computer can't solve....

The halting problem!

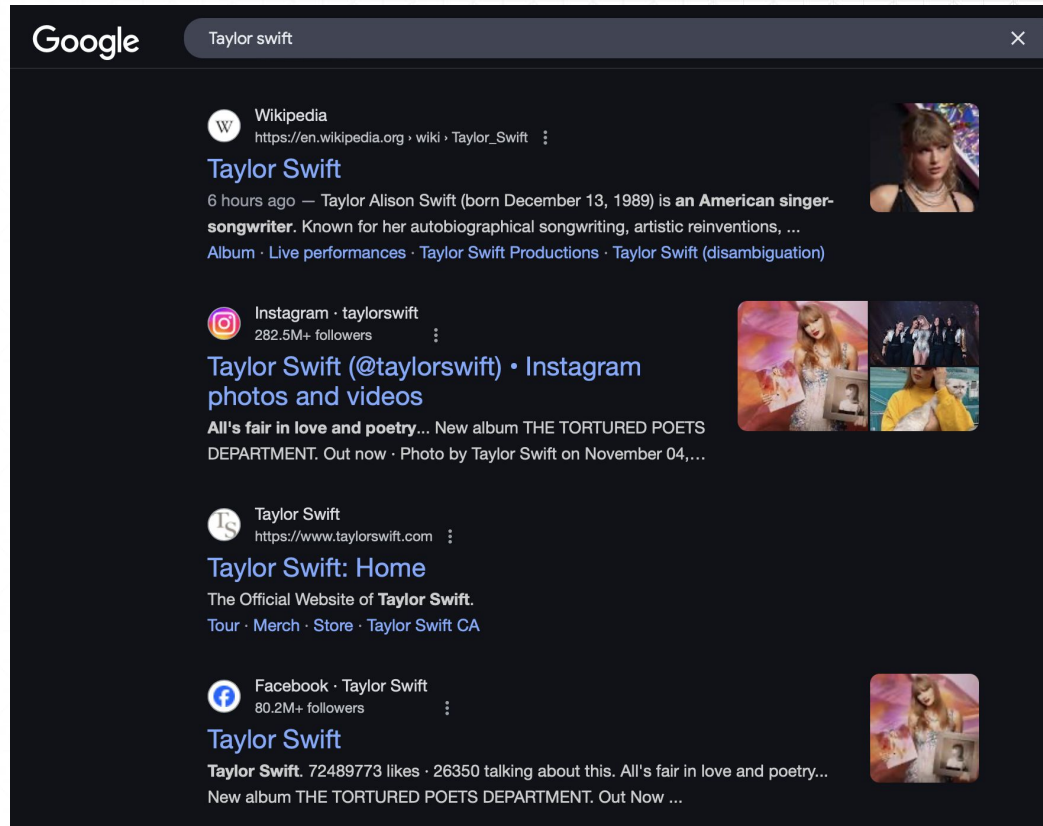
The **halting problem** is the problem of determining, from a description of an arbitrary **computer program**, whether the program will finish running, or continue to run forever.

The halting problem is *undecidable*, meaning that no general **algorithm** exists that solves the halting problem for all possible programs.



How does Google Rank Pages?

Why is the
Wikipedia article
ranked higher than
Taylor's official
website?



The screenshot shows a Google search interface with the search term "Taylor swift" in the search bar. The search results are displayed in a dark theme. The first result is from Wikipedia, titled "Taylor Swift", with a snippet mentioning she is an American singer-songwriter. The second result is from Instagram, titled "Taylor Swift (@taylorswift) • Instagram photos and videos", with a snippet about her new album "THE TORTURED POETS DEPARTMENT". The third result is from the official website, titled "Taylor Swift: Home", with a snippet stating it is the official website. The fourth result is from Facebook, titled "Taylor Swift", with a snippet about her new album. Each result includes a small profile picture or thumbnail image.

Google Taylor swift

Wikipedia
https://en.wikipedia.org/wiki/Taylor_Swift

Taylor Swift
6 hours ago — Taylor Alison Swift (born December 13, 1989) is an **American singer-songwriter**. Known for her autobiographical songwriting, artistic reinventions, ...
Album · Live performances · Taylor Swift Productions · Taylor Swift (disambiguation)

Instagram · taylorswift
282.5M+ followers

Taylor Swift (@taylorswift) • Instagram photos and videos
All's fair in love and poetry... New album THE TORTURED POETS DEPARTMENT. Out now · Photo by Taylor Swift on November 04,...

Taylor Swift
https://www.taylorswift.com

Taylor Swift: Home
The Official Website of **Taylor Swift**.
Tour · Merch · Store · Taylor Swift CA

Facebook · Taylor Swift
80.2M+ followers

Taylor Swift
Taylor Swift. 72489773 likes · 26350 talking about this. All's fair in love and poetry...
New album THE TORTURED POETS DEPARTMENT. Out Now ...



How Google Ranks Pages

Google ranks pages using the PageRank algorithm.

A page is important if many other important pages link to it.

It's like popularity: If many well-known people recommend a book, it's probably a good book.

Cofounder
of Google.
Invented
PageRank
with
Sergey
Brin

Larry Page



Page in 2009

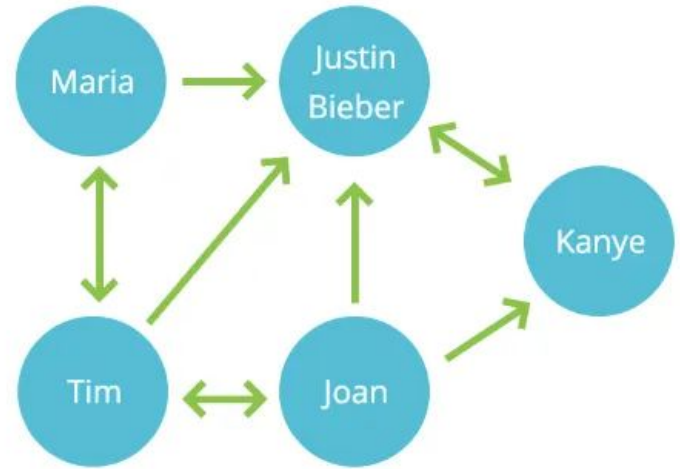


Example of a directional graph

Nodes: People

Edges: follows on Instagram

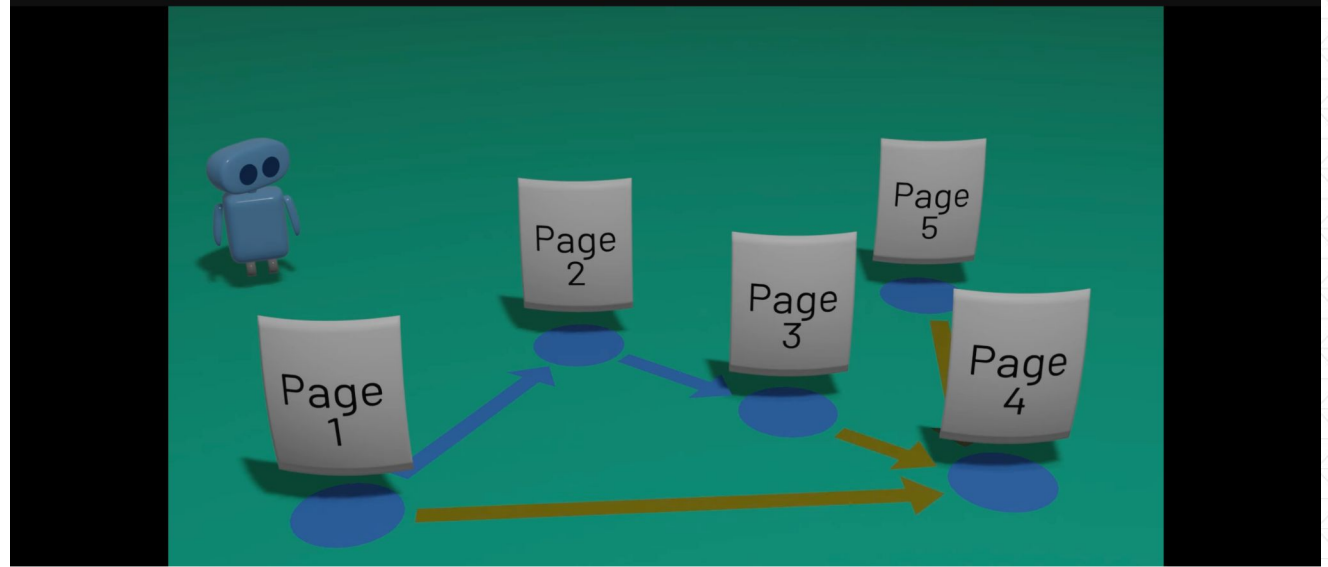
Instagram Followers Graph



We can make a graph out of the way websites link to each other

Nodes: Pages

Edges: Links



How Google's PageRank Algorithm Works



Spanning Tree
217K subscribers

Subscribe

3.8K



Share



Ask



All

From the series

From Spanning Tree



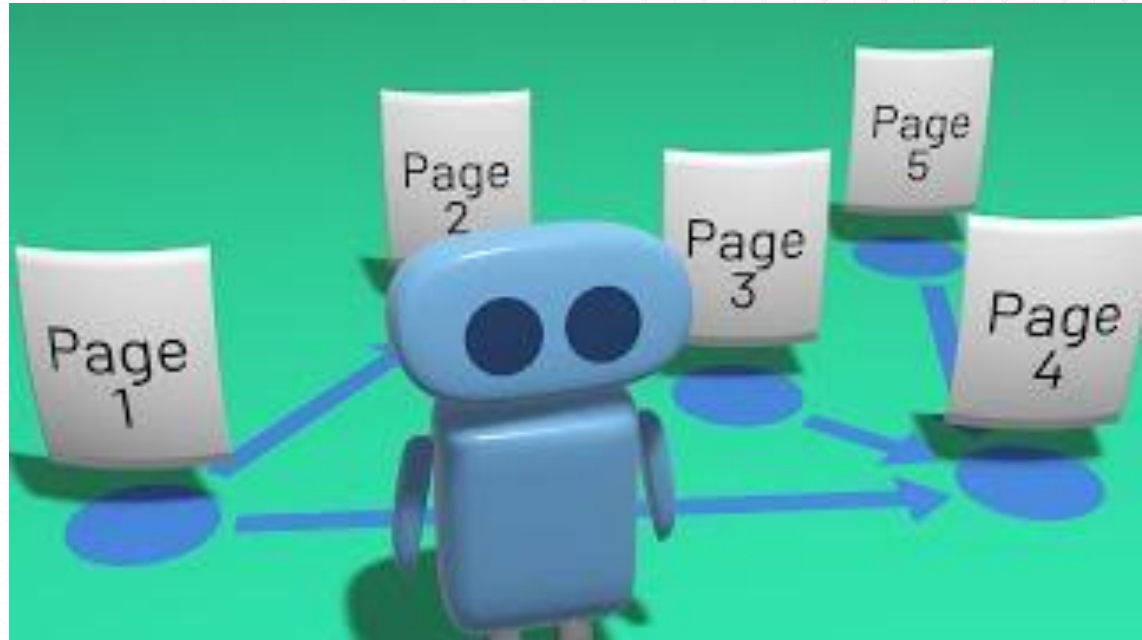
What Are Bloom Filters?



A “Random walk” moves between linked webpages randomly

In PageRank this is called the “Random Surfer”. It’s used to find the top ranked pages.

[No need for sound on video]



Today you're once again using Google Co-Lab to run Python Code

How to upload a file to your Google Co-Lab notebook:

