Google Pagerank
Using CUDA Framework

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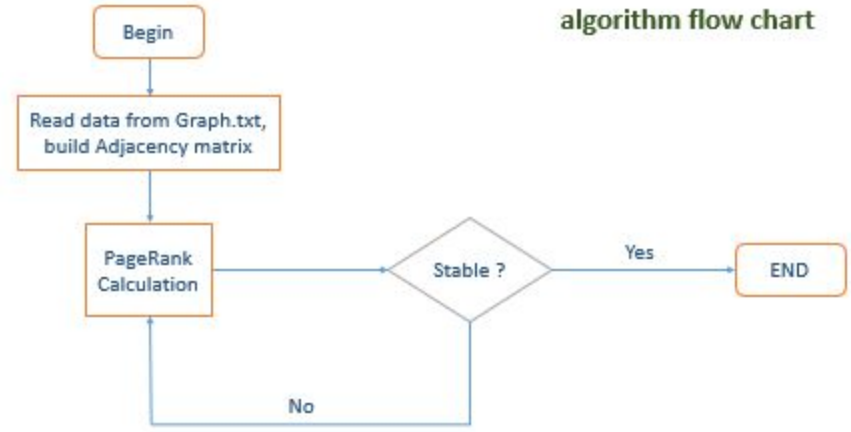
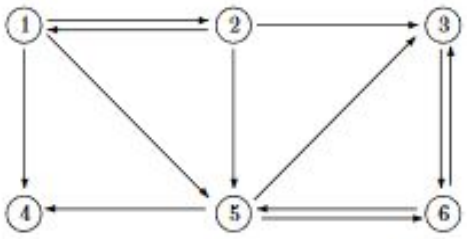
Pagerank Algorithm:

- Algorithm used by the Google web search engine to rank websites in their search engine results.
- PageRank works by counting the number of links to a page to determine a rough estimate of how important the website is.
- Assumption : more important websites are likely to receive more links from other websites.
- The numerical weight that it assigns to any given element E is referred to as the PageRank of E.



Power Method for Page Rank:

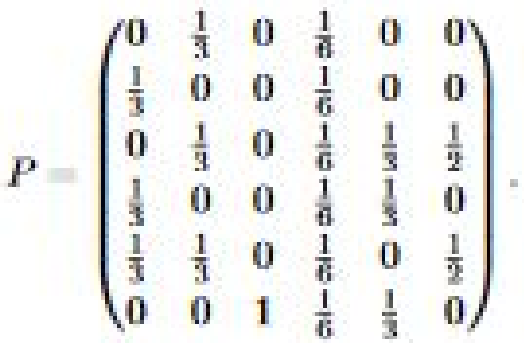
EXAMPLE :



$$Q = \begin{pmatrix} 0 & \frac{1}{3} & 0 & 0 & 0 & 0 \\ \frac{1}{3} & 0 & 0 & 0 & 0 & 0 \\ 0 & \frac{1}{3} & 0 & 0 & \frac{1}{3} & \frac{1}{2} \\ \frac{1}{3} & 0 & 0 & 0 & \frac{1}{3} & 0 \\ \frac{1}{3} & \frac{1}{3} & 0 & 0 & 0 & \frac{1}{2} \\ 0 & 0 & 1 & 0 & \frac{1}{3} & 0 \end{pmatrix}.$$

Random Walk and Markov Chains:

- A surfer visiting a Web page chooses the next page among the outlinks with equal probability.
- A Markov chain is a random process in which the next state is determined completely from the present state; the process has no memory.
- Matrix gets modified to :



Output

```
--------------------    Sequential Implementation        ---------------------

Rank[1] :6441
Rank[2] :8442
Rank[3] :210
Rank[4] :5486
Rank[5] :2187
Rank[6] :1583
Rank[7] :7298
Rank[8] :8401
Rank[9] :1030
Rank[10] :7957

Time taken :534504.000000

--------------------    Parallel Implementation          ---------------------

Rank[1] :6441
Rank[2] :8442
Rank[3] :210
Rank[4] :5486
Rank[5] :2187
Rank[6] :1583
Rank[7] :7298
Rank[8] :1030
Rank[9] :8401
Rank[10] :1573

Time taken :55829.000000
```

Comparison with k = 32 and 10000 nodes in graph.

Performance Comparison

Num of threads	Num of nodes	Sequential	Parallel	Speedup
8	100	35	20470	0.0017
16	100	34	13332	0.0025
32	100	33	20453	0.0016
64	100	33	19751	0.0016
128	100	33	19677	0.0016
8	1000	5340	572	9.33
16	1000	5350	721	7.42
32	1000	5357	581	9.22
64	1000	5348	576	9.28
128	1000	5340	583	9.15
8	10000	844597	77137	10.94
16	10000	822243	74125	11.09
32	**10000**	**851998**	**62360**	**13.66**
64	10000	833333	74288	11.21
128	10000	823084	74436	11.05