

CS 101:

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I. Example: Show that $(A^d)_{ij} = \# \text{ of } x_i - x_j \text{ walks in } G \text{ of length } d$

Base: $d = 0 \Rightarrow A^0 = I$

II. Breadth first search BFS

- BFS does the following:
 1. Discovers every vertex reachable from source $s \in V$
 2. Computes $\delta(s, x)$ to every $x \in V$
 3. Creates a BFS tree also called Predecessor subgraph. This is a subtree of G that includes all $x \in V$ reachable from S . The unique path is this tree from s to x

- vertex attributes:

Colors(x) = White, grey, black

D(x) distance from s to x i.e. $\delta(s, x)$

P(x) parent or predecessor of x

Also use FIFO queue: Q

- Code for BFS

```
BFS(G, s)
for all  $x \in V - \{s\}$ 
    color( $x$ ) =  $\omega$ 
    d( $x$ ) =  $\infty$ 
    P( $x$ ) = nil
color(s) = g
d(s) = 0
P(s) = nil
 $\phi = s$ 
Enqueue( $\phi, s$ )
while  $\phi \neq \emptyset$ 
     $x = \text{Dequeue}()$ 
```