

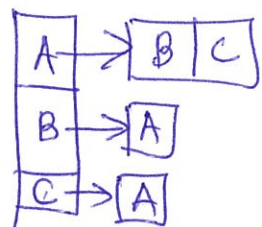
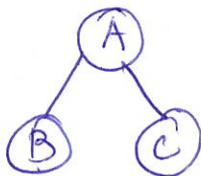
Sep 29

We just argued

$$2m = \sum_{u \in V} n_u$$

Undirected $G = (V, E)$

$n_u = \# \text{ neighbors of } u = |\{w \mid (u, w) \in E\}|$
(degree of u)



$$n_A = 2$$

$$n_B = 1$$

$$n_C = 1$$

→ size = 3 ptr +

list size : 2 = n_A for A

1 = n_B for B

1 = n_C for C

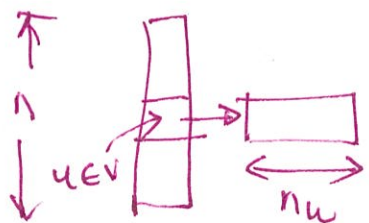
Total size = 3 + $n_A + n_B + n_C = 3 + 4 = 7$.

Adj list in general

ptrs = $|V| = n$

sum of list sizes = $\sum_{u \in V} n_u$

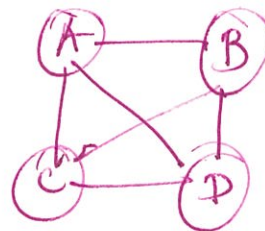
$$= 2m$$



⇒ overall size = ~~n~~ + $2m = \Theta(m+n)$

between n & $\Theta(n^2)$

$$\begin{aligned} & \textcircled{A} \quad \textcircled{B} \quad 0 \leq m \leq \binom{n}{2} \\ & \textcircled{C} \quad \textcircled{D} \quad = \frac{n(n-1)}{2} \\ & \leq n^2 \end{aligned}$$



BFS (G, A) // G is in adj. list format.

- $O(n)$
0. $CC[s] \leftarrow T$ and $CC[u] \leftarrow F \quad \forall u \neq s \in V$
assignment $\nearrow O(n)$
 1. $i \leftarrow 0$
 2. $L_0 \leftarrow \{s\}$ \leftarrow empty set
 3. While $L_i \neq \emptyset$ // T_i be the # iterations of this loop
 - 3.1 $L_{i+1} \leftarrow \{\}$ // $O(1)$
 - 3.2 for all u in L_i & T_{i2} be the # times algo gets here
for $(u, w) \in E$
If $CC[w] = F$ // T_{i23} # times algo gets here.
 $CC[w] \leftarrow T$ } $O(1)$
Add w to L_{i+1}
 - 3.3 $i++$ // $O(1)$
 4. Return CC // connected comp of $s = \{w \mid CC[w] = T\}$
 $\nearrow O(n)$

Total time: $O(n) + T_1 \cdot O(1) + T_{i23} \cdot O(1) + O(n)$

\nearrow
3.1 + 3.3

$\leq O(n) + O(T_{i23})$

\nearrow Goal: $T_{i23} \leq O(m)$.

$\leq O(m+n)$.