Feb 28

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

$O(n)$ {
0. $cc[s] \leftarrow T$ and $cc[u] \leftarrow F$ $\forall u \neq s \in V$ $O(n)$
1. $i \leftarrow 0$ $O(1)$
2. $L_0 \leftarrow \{s\}$ $O(1)$

3. While $L_i \neq \emptyset$ ← empty set // T_1: # iterations of this loop.

3.1 $L_{i+1} \leftarrow \{\ \}$ $O(1)$

3.2 for all u in L_i } T_{12}: # times alg. gets here

for (u, w) in E

if $cc[w] = F$ ← test of equality

$cc[w] \leftarrow T$

add w to L_{i+1} } $O(1)$ T_{123}: # times these lines get executed

3.3 $i{+}{+}$ $O(1)$

4. Return cc $O(n)$

Connected component of $s = \{w \mid cc[w] = T\}$

Total runtime: $O(n) + \underset{3.1 \,\&\, 3.3}{T_1} \cdot O(1) + T_{123} \cdot O(1) + O(n)$

$= O(n) + T_{123} \cdot O(1)$

$= O(n) + O(T_{123})$ $\leq O(m)$

$\leq O(n+m)$