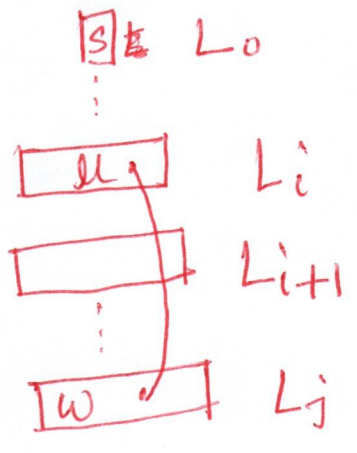**Proposition:** let T be a BFS tree for $G = (V, E)$.

IF $(\mu, \omega) \in E$ s.t. $\mu \in L_i$, $\omega \in L_j$

$$\Rightarrow |i - j| \leq 1 \Leftrightarrow i \in \{j-1, j, j+1\}$$

Proof idea: W.L.O.G. assume $i \leq j$ [if $\cancel{i \neq} \; i > j$, change the rules of i & j]

$\hookrightarrow$ without loss of generality

For contradiction, assume $|i - j| > 1 \Rightarrow j > i + 1$

$$\Rightarrow j \geq i + 2$$

$s \in L_0$

$\mu \in L_i$

L_{i+1}

$\omega \in L_j$

Consider the situation when BFS is creating L_{i+1}.

$\Rightarrow \mu \in L_i$, $\omega \notin L_0, \cdots, L_i$

$\Rightarrow (\mu, \omega) \in E$

$\Rightarrow \omega$ will be added by BFS to L_{i+1}

$\Rightarrow$ contradicts $\omega \in L_j$ for $j \geq i+2$ $\quad \square$