
Algorithm 3: QUBE(MUC_U)

input : MUC_U - Minimum Union Cycle that updated vertices belong to

output : $C[v_i]$ - Updated Betweenness Centrality Array

1 **begin**

2 Let SP be the set of all pair shortest paths in MUC_U ;

3 Let $C[v_i]$ be an empty array, $v_i \in MUC_U$;

4 $SP, C[v_i] \leftarrow \text{Betweenness}()$;

5 **for** each shortest path $\langle v_a, \dots, v_b \rangle$ in SP **do**

6 **if** v_a is a connecting vertex **then**

7 $G_a :=$ Subgraph connected by a connection vertex v_a ;

8 **for** each $v_i \in \langle v_a, \dots, v_b \rangle - \{v_b\}$ **do**

9 $C[v_i] := C[v_i] + \frac{|V_{G_a}|}{|SP(v_a, v_b)|}$;

10 **if** v_b is also a connecting vertex **then**

11 $G_b :=$ Subgraph connected by a connection vertex v_b ;

12 **for** each $v_i \in \langle v_a, \dots, v_b \rangle$ **do**

13 $C[v_i] := C[v_i] + \frac{|V_{G_a}| \cdot |V_{G_b}|}{|SP(v_a, v_b)|}$;

14 **if** G_a is disconnected **then**

15 $C[v_a] := C[v_a] + |V_{G_a}|^2 - \sum_{l=1}^n (|V_{G_a^l}|^2)$
