

**Algorithm 6.6. Betweenness centrality batch.**

Var	Type	Description
<b>S</b>	$\mathbb{B}^{N \times  p  \times N}$	the search, keeps track of the depth at which each vertex is seen for each starting vertex
<b>P</b>	$\mathbb{Z}^{ p  \times N}$	the number of shortest paths to each vertex from each starting vertex
<b>F</b>	$\mathbb{Z}^{ p  \times N}$	the fringe, the number of shortest paths to vertices at the current depth from each starting vertex
<b>W</b>	$\mathbb{R}^{ p  \times N}$	the weights for the BC updates for each starting vertex
<b>B</b>	$\mathbb{R}^{ p  \times N}$	the BC score for each vertex for each starting vertex
<b>U</b>	$\mathbb{R}^{ p  \times N}$	the BC update for each vertex for each starting vertex
<b>r</b>	$\mathbb{Z}^{ p }$	the current root values, or starting vertices for which to compute BC updates
<b>d</b>	$\mathbb{Z}$	the current depth being examined

$b = \text{BETWEENNESSCENTRALITY}(G = A : \mathbb{B}^{N \times N}, P)$

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1  b = 0
2  for  $r \in P$ 
3      do
4           $d = 0$ 
5           $\mathbf{S} = 0$ 
6           $\mathbf{P} = \mathbf{I}(r, :)$ 
7           $\mathbf{F} = \mathbf{A}(r, :)$ 
8          while  $\mathbf{F} \neq 0$ 
9              do
10                  $d = d + 1$ 
11                  $\mathbf{P} = \mathbf{P} + \mathbf{F}$ 
12                  $\mathbf{S}(d, :, :) = \mathbf{F}$ 
13                  $\mathbf{F} = \mathbf{FA} \times \neg \mathbf{P}$ 
14             while  $d \geq 2$ 
15                 do
16                      $\mathbf{W} = \mathbf{S}(d, :, :) \times (1 + \mathbf{U}) \div \mathbf{P}$ 
17                      $\mathbf{W} = (\mathbf{AW}')'$ 
18                      $\mathbf{W} = \mathbf{W} \times \mathbf{S}(d - 1, :, :) \times \mathbf{P}$ 
19                      $\mathbf{U} = \mathbf{U} + \mathbf{W}$ 
20                      $d = d - 1$ 
21             b = b + ( +. U)

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