Algorithm: Molecular Graph Realizability Check

Input: A sequence of integer sets $C = \{E_1, E_2, \ldots, E_n\}$, where each set $E_i = \{v_{i1}, v_{i2}, \ldots, v_{im_i}\}$ is sorted in ascending order.
Output: Boolean value indicating whether C is realizable as a molecular graph.

Procedure:

Initialization:
Set $C_{max} = \{d_1, d_2, \ldots, d_n\}$, such that $d_i \leftarrow \max(E_i)$, for all i
Compute total valence sum: $D = \sum_{i=1}^{n} d_i$

Step 1: Handshake Lemma Check
if D is odd **then**
Iterate over C to find odd Δ such that $\Delta = d_i - v_{ij}$ for $v_{ij} \in E_i \setminus \{d_i\}$. If multiple odd Δ exist, take the smallest one.
if such odd Δ exists for any first E_i **then**
Update max valence: $d_i \leftarrow d_i - \Delta$, update sum: $D \leftarrow D - \Delta$
else
Return false
end if
end if

Step 2: Connectivity Check
if $D < 2(n-1)$ **then**
Return false
end if

Step 3: Loop Prevention Check
if $D \geq 2d_{imax}$, where $d_{imax} = \max\{d_1, d_2, \ldots, d_n\}$ **then**
Return true
else
if $v_{ij} < d_{imax}$ exists in E_i **then**
Update C: remove d_{imax} from E_i
Set $v_{imax} \leftarrow$ next largest available v_{ij}
Update C_{max}: replace d_{imax} with v_{imax}
Update sum: $D \leftarrow D - d_{imax} + v_{imax}$
Go to Step 1
else
Return false
end if
end if