Preliminar notes on maximum-flow problem solved in FCPP.
Notation:
• $\mathcal{C}$ will denote the directed weighted graph of capacities.
s and t will denote respectively source and sink of our graph.
• $\mathcal{R}$ will denote the directed weighted graph of residual capacities.
• For a directed graph G, $d_G(\delta,\delta')$ will be the distance from node δ to node δ'. It takes values in $\mathbb{N}\cup\{\infty\}$.
• For a acyclic directed graph G, $D_G(\delta,\delta')$ will be the maximum of the lenghts of all paths from node δ to node δ'.
• For a path $\mathfrak{p}$ we will denote with $|\mathfrak{p}|$ its lenght.

When it will be convenient, we will treat a directed weighted graph G as a function $G : V\times V \ \to \mathbb{R}_+$, where V is its set of vertices. With a little abuse of notation we will say that the edge from a node δ to a node δ' is in G, or $(\delta,\delta')\in G$, in place of $G(\delta,\delta')\neq 0$.
Likewise we will say that a path $\mathfrak{p}$ is contained in G, or $\mathfrak{p}\subset G$, if every edge in $\mathfrak{p}$ is in G.

Observation 1. $\mathcal{C}$ is acyclic and

$$\forall\delta,\delta' :\ \mathcal{C}(\delta,\delta')\neq 0 \Rightarrow \mathcal{C}(\delta',\delta) \ = \ 0 \tag{1}$$

i.e. the capacity between any two nodes can be nonzero in almost one direction.
$\mathcal{R}$, has the same set of vertices than $\mathcal{C}$, it can have cycles, and has the property that

$$\forall\delta,\delta' :\ \mathcal{R}(\delta,\delta')+\mathcal{R}(\delta',\delta) \ = \ \mathcal{C}(\delta,\delta')+\mathcal{C}(\delta',\delta)\ . \tag{2}$$