Solution for Connecting Supertrees

Subtask 1

Construct any tree on n nodes.

Subtask 2

We know that $p[i][j] = 0$ if and only if i and j belong to different connected components. If $p[i][j] > 0$ and $p[j][k] > 0$, then we must have $p[i][k] > 0$; we may return impossible if this condition is not satisfied.

Once this condition is satisfied, we proceed to identify the connected components and construct any tree for each connected component.

Subtask 3

We proceed to identify the connected components as per the previous section. Instead of constructing a tree through each connected component, we construct a cycle instead.

Take note that connected components cannot have size 2; there are no cycles of length 2.

Subtask 4

As with the previous subtasks, we deal with each connected component separately.

For each i, consider the set of all j such that $p[i][j] = 1$. For each of these sets, we construct any tree through these nodes. For each of these trees, assign a special node which we will call the `root'.

For each connected component, we now construct a cycle through these roots.

Subtask 5

We need to check for an additional condition: if $p[i][j] = 1$ and $p[j][k] = 1$, then we must have $p[i][k] = 1$.

The previous checks from subtask 3 (consistency of connected components, no cycles of length 2) still apply as usual.

Subtask 6

If $p[i][j] = 3$ for some pair (i, j), then there must be another pair (i', j') such that $p[i'][j'] \geq 4$. Therefore, this cannot occur.

We simply return 0 whenever this occurs.