**Role of Traversal Numbers**

- **DAG =** [DFT, Forward-edges, Cross-edges]
- **Cyclic Graph =** [DAG, Back-edges]
- **Randomized Post-order Numbers (RPONs)**
- **Randomized Pre-order Numbers (RPOR)**

**Cyclic Graphs: β-RPONs, β-RPONs**

- β-node ‘x’: start node of a back-edge e(x, w), \( g_x \)
- β-reachable \( Y \): node reachable from ‘x’ over e(x, w), \( \{g_x, g_y, g_z\} \)
- For each \( y \): β-reachable from ‘x’:
  - Compute \( \beta\text{-RPON}: r_1^x, r_2^x, r_3^x, r_4^x, r_5^x \text{ or } \beta\text{-RPON of } x \).
  - Compute \( \beta\text{-RPOR}: p_1^x, p_2^x, p_3^x, p_4^x, p_5^x \text{ or } \beta\text{-RPOR of } x \).

**Example**

Cyclic Graphs: Verification

1. Verify \( \psi_x: \{\{g| x \in G\}, G\} \)
2. Edge e(z, x)
3. Content Verification = \( 1\) Fails: \( C_x \), or \( G_x \) compromised.

**No leakage:**
- Every edge e(z, x) is conveyed as a tree-edge.
- Else knowledge of back-edge does not leak any information.

**References**

- [Structural Signatures for Tree Data Structures](Ashish Kundu & Elisa Bertino, VLDB’08).
- [Completely Secure Sharing of Trees and Hierarchical Content](Ashish Kundu & Elisa Bertino, CERIAS Symposium’07). Best paper: 2nd.
- [Secure Dissemination of XML Content Using Structure-Based Routing](Ashish Kundu & Elisa Bertino, IEEE DODC’06). (Best student paper)
- [Structural Signatures for Graph Data Structures](Ashish Kundu & Elisa Bertino, Ready for submission).