

- 粗粒度冗余（含非极大二分团的节点）
- 中等粒度冗余（重复集合运算）
- 细粒度冗余（无效顶点访问）

- 根节点
- 极大二分团
- 非极大二分团

**w:**

$$L_w = \begin{matrix} L_{\text{root}} \\ \cap \\ N(v_0) \end{matrix} = \begin{matrix} [u_0 & u_1 & u_2 & u_3 & u_4 & u_5 & u_6 & u_7 & u_8 & u_9] \\ \cap \\ [u_0 & u_1 & u_2 & u_4 & u_5 & u_6 & u_7] \end{matrix} = [u_0 & u_1 & u_2 & u_4 & u_5 & u_6 & u_7]$$

**x:**

$$N_w(v_1) = L_x = \begin{matrix} L_w \\ \cap \\ N(v_1) \end{matrix} = \begin{matrix} [u_0 & u_1 & u_2 & u_4 & u_5 & u_6 & u_7] \\ \cap \\ [u_0 & u_1 & u_2 & u_3] \end{matrix} = [u_0 & u_1 & u_2]$$

**y:**

$$N_w(v_2) = L_y = \begin{matrix} L_w \\ \cap \\ N(v_2) \end{matrix} = \begin{matrix} [u_0 & u_1 & u_2 & u_4 & u_5 & u_6 & u_7] \\ \cap \\ [u_0 & u_1 & u_3 & u_4 & u_5 & u_6 & u_7 & u_8] \end{matrix} = [u_0 & u_1 & u_4 & u_5 & u_6 & u_7]$$

**z:**

$$N_w(v_3) = L_z = \begin{matrix} L_w \\ \cap \\ N(v_3) \end{matrix} = \begin{matrix} [u_0 & u_1 & u_2 & u_4 & u_5 & u_6 & u_7] \\ \cap \\ [u_0 & u_3 & u_4 & u_5 & u_6 & u_8 & u_9] \end{matrix} = [u_0 & u_4 & u_5 & u_6]$$

**q:**

$$N_x(v_2) = L_r = \begin{matrix} L_x \\ \cap \\ N_w(v_2) \end{matrix} = \begin{matrix} [u_0 & u_1 & u_2] \\ \cap \\ [u_0 & u_1 & \cancel{u_3} & u_4 & u_5 & u_6 & u_7 & \cancel{u_8}] \end{matrix} = [u_0 & u_1]$$

**r:**

$$N_x(v_3) = L_r = \begin{matrix} L_x \\ \cap \\ N_w(v_3) \end{matrix} = \begin{matrix} [u_0 & u_1 & u_2] \\ \cap \\ [u_0 & \cancel{u_3} & u_4 & u_5 & u_6 & \cancel{u_8} & \cancel{u_9}] \end{matrix} = [u_0]$$

**s:**

$$N_y(v_3) = L_s = \begin{matrix} L_y \\ \cap \\ N_w(v_3) \end{matrix} = \begin{matrix} [u_0 & u_1 & u_4 & u_5 & u_6 & u_7] \\ \cap \\ [u_0 & \cancel{u_3} & u_4 & u_5 & u_6 & \cancel{u_8} & \cancel{u_9}] \end{matrix} = [u_0 & u_4 & u_5 & u_6]$$

**t:**

$$N_q(v_3) = L_t = \begin{matrix} L_q \\ \cap \\ N_x(v_3) \end{matrix} = \begin{matrix} [u_0 & u_1] \\ \cap \\ [u_0 & \cancel{u_3} & \cancel{u_4} & \cancel{u_5} & \cancel{u_6} & \cancel{u_8} & \cancel{u_9}] \end{matrix} = [u_0]$$

