Exercise 1 – Herbrand Semantics

Given the schedule:

$$s = r_1[x] \ r_3[x] \ w_3[y] \ w_2[x] \ c_3 \ r_4[y] \ w_4[x] \ c_2 \ r_5[x] \ c_4 \ w_5[z] \ w_1[z] \ c_1 \ c_5$$

We are told that transactions t_3 and t_4 are **copiers**, i.e., the write functions are identity functions on one of their inputs:

$$f_{ix}(v_1, \ldots, v_m) = v_j \quad \text{for some } j$$

Step 1: Compute values of each write using Herbrand semantics

- $H_s[r_3[x]] = H_s[w_0[x]] = f_{0x}()$

- $H_s[w_3[y]] = H_s[r_3[x]] = f_{0x}()$ (copier)

- $H_s[w_2[x]] = f_{2x}()$ (no read in t_2)

- $H_s[r_4[y]] = H_s[w_3[y]] = f_{0x}()$

- $H_s[w_4[x]] = H_s[r_4[y]] = f_{0x}()$ (copier)

- $H_s[r_5[x]] = H_s[w_4[x]] = f_{0x}()$

- $H_s[w_5[z]] = f_{5z}(H_s[r_5[x]]) = f_{5z}(f_{0x}())$

- $H_s[r_1[x]] = f_{0x}()$

- $H_s[w_1[z]] = f_{1z}(H_s[r_1[x]]) = f_{1z}(f_{0x}())$

Step 2: Final writes to each data item

The last writes in the schedule are:

- x: last write is $w_4[x] \Rightarrow H[s](x) = H_s[w_4[x]] = f_{0x}()$

- y: last write is $w_3[y] \Rightarrow H[s](y) = H_s[w_3[y]] = f_{0x}()$

- z: last write is $w_1[z] \Rightarrow H[s](z) = H_s[w_1[z]] = f_{1z}(f_{0x}())$

Answer: Herbrand Semantics

$$\boxed{H[s](x) = f_{0x}(), \quad H[s](y) = f_{0x}(), \quad H[s](z) = f_{1z}(f_{0x}())}$$