2. $\{Y \in \mathfrak{B} \quad | \quad X \; f \; Y\}$ is a free star for every $X \in \mathfrak{A}$;

what is equal to the following:

1. $(I \sqcup J) \; f \; Y \Leftrightarrow I \; f \; Y \vee J \; f \; Y$ and not $0 \; f \; Y$ for every $Y \in \mathfrak{B}$, $I, J \in \mathfrak{A}$;

2. $X \; f \; (I \sqcup J) \Leftrightarrow X \; f \; I \vee X \; f \; J$ and not $X \; f \; 0$ for every $X \in \mathfrak{A}$, $I, J \in \mathfrak{B}$.

By the way, it implies that $f \mapsto [f]^*$ is a bijection from the set of funcoids from $\mho_0$ to $\mho_1$ into the set of multifuncoids of the form $\mathscr{P}\mho_0 \times \mathscr{P}\mho_1$, for every sets $\mho_0$ and $\mho_1$.

Now suppose f is a multifuncoid of the form $\mathfrak{P}^2$. Then:

1. $(I \sqcup J) \; f \; Y \Leftrightarrow I \; f \; Y \vee J \; f \; Y$ and not $0 \; f \; Y$ for every $Y, I, J \in \mathfrak{P}$;

2. $X \; f \; (I \sqcup J) \Leftrightarrow X \; f \; I \vee X \; f \; J$ and not $X \; f \; 0$. for every $X, I, J \in \mathfrak{P}$.

Thus multifuncoids of the form $\mathfrak{P}^2$ are essentially equivalent to funcoids from $\mathfrak{P}$ to $\mathfrak{P}$ ([1]), formally: there exist a funcoid f' such that $[f']^* = f$.

$E^* f = \left\{ L \in \mathfrak{F}^2 \quad | \quad \operatorname{up} L \subseteq f \right\} = \{(L_0; L_1) \quad | \quad L_0, L_1 \in \mathfrak{F}, \forall g_0 \in \operatorname{up} L_0, g_1 \in \operatorname{up} L_1 : (g_0; g_1) \in f\} = \left\{ (L_0; L_1) \quad | \quad L_0, L_1 \in \mathfrak{F}, \forall g_0 \in \operatorname{up} L_0, g_1 \in \operatorname{up} L_1 : g_0 \, [f']^* \, g_1 \right\} = \{(L_0; L_1) \quad | \quad L_0, L_1 \in \mathfrak{F}, L_0 \, [f'] \, L_1\} = [f']$.

Thus:

1. $(I \sqcup J) \; (E^* f) \; Y \Leftrightarrow I \; (E^* f) \; Y \vee J \; (E^* f) \; Y$ and not $0 \; (E^* f) \; Y$ for every $Y, I, J \in \mathfrak{F}$;

2. $X \; (E^* f) \; (I \sqcup J) \Leftrightarrow X \; (E^* f) \; I \vee X \; (E^* f) \; J$ and not $X \; (E^* f) \; 0$ for every $X, I, J \in \mathfrak{F}$.

that is $E^* f$ is a multifuncoid of the form $\mathfrak{F}^2$.

References

[1] Victor Porton. Funcoids and reloids. At `http://www.mathematics21.org/binaries/funcoids-reloids.pdf`.

[2] Victor Porton. Filters on posets and generalizations. *International Journal of Pure and Applied Mathematics*, 74(1):55–119, 2012.