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General Identifiability with Arbitrary Surrogate Experiments Errata

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The original manuscript left implicit the enforcement of the positivity constraint, which is standard since at least [Pearl, 2000, p. 77]. This should be made explicit by updating Def. 4 as follows (changes marked in red):

Definition 4 (g-Identifiability)**.** Let $\mathbf{X}$, $\mathbf{Y}$ be disjoint sets of variables, $\mathbb{Z} = \{\mathbf{Z}_i\}_{i=1}^m$ be a collection of sets of variables, and let $\mathcal{G}$ be a causal diagram. $P_{\mathbf{x}}(\mathbf{y})$ is said to be g-identifiable from $\mathbb{Z}$ in $\mathcal{G}$, if $P_{\mathbf{x}}(\mathbf{y})$ is uniquely computable from positive distributions $\{P(\mathbf{V} \setminus \mathbf{Z} \mid do(\mathbf{z})) > 0\}_{\mathbf{Z} \in \mathbb{Z}, \mathbf{z} \in \mathfrak{X}_{\mathbf{Z}}}$, in any causal model which induces $\mathcal{G}$.

All the soundness proofs in the paper do not rely on positivity. Still, to enforce positivity in the converse, it suffices to update Eq. (1) in the paper as follows (changes marked in red):

$$t_i \leftarrow \bigoplus_{\mathcal{H} \in \mathcal{F}_i} \left(\bigoplus_{V \in pa(T)_{\mathcal{H}}} v_{\mathcal{H}} \oplus \bigoplus_{U \in \mathbf{U}^T_{\mathcal{H}}} u_{\mathcal{H}} \right). \tag{A.1}$$

Now note that the outer xor in Eq. (A.1) can be distributed to write t_i in terms of its parents in the thicket:

$$t_i \leftarrow \bigoplus_{V \in pa(T)} v_i \oplus \bigoplus_{U \in \mathbf{U}^T, \mathcal{H} \in \mathcal{F}_i} u_{\mathcal{H}}. \tag{A.2}$$

Let $\phi_i = |\mathbf{U}_i^{\times}| \bmod 2$ and $\psi_i = |\mathbf{V}_i^{\downarrow}| \bmod 2$, where $\mathbf{U}_i^{\times}$ and $\mathbf{V}_i^{\downarrow}$ are the set of crossing $\mathbf{U}$'s and frontiers for hedge i. Then, for every hedge in which $\phi_i = \psi_i$, pick one $T^* \in \mathbf{V}_i^{\downarrow}$ and define t_i^* as the negation of Eq. (A.2). Finally, for every R in the bottom of the thicket, it suffices to append '$\oplus \tilde{u}_R$' to Eq. (2) and (3) where $P(\tilde{U}_R = 0) \neq 0.5$.